DISCUSSION PAPER SERIES

No. 2686

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TRANSITION ECONOMICS

Centre for Economic Policy Research

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Available online at: www.cepr.org/pubs/dps/DP2686.asp

ISSN 0265-8003

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Discussion Paper No. 2686
February 2001

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CEPR Discussion Paper No. 2686

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ABSTRACT

Debt Overhang and Barter in Russia

In this Paper we study, both theoretically and empirically, the relationship between barter and the indebtedness of Russian firms. We build a model in which a firm uses barter to protect its working capital against outside creditors even when barter involves high transaction costs. The main innovation of our work is to allow renegotiation between the firm and its creditors. If the creditors are rational, they often agree to postpone debt payments in order to avoid destroying the firm's working capital. It turns out, however, that even if the firm cannot ensure it will not divert cash *ex post*, the outcome of renegotiation still provides *ex ante* incentives to use barter. We show that the greater the debt overhang, the more likely the use of barter, and although the possibility of debt restructuring reduces barter, it does not eliminate it altogether. We also discuss the role of the government bond market and weak bankruptcy legislation. The firm-level evidence from two independent surveys is consistent with the model's predictions.

JEL Classification: P30
Keywords: barter, debt overhang, demonetarization, renegotiation

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Submitted 11 October 2000

NON-TECHNICAL SUMMARY

The extent of the demonetarization of Russia's transition economy is striking, and there are a number of competing theories offering explanations for the spread of barter in Russia. The most common explanation is the liquidity squeeze. The other main explanation is that non-monetary transactions are a strategic choice made by managers. This Paper tries to reconcile both views in a single model.

The lack of liquidity and the delay in restructuring models are based on very different assumptions and suggest rather different policy implications. The liquidity hypothesis is based on the idea that there is no conflict of interest between managers and investors. The managers choose the strategies that are best for the firm. Barter is involuntary: there is no way of selling for cash since most of the firm's customers do not have any. The managers simply react to the temporary liquidity problems. Therefore, if we assume that the lack of liquidity is the cause of barter, in order to reduce barter it is necessary to loosen monetary policy and make sure that more credit is injected into firms.

On the other hand, the model underlining the role of the lack of restructuring assumes that outside investors have little control over managers and cannot make sure that value-enhancing restructuring is undertaken. Therefore this theory suggests that barter is a result of poor corporate governance and until the protection of investors' rights is improved, lending to such firms will not help to reduce barter. Managers will continue to divert cash for personal consumption (e.g. through offshore firms). Once the cash is taken out of the real sector, the firms' liquidity constraints are not relaxed, so there is no change in real output. On the other hand, the increased consumer demand results in inflation. Hence, the question of whether barter should be explained by temporary liquidity shocks or by the strategic behaviour of managers is not of purely academic interest but also has important policy implications.

One crucial question that arises is why firms do not borrow cash from banks. The liquidity constraint story implies that the firms are profitable and there are enough expected future revenues to make repayment possible. Due to the problem of moral hazard implied in the lack of a restructuring model, however, there can be no commitment to repayment. This point is at the heart of the lack of restructuring theory: the liquidity shortage is endogenous, being a consequence of the poor protection of creditors' rights.

As a consequence, these two explanations of barter should not be discussed separately: the liquidity shortage is linked to a lack of credit which in turn is related to a lack of investors' control over managers. The goal of our Paper is to explore the link between debt and barter in the presence of imperfect institutions. We explicitly model a game with renegotiations and show that

when debt restructuring occurs, it does reduce the incentive to barter. On the other hand, the threat of cash diversion by the manager may prevent debt restructuring. Anticipating the failure of debt restructuring, the manager would then still prefer barter. This is the most striking and original feature of the model: debt renegotiation is not sufficient to eradicate the barter phenomenon – the risk of cash diversion distorts the creditor's incentive to participate in the renegotiation process.

Our model implies that in the presence of a cash diversion risk (similar to the 'transformation risk' introduced in Myers and Rajan, 1998), barter is a serious threat to outside creditors. As in most debt overhang models, we take the initial level of debt as given. On the other hand the results of the model suggest that the rational creditors should avoid lending to Russian firms until contract enforcement is improved. This is fairly consistent with the fact that bank credit is very low in Russia (EBRD, 1999).

1. Introduction

The extent of demonetization of Russia's transition economy is striking. According to the Russian Economic Barometer, in 1998 about 55% of inter-firm transactions were made through barter, while the 1998 Institute for the Economy in Transition survey reports a share of 40% (with another 10% carried out in vecksels). There is a number of competing theories offering explanations of the spread of barter in Russia. The most common explanation is the liquidity squeeze. Commander and Mummsen (1998) report that most managers believe the lack of liquidity to be the major cause of barter. The other main explanation is that non-monetary transactions are a strategic choice made by managers. Karpov (1997) and Gaddy and Ickes (1998) suggest that barter may be used by managers to hide revenues from outside owners and creditors (including the tax authorities) and delay restructuring.

These two theories (lack of liquidity and the delay of restructuring) are based on very different assumptions and suggest rather different policy implications. The liquidity hypothesis is based on the idea that there is no conflict of interest between managers and investors. The managers choose the strategies that are best for the firm. Barter is involuntary: there is no way of selling for cash since most of the firm's customers do not have any. The managers simply react to the temporary liquidity problems. Therefore, if we assume that the lack of liquidity is the cause of barter, in order to reduce barter it is necessary to loosen monetary policy and make sure that more credit is injected into firms.

On the other hand, the model underlining the role of the lack of restructuring assumes that outside investors have little control over managers and cannot make sure that value-enhancing restructuring is undertaken. Therefore this theory suggests that barter is a result of poor corporate governance[5] and until the protection of investors' rights is improved, lending to such firms will not help to reduce barter. Managers will continue to divert cash for personal consumption (e.g. through offshore firms). Once the cash is taken out of the real sector, the firms' liquidity constraints are not relaxed, so there is no change in real output. On the other hand, the increased consumer demand results in inflation. Hence, the question of whether barter should be explained by temporary liquidity shocks or by the strategic behaviour of managers is not of purely academic interest but has important policy implications, too.

A closer look at the two explanations shows, however, that they are not mutually exclusive. The lack of restructuring theory assumes that non-monetary transactions are less transparent and therefore make transfer pricing and asset stripping easier for the incumbent management. The liquidity hypothesis states that barter is an involuntary response of managers to the lack of cash. It turns out that lack of cash may be emerge in equilibrium in the model where managers are not controlled by outside investors. If firm A has to pay firm B for goods supplied and firm A currently has no cash, A may offer B payment in kind. Then B will not be able to pay its own supplier C in cash and will, likewise, have to pay C in kind. Certainly, this logic raises a number of questions. First, suppose that A has a cash windfall. Then A may not want to use it to pay B since A know that B will accept barter because B knows that C will accept barter etc. Hence, A may well use the cash for its personal consumption (see Kuznetsov (2000) and Yakovlev (1999) for a detailed account from case studies and the evidence in Guriev and Ickes (2000)). The other question that arises is why firms do not

[5] Formally, Russian law provides a rather high degree of investor rights protection. On the other hand, Gelfer, Pistor and Raiser (2000) show that what really influence's a firm's ability to raise external finance is not the legislation in place, but the effectiveness of legal institutions. See Sonin and Zhuravskaya (2000) for discussion of the differences between intended and actual performance of bankruptcy procedures in Russia.

borrow cash from banks. The liquidity constraint story implies that the firms are profitable, and there are enough expected future revenues to make repayment possible. However, due to the problem of moral hazard discussed above, there can be no commitment to repayment. Moreover, if B owes money to a bank, B may actually prefer A to pay in kind since the non-monetary transactions are much less transparent for outside creditors. This point is at the heart of the lack of restructuring theory: the liquidity shortage is endogenous, being a consequence of the poor protection of creditors' rights.

Therefore, these two explanations of barter should not be discussed separately: the liquidity shortage is linked to a lack of credit which in turn is related to a lack of investor's control over managers. The goal of our paper is to explore the link between debt and barter in the presence of imperfect institutions. Many authors have suggested that debt overhang is equivalent to a "100% tax on monetary revenues" (Hendley et al. (1998)) and therefore provides incentives for barter.[6] The manager uses barter to avoid the "tax" that would wipe out the firm's working capital and would therefore result in under-utilisation of capacities. This means that barter is actually good since it makes it possible to sustain an efficient output level. However, the transaction costs of barter (including legal, search, transportation and storage costs) are high. It is therefore clear why the same outcome cannot be achieved without barter, namely, why the creditors would not agree to postpone debt payments. If the firm only suffers from a temporary liquidity shortage but is solvent in the long-term, the creditor should agree to re-finance the debt. The firm will then have an incentive to sell for cash, use the cash for purchasing inputs and pay the debt later. We explicitly model the game with renegotiation and show that when debt restructuring occurs, it does reduce the incentive to barter. On the other hand, the threat of cash diversion by the manager may prevent debt restructuring. Anticipating the failure of debt restructuring, the manager would then still prefer barter. This is the most striking and original feature of the model: debt renegotiation is not sufficient to eradicate the barter phenomenon – the risk of cash diversion distorts the creditor's incentive to renegotiate the debt.

Our model therefore implies that in the presence of a cash diversion risk (very similar to the "transformation risk" introduced in Myers and Rajan (1998)), barter is a serious threat to outside creditors. As in most debt overhang models, we take the initial level of debt as given. On the other hand the results of the model suggest that the rational creditors should avoid lending to Russian firms until contract enforcement is improved. This is fairly consistent with the fact that bank credit is very low in Russia (EBRD (1999)).[7]

Our model adds an interesting dimension to the stock of literature dealing with soft budget constraints. As shown in G. Roland and E. Berglöf (1998), the soft budget constraint usually arises because creditors lack the ability to liquidate the indebted firm when it should be liquidated. In our model, where only the *ex post* situation is considered, the creditors would like to refinance the firm which is productive *ex post* but the refinancing fails due to a lack of commitment on the manager's side. Thus the manager chooses inefficient barter in order to

[6] Linz and Krueger (1998) or Aukutsionek (1998) interpret barter as a mechanism used to avoid undue bankruptcy when barter is due to liquidity shortage in a context of imperfect financial market conditions and of credit market imperfections.

[7] Formally, our model applies to the relationship with outside creditors. However, it also describes well the interaction with all creditors whose rights are not protected. A good example of this is wage arrears. Workers (creditors) know that if the manager uses the cash for purposes other than payment of wages due, they will not be paid. Therefore they insist the firm pay their wages whenever it has any cash available. To avoid paying off wage arrears, managers use barter. See Earle and Sabirianova (2000) for a comprehensive analysis of wage arrears in Russia and empirical evidence on the strategic choice of wage arrears by the managers.

avoid liquidation.

The empirical section (Section 3) shows that firm-level evidence is consistent with the model's predictions. We use two different data sources : the *Russian Economic Barometer* over 1995-96 on a quarterly basis, and the *Institute for the Economy in Transition* survey matched with the Goskomstat dataset for 1996 and 1997. Section 4 concludes and discusses the main policy implications.

Given the extent of demonetization, it is little wonder that there are quite a few other theories and explanations. Hendley et al. (1998) refer to poor payment systems and tax evasion, Marin and Schnitzer (2000) and Carlin et al. (2000) provide evidence that barter can help fight disorganisation, Guriev and Kvassov (2000) show that market concentration is an important determinant of barter. Drebentsov et al. (1999) suggest that the main source of non-monetary transactions is the government's subsidies to inefficient firms. In this paper, we concentrate on the lack of liquidity and the delay of restructuring models, since those are believed to be mutually exclusive while the other theories complement one other.

2. The Model

In this Section, we suggest a simple model that describes the behaviour of a liquidity constrained firm with outside debt. The firm faces the following choice: if it pays off the debt, it will be stripped of working capital and will not be able to purchase inputs for the next round of production. Therefore the firm would rather hide the cash. One way of doing this is to sell for barter that has no value to the outside creditor (and thus cannot be expropriated by the creditor). Even if barter transactions are costly, they makes it possible to postpone debt payments and finance another round of production which may then make it possible to pay off the debt.

This explanation of the link between liquidity constraint and barter is not, however, fully consistent. Indeed, if the firm is efficient and each additional round of production adds value, why would the creditor not voluntarily restructure the debt? Since forgiving/refinancing the debt should lead to an increased utilisation of the firm's efficient capacities, voluntary renegotiation would result in the delaying of debt service. This argument is common in literature concerning financial contracting in developed countries[8] and debt relief in developing economies[9], so it is not at all clear why it should not apply to a transition economy.

We provide two alternative answers to this puzzle. First, it turns out that even in the presence of renegotiation, the risk of cash diversion by the firm's manager (so called "transformation risk") may cause barter to emerge. Second, if the creditor has access to investment opportunities that the firm does not have, and if these opportunities yield very high returns, as in the case of Russia's government bond bubble, the creditor will not be interested in debt restructuring.

At the core of the model is the lack of effective bankruptcy procedures. Unlike the conventional models of debt (Hart, 1995), we assume that the creditor cannot gain control of the firm's assets if the firm does not pay on time. The assets that the creditor can take over if debt payments are not made on time are limited to cash; barter payments cannot be expropriated by the creditor, nor can he replace the manager.

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[8] Hart (1995), Ch. 5.

[9] E.g. Krugman (1988).

2.1 The setting

There are two agents: a firm F and an outside creditor C. F owes C debt $D_0 > 0$. The firm has a unit of output and no cash. The firm may sell the output either for cash or for barter and use the revenue to purchase inputs. The relative prices in the cash market are better for the firm than those in the barter market: barter transactions involve high legal, transportation and storage costs. On the other hand, cash revenues can be captured by the creditor while barter revenues cannot. Cash revenues are accrued to F's current account which the creditor can easily seize. In-kind payments have no value to the creditor and can only be used as inputs in F's production.

There are two periods.[10] The timing is as in Figure 1. At time $t=0$, F has a unit of output and can choose whether to sell it for cash or for barter. The share of output to be sold for cash is m_0 and the share of output to be sold for barter is b ($m_0+b\leq 1$). The cash prices of output and input are normalised to 1: selling m_0 for cash, F gets m_0 rubles that can buy m_0 units of input. The relative barter prices for inputs are $\beta\in[0,1]$ where $(1-\beta)$ represents the transaction costs of barter. Thus, selling b for barter, F gets βb units of input. At time $t=1$, the debt is due. F and C observe F's cash revenues and can renegotiate the contract. They bargain over a new contract (P,D_1) where P is the payment at time $t=1$ and D_1 is the new debt due at $t=2$. If the renegotiation succeed, F's cash balance becomes $m_1 = m_0 - P$, and F promises to pay D_1 at $t=2$. If the renegotiation fail, C takes $P=\min\{m_0,D_0\}$ and invests it elsewhere.[11] In this case, F only has $m_1 = m_0 - \min\{m_0,D_0\}=[m_0 - D_0]_+$. The new debt is $D_1 = D_0 - \min\{m_0,D_0\}=[D_0 - m_0]_+$.[12]

After the renegotiation, F buys inputs for cash. The firm spends $x\in[0,m_1]$ rubles on inputs, so that the total amount of inputs the firm can use for production is $q = \beta b + x$.

The firm has linear technology that converts q units of input into λq units of output. The maximum capacity is one unit of input: $q\leq 1$. Therefore the capacity constraint never binds since $q \leq b + x \leq b + m_1 \leq b + m_0 \leq 1$.

Once the output λq is produced, F decides again whether to sell it for cash or for barter. The cash revenues $m_2 \in [0, \lambda q]$ can again be confiscated by the creditor if the debt has not yet been repaid. The remaining cash is used for consumption by F's owners. Then the game ends.

The gross interest rate in the economy is normalised to 1. Therefore the creditor's and the firm's payoffs are respectively:

$$U^C = P + \min\{m_2, D_1\} \tag{1}$$

and

$$U^F = m_1 - x + [m_2 - D_1]_+, \tag{2}$$

[10] The two-period setting is chosen to simplify the analysis. Apparently the finite horizon model or infinite horizon model with discounting would produce similar results.

[11] The existing contract gives C a right to claim D_0 but F cannot physically pay more than m_0 because of the liquidity constraint.

[12] Hereinafter $[\cdot]_+$ denotes $\max\{\cdot,0\}$.

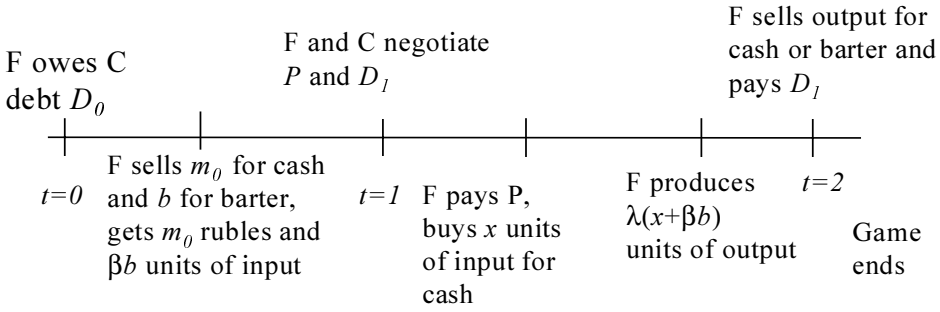

Figure 1. The timing.

2.2 Assumptions

1. For simplicity's sake we will make a few assumptions concerning the firm's productivity λ and transaction costs of barter $1-\beta$:

$1 < 1/\beta < \lambda < 2$

The first inequality implies that barter is less efficient than money: $\beta < 1$. The second inequality states that the firm's productivity is high enough to ensure that even with the relative prices β, the firm adds value: $\lambda\beta > 1$. Together, these two inequalities imply that the firm adds value to the cash prices as well: $\lambda > 1$. The last (technical) condition makes the problem less trivial. If the firm were too productive $\lambda > 2$, renegotiation would always postpone debt service. The gains from another round of production would be so large that they would always overcome the transformation risk (i.e. F's diversion of cash m_1 for current consumption).[13]

2. F has all bargaining power. This is again a simplifying assumption. We give all the bargaining power to the firm in order to show that even if F is the residual claimant, there will still be incentives for barter.

3. Parties have symmetric information: creditors are perfectly aware that their rights might be violated. The problem we are dealing with is a problem of enforcement, which can be analysed within the framework of incomplete contracts. C knows that there is no mechanism to enforce a contract that obliges F to use cash for buying inputs rather than for personal consumption.

4. Cash has the same value for both parties but barter can only be used as an input in

[13] This condition is related to the fact that we only have two periods. If there were T periods, the constraint would be $\lambda<T$.

production using the technology owned by F. Technology is inalienable. Even if F breaches the debt contract, C cannot take control of the productive assets.[14]

2.3 The first best

Apparently, the social optimum is to sell for cash, buy one unit of input and produce at maximum capacity. In other words, b=0, m_0=1, q=1, m_2=λq. Social welfare equals λ.

There are three potential sources of inefficiency in the model. First, selling for barter rather than for cash. Barter sales involve transaction costs (1–β)b. The second source of inefficiency is the failure of debt renegotiation: if C takes all the cash F has at t=1, F produces below social optimum q<1, and therefore a dead weight loss (λ-1)(1-q) arises.

The third problem is the cash diversion (transformation) risk: even if debt payments are postponed and F keeps some cash, F may prefer to spend it for consumption right away rather than to purchase inputs. As in Myers and Rajan (1998) we assume that the more liquid the asset is, the higher the transformation risk is. A manager has more discretion in using liquid assets, and therefore outside investors have less control over the manager the more liquid the assets are. The transformation risk often appears in literature on incomplete financial contracts where the only contractible variable is the payment from one party to the other, while the levels of inputs and outputs are not contractible. In our model, the manager can easily transform cash for his private benefit while the in-kind payments (inputs) can only be used for production.

The first best can be implemented if there is effective bankruptcy legislation.[15] Indeed, let us assume for a moment, that Assumption 4 does not hold. Thus, if F does not pay C, C can replace the manager and manage the firm himself. Then F knows that selling for barter will not help: if F sells for barter so that there is not enough cash to repay the debt, C takes over. C uses the inputs b for production, and the previous manager gets nothing.

2.4 No renegotiation

Let us first study what happens if renegotiation at t=1 is not allowed. We will solve the model via backward induction. First, we will find m_2 under given x, P, D_1, m_0 and b. Second, we will determine x given P, D_1, m_0 and b. Then we will find P and D_1, given m_0 and b. Finally, we will describe the choice of m_0 and b. The ultimate goal of our analysis is to establish to what extent the choice between money and barter depends on debt D_0.

The choice between money and barter at t=2 is trivial. Since barter can only be used for production, it makes no sense to sell in the last period for barter.[16] Hence, m_2=λq.

The amount of inputs bought for cash $x \in [0, m_0 - P]$ is chosen by the firm to maximise

$U^F = m_0 - P - x + [\lambda\, \beta b + \lambda x - D_1]_+$.

[14] The conventional explanation of this assumption lies in the inalienable nature of human capital. Although it may be applicable to Russia, we have in mind a much bigger problem: the absence of effective bankruptcy procedures. In Russia, creditors have a hard time claiming the assets of bankrupt firms (see Sonin and Zhuravskaya (2000)). Thus even physical capital is inalienable. Certainly, it is much easier for creditors to get hold of liquid assets (cash).

[15] Formally, another simple solution is to write off the debt. Certainly, this does not satisfy C's individual rationality constraint.

[16] This is due to the finite horizon setting.

This function is convex with regard to x. Therefore the solution must be a corner one: either $x = 0$ or $x = m_0 - P$. Let us check when F prefers $x = m_0 - P$. Using all available cash to buy inputs provides F with a higher payoff whenever

$[\lambda\beta b + \lambda(m_0 - P) - D_1]_+ \geq m_0 - P + [\lambda\beta b - D_1]_+$.

Since $m_0 - P \geq 0$, this condition is equivalent to:

$$\lambda\beta b - D_1 + (\lambda - 1)(m_0 - P) \geq 0. \quad (3)$$

Let us find the first-period payments P and the second period debt D_1. Since there are no renegotiation, $P = \min\{m_0, D_0\}$ and $D_1 = [D_0 - m_0]_+$. Now we can describe the choice between money and barter. The firm chooses b and m_0 to maximise (2) subject to $b + m_0 \leq 1$. There can be 2 cases:

1. The firm gets enough cash revenues to pay off the initial debt: $m_0 \geq D_0$. In this case $P = D_0$ and $D_1 = 0$. Inequality (3) holds, so that $x = m_0 - P$ and the firm's payoff (2) becomes $U^F = \lambda\beta b + \lambda(m_0 - D_0)$. Since $\beta < 1$, the firm is better-off selling for cash as much as possible: $m_0 = 1$ and $b = 0$. Apparently, this case is only possible if $D_0 \leq 1$. F's utility is $U^F_{m0=1} = \lambda(1 - D_0)$.
2. The firm does not have enough cash revenues to repay the debt: $m_0 < D_0$. It has to pay all the cash to the creditor: $P = m_0$, and $D_1 = D_0 - m_0$,, and is left with no cash to buy inputs $x = 0$. The firm's payoff (2) becomes $U^F = [\lambda\beta b + m_0 - D_0]_+$. Since $\lambda\beta > 1$, the firm is better-off selling everything for barter: $m_0 = 0$ and $b = 1$. Thus the firm gets $U^F_{b=1} = [\lambda\beta - D_0]_+$.

Comparing the two cases we see that the firm is better-off selling for barter whenever debt is sufficiently high (see Figure 2).

Proposition 1. *In the model without renegotiation, the firm chooses to sell all its output for barter* $U^F_{b=1} \geq U^F_{m0=1}$ *if and only if* $D_0 \geq D^* = \lambda(1-\beta)/(\lambda-1)$. *Otherwise, the firm sells all its output for cash.*

The Proposition is quite intuitive. Indeed, if there are no renegotiation, the creditor will seize all the cash that the firm gets for its sales. Stripped of the working capital, the firm would not be able to continue production at a reasonably high level. In order to protect its working capital, the firm chooses to hide the revenues from the creditor via selling for barter. Although inefficient ($\beta < 1$), barter makes it possible to avoid the expropriation of working capital while facilitating buying inputs. Being able to produce in the second period, the firm gets cash and partially or fully repays the debt.

2.5 The model with renegotiation

The model above assumes that renegotiation are not allowed and that the creditor seizes all the cash the firm has at $t = 1$. Apparently, this may be myopic: by restructuring the debt, the creditor would encourage the firm to produce more in the next period. This, in turn, would increase the creditor's chances of getting his money back. Debt restructuring may therefore provide the *ex ante* incentives for the firm to sell for cash rather than for barter. F knows that C will not expropriate all the cash right away, so there is no need to hide revenues in the form of barter and to pay for the cost of barter. In this Section, we study a model with renegotiation and check to which extent renegotiation may help to reduce barter.

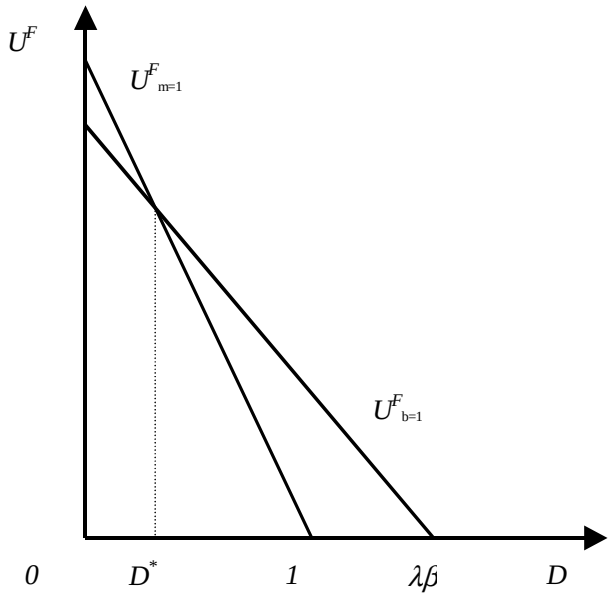

Figure 2. Firm's payoff as a function of outside debt in the model without renegotiation.

Again, we will solve the model via backward induction. Apparently, the choice of m_2 and x under given P, D_1, m_0 and b are the same as in the previous Section. In the second period, F sells for cash: $m_2=\lambda q$. The amount of inputs bought for cash is $x = m_0 - P$ whenever (3) holds and $x = 0$ otherwise.

Now consider the renegotiation of debt payments. The firm and the creditors bargain on P and D_1 to maximise the joint surplus of F and C at the date $t=1$. At this point, the choice between money and barter m_0 and b has already been made, so that the renegotiation only affects the debt overhang in the last period of and therefore F's incentives to produce more output. If P and D_1 are such that (3) holds, then F uses the remaining cash – if any is left – to buy inputs and produce more. Otherwise the manager immediately diverts the remaining cash for personal consumption and only uses inputs already bought for barter. The parties' payoffs calculated at $t=1$ are as follows:

1. Inequality (3) holds (no diversion):

$$U^C = P + \min\{\lambda\beta b + \lambda(m_0 - P), D_1\};\ U^F = [\lambda\beta b + \lambda(m_0 - P) - D_1]_+.$$

2. Inequality (3) does not hold (diversion):

$$U^C = P + \min\{\lambda\beta b, D_1\};\ U^F = m_0 - P + [\lambda\beta b - D_0 + P]_+ .$$

Since F has all the bargaining power, F chooses P and D_1 to maximise U^F subject to the creditor's participation constraint $U^C \geq m_0 + \min\{\lambda\beta b\ ,\ D_0 - m_0\}$ (the right hand side is the creditor's payoff if the bargaining breaks down).

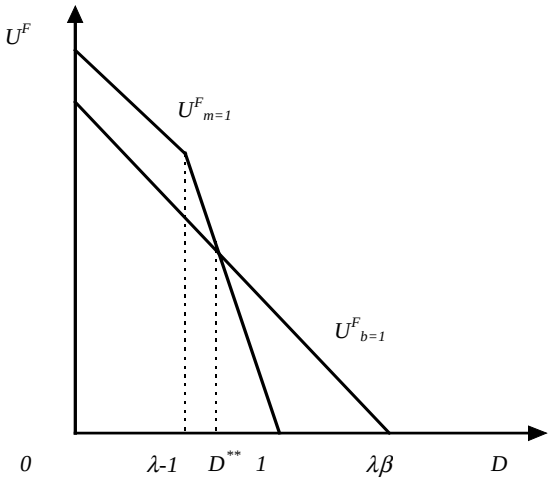

Figure 3. Firm's payoff as a function of outside debt in the model with renegotiation.

It is easy to show that case 2 never occurs in equilibrium. The aim of renegotiation is to postpone debt payments to leave some cash for input purchases. If the firm uses the cash for current consumption and if x=0, then there is no case for renegotiation. To make sure that case 2 does not occur, the parties will agree on a contract P, D_1 that satisfies the constraint (3) and therefore prevents the firm from diverting the cash. Unfortunately, the constraint (3) may be binding which may distort the choice of P , D_1: the diversion never happens but the threat of diversion may prevent the parties from achieving the first best.

Formally, F chooses P , D_1 to maximise:

$$[\lambda\beta b+\lambda(m_0-P)-D_1]_+ \qquad (4)$$

subject to (3) and the creditor's individual rationality constraint:

$$P+\min\{\lambda\beta b+\lambda(m_0-P),\, D_1\}\geq m_0+\min\{\lambda\beta b\,,\, D_0-m_0\}.$$

The solution to this problem is $P=(2-\lambda)^{-1}[m_0+\min\{\lambda\beta b\,,\, D_0-m_0\}-\lambda\beta b-(\lambda-1)m_0]_+$, $D_1=m_0+\min\{\lambda\beta b\,,\, D_0-m_0\}-P$. Thus, whenever $m_0+\min\{\lambda\beta b\,,\, D_0-m_0\}>\lambda\beta b+(\lambda-1)m_0$, renegotiation results in $P>0$. Some cash is used to pay off the debt rather than to buy inputs. This provides F with the wrong incentives: indeed, selling for cash, F would lose some of its working capital and therefore would not be able to produce as much as it could if it had sold its output for barter. Notice that P>0 holds if and only if constraint (3) is binding.[17] If there were no risk of cash diversion, the parties would postpone all debt payments P=0.[18]

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[17] In particular, if $\lambda>2$ were the case, the condition (3) would not bind, and the solution would always be P=0, $D_1=m_0+\min\{\lambda\beta b,\, D_0-m_0\}$. If the firm is very productive, renegotiation always postpone debt service: the gains of another round of production are so large that they always overcome the transformation risk (i.e. F's diversion of cash m_1 for current consumption): the relationship between barter and debt disappears.

[18] Constraint (3) assures that the utility derived from buying inputs with all cash available is higher than that derived from diverting cash and financing all production through barter: in other words, there is no risk of cash

Substituting P, D_1 into (4), we obtain the firm's payoff as a function of b and m_0

$$U^F = m_0+([\lambda\beta b + m_0 - D_0]_+ - (2-\lambda)m_0) - (2-\lambda)^{-1}(\lambda-1)[(2-\lambda)m_0 - [\lambda\beta b + m_0 - D_0]_+]_+ \quad (5)$$

The firm chooses b and m_0 to maximise (5) subject to $b+m_0 \le 1$. Apparently, (5) increases with both b and m_0, so that this constraint is binding $b+m_0=1$. Substituting $b=1-m_0$, we obtain a convex function of m_0. Therefore the solution is always a corner one: either sell everything for cash $m_0=1$ or sell everything for barter $m_0=0$. If F sells everything for barter it gets
$U^F_{b=1}=[\lambda\beta-D_0]_+$. If F sells everything for cash, it gets $U^F_{m0=1}= 1+([1-D_0]_+-(2-\lambda))-(2-\lambda)^{-1}(\lambda-1)[(2-\lambda)-[1-D_0]_+]_+$.

Figure 3 shows $U^F_{b=1}$ and $U^F_{m0=1}$ as functions of the initial debt D_0. One can easily show that $U^F_{b=1} > U^F_{m0=1}$ if and only if $D_0 > D^{**}=(1-\lambda\beta(2-\lambda)) / (\lambda-1)$.

Notice that the kink in the line $U^F_{m0=1}$ occurs where the constraint (3) becomes binding. The payoff to cash transaction $U^F_{m0=1}$ becomes decreasing faster with debt, since cash sales leave manager vulnerable to confiscation because debt postponement is constrained by the threat of cash diversion. If the manager could commit not to divert cash, the line $U^F_{m0=1}$ would have no kink and would always dominate $U^F_{b=1}$.

Proposition 2. *In the model with renegotiation, the firm chooses to sell all its output for barter $U^F_{b=1} \ge U^F_{m0=1}$ if and only if $D_0 \ge D^{**}=(1-\lambda\beta(2-\lambda)) / (\lambda-1)$. Otherwise, the firm sells all its output for cash. In the presence of renegotiation, barter is less likely: $D^* < D^{**}$.*

The Proposition implies that the introduction of renegotiation makes barter less likely: if $D_0 \in (D^*, D^{**})$ barter does not occur in the presence of renegotiation but it would occur if renegotiation were not allowed.

Thus, renegotiation reduces barter but does not eliminate it altogether. Why is this? The key is the cash diversion risk: the firm's manager cannot ensure he will not divert cash for current consumption rather than for purchasing inputs. The reason why the firm's manager may be interested in diversion is the remaining debt overhang. If the debt is rescheduled, and the second-period debt burden is too high, the firm expects to receive too little of the cash revenues m_2. Therefore diversion is likely to happen. Diversion can be prevented by reducing the second period debt overhang, but this is costly. To compensate the creditor for the lower second-period return, F has to pay more in the first period which in turn provides F with the wrong *ex ante* incentives: F knows that it will have to pay something in the first period and will prefer to have as little cash and as much barter as possible.

2.6 Bubble

The analysis above shows that renegotiation may help to decrease barter. However, renegotiation does not always take place. One explanation is the famous the free-rider problem. If there are many creditors, then it will be hard for them to agree on the renegotiation outcome since each of them will want a free ride at the others' expense. Another important explanation of the failure of renegotiation to eliminate barter may be the presence of a financial bubble that pays a high real interest rate. During 1995-98, the Russian government bond (GKO) market paid out very high real returns. Since the bubble burst in August 1998, barter levels have been steadily decreasing. We will introduce the GKO market in the following way.

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diversion. If the constraint is binding, it means that the parties cannot agree on postponing all debt payments, because a threat of diversion exists.

Suppose that the creditor has an investment opportunity that pays off a gross interest rate $\delta>\lambda$. The firm does not have access to this opportunity. At the time of renegotiation, the parties expect the following payoffs:

$$U^C=P+\delta^{-1}\min\{m_2,D_1\}, \qquad U^F=m_1-x+[m_2-D_1]_+.$$

Solving the model by backward induction, we obtain the equilibrium which is equivalent in real terms to the equilibrium without renegotiation. Indeed, $m_2=\lambda q$, $x= m_0 - P$ if (3) holds and $x=0$ otherwise. The renegotiation end up with $P =\min\{m_0,D_0\}$ and $D_1=[D_0 -m_0]_+$. Indeed, C is not interested in the second period payments unless F offers δ second-period rubles for each first-period one. But this does not happen: F's internal rate of return is λ. Thus, the choice between money and barter at $t=0$ is precisely the same as in the model without renegotiation.

Certainly, stripping the firm of its working capital and buying the bonds is locally efficient: the coalition of F and C makes more money through investing in GKO rather than through buying inputs and producing. We should not forget, though, that δ is not a market rate of return. Rather, it is a growth rate of a bubble. The cost of capital in the economy is still normalised to one, and therefore redirecting the cash from the real sector to the bond market is not efficient for the economy as a whole.[19]

3 Empirical results

3.1 Data description

The REB is a survey which has been conducted since 1992[20]. On a quarterly basis (REB quarterly survey), a sub-sample of the survey has been obtained for 1995 and 1996 only. About 170 to 210 firms considered representative in terms of geographic as well as sector localisation answer the REB quarterly questionnaire. In order to control for regional or sector effect of barter we shall use regional and industry dummies in our regressions. An important bias is the predominance of privatised firms, as opposed to new private firms. In the 1996 sample, 18% were state-owned, 26% had a mixed property structure, and 56% were privatised former state-owned-enterprises.

The variables we used are summarised in Tables A1 and A2 in the Appendix; they are either expressed in per cent of a monthly usual current level (*br, utc)* or with respect to a previous level set equal to 100 (d*t0*). The REB barter variable *br* is the current share of barter in sales (as a percentage), for each firm at each time (t varies from t= first quarter of 1995 to t= last quarter of 1996). The proxy for indebtedness *dt0* is the level of indebtedness towards banks, the level six months ago being set equal to 100. The output decline is captured by the capacity utilisation rate *utc.* The higher the *utc* is the more competitive the firm is in the market economy.

We shall also use the dataset *Barter in Russian industrial firms* (BRIF) built in the New Economic School Research Project "Non-Monetary Transactions in Russian Economy". This dataset was created by matching the surveys of managers of Russian industrial firms conducted in 1996-98 by Serguei Tsoukhlo (Institute of Economies in Transition, Moscow)

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[19] Certainly, this is not a closed and consistent model with rational players: we have just looked at one end of the GKO cash flows. Building a general equilibrium of a Ponzy game is however not the purpose of this paper. We can only say that somewhere in the public or private sector, there must have been myopic agents who supported the high rate of return.

[20] For a more detailed presentation of the survey, see *The Russian Economic Barometer* publication, any volume.

with the Goskomstat database of Russian firms (Federal Committee of Statistics of Russian Federation). Since Goskomstat data was most complete for 1996 and 1997 we ran regressions for the 1996 and 1997 data.

The barter data included six to seven hundred firms each year. The barter data is comprised of the answers given by firms' managers to the following (eight) questions: " how much of your firm's inputs (outputs) were paid in rubles, in dollars, in kind and in promissory notes? " The Goskomstat database includes compulsory statistical reports that all large and medium-size firms must submit to the Russian Federal Statistics Committee. There are over 16 thousand firms in the database. However, there are many missing items in the financial accounts. After matching barter data with the Goskomstat data we ended up with roughly three hundred observations in each year among which only about a hundred firms appeared both in 1996 and 1997.

As a proxy of debt we take the firm's total indebtedness in the beginning of the corresponding year divided. This variable (sum of line items 610 and 620 in the balance sheet) includes bank loans (610) and amounts owed to suppliers, subsidiaries, consolidated government, IOU holders, employees and other creditors (620).

In order to control for other explanations of barter we also include firms' size, export and market power, as well as regional and industry dummies in our regressions. As a proxy of size we take logarithm of annual sales. As for exports, we include share of exports in sales. The summary statistics and pairwise correlations are provided in Tables A3 and A4 in the Appendix. We also included regional and 2-digit industry dummies.[21] The industry dummies are described in Table A5. As for the regions, we have only introduced dummies for Moscow and seven presidential districts but only Moscow's, Urals' and Siberia's dummies came out significantly different from the European Russia which we used as the base category.

3.2 The empirical strategy

The model in Section 2 predicts that the level of outside debt causes the share of barter in sales: we expect indebted firms, because they are both liquidity constrained and inclined to assets stripping, to resort to barter more often. But causality can run to the opposite direction: the assumption of symmetric information implies that creditors, perfectly aware that their rights may be violated, may be induced to decrease endogeneously loans towards indebted firms. If the observed level of barter is high enough, the creditor anticipates that the firm will continue to confiscate cash and use barter, and *ex ante* reduces its credit supply. As a consequence debt should depend upon barter as well[22], creating the well-kwon endogeneity problem :

$$debt = a + b * barter + c * utc + v \qquad \text{(Eq.1)}$$

$$barter = \alpha + \beta * debt + u \qquad \text{(Eq.2)}$$

The first equation estimates the dependence of barter on indebtedness, controlling for size, regional and industry dummies as implied by our model: more indebtedness means more violation of creditors rights. In the second equation we take into account the fact that more barter induces a lower level of indebtedness (b is expected to be negative). Furthermore the

[21] To make the evidence from the two datasets comparable we have not used 5-digit industry information such as concentration ratios and consumer goods indexes. Including them in the regressions does not change the results. See Guriev and Kvassov (2000) on the effect of these variables on barter.

[22] And upon an exogeneous variable: the rate of capacity utilisation, as specified in equation 2.

threat of cash diversion shall depend upon productivity: if productivity is high enough (e.g. $\lambda > 2$), then the benefit from postponing the debt overcomes the transformation risk, all production is financed through cash, and the threat of cash diversion vanishes. Hence more productive firms are in a better position to raise external finance, and c is expected to be positive.

There is one competitive explanation for the causality which runs from barter and productivity towards indebtedness: if the proportion of bad loans is very high, the *ex post* benefits of bailing out are higher than the benefits of liquidation. In this alternative framework[23], any deterioration of the firms healthiness[24] (proxied by both barter and the rate of capacity utilisation) increases the level of debt, instead of lowering it ; b should be positive and c negative. There is an *ex post* injection of soft credit from banks to the firms, which should be liquidated.

Whatever the rationale behind the endogeneity of debt (higher ex post benefits of bailing out or symmetric information which implies that rational creditors do not borrow to bartering firms), our model interprets barter as a way of stripping the firms assets: this is the key model's implication we want to validate. Testing for any possible source of endogeneity allows either to validate the model's assumption that debt is given exogeneously, or to control for the bias which could occur in the presence of endogeneity.

3.3 Evidence from REB survey

In the REB *dt0* is the current level of debt with a previous level of 100 six months ago. Although in the model we defined D_0 as the level of debt, any increase in indebtedness, which can be due to repaying the interest or raising additional funds, is relevant as well. The basic model's intuition being that barter is a way of stripping assets, both the stock and the flow can be expected to increase the probability of that stripping (in other words D_0 could be defined as either the level or the increase in indebtedness). As a matter of fact we are provided in both surveys with the two indicators: the increase in debt in the REB, and the level of debt in the BRIF survey.

The results of the OLS regressions for barter are presented in table 1 column A. In addition to indebtedness we also introduce as control variables the firm's size, measured as a number of employees (*lab*), and regional and industry dummies. When we estimate the effect of indebtedness on the whole sample, the coefficient is positive but not significant. In column B, where firms with dt0<200[25] are excluded[26], we get an higher and significant coefficient.

[23] See E. Berglof and G. Roland (1998).

[24] The healthier firms have little access, if any, to external finance. Another reason suggested in S. Brana and M. Maurel (1999) is that in the presence of adverse selection, credit is rationed, healthier firms do not borrow. Note also that the healthier firms tend to repay debt while loss-making firms remain indebted.

[25] 16 firms are less than six per cent of the sample.

[26] According to the model, the coefficient must be significant if the firms are not too indebted.

Table 1 : OLS regressions with robust standard errors, IV regression, OLS augmented regression

	A	B[a]	C	D
Barter	OLS Whole sample	*dt0* < 200	*IV*[b] Whole sample	*OLS* Whole sample
dt0	0.011 (0.010)	0.036* (0.024)	0.29 (0.194)	0.098** (0.035)
Squared dt0				-0.00006* (0.00004)
dt0 times *utc*				-0.0011** (0.00038)
Lab	0.003***(0.001)	0.002** (0.001)	-0.0007 (0.003)	
Regional and industry dummies	***	***	***	***
Constant	22.37 ***(6.22)	20.44***(6.62)		
N	261	245	261	259
R2	0.42	0.41		0.44
Hausman statistics : 3.71 ; Prob > Chi(2) = 1.0000				

*** - significance at 1% level, ** - significance at 5% level, * - significance at 10% level
Source : see annex 1
[a] : we check the robustness by varying the critical size of debt : 200 or 175 (number of observations : 245) ; 150 (the number of observations drops from 245 to 204). The correlation between debt and barter increases continuously from 0.011 (not significant) to 0.062 (significant at 10%). In between the estimate is 0.036, significant at 15%.
[b] : *utc* is used as an instrument.

Column C presents the IV estimation, where *utc* according to the system of simultaneous equations is used as an instrument. Running the Hausman test (that is computing the difference in coefficients from columns A and C) concludes that debt is exogeneous (confirming the model's assumption), which implies that more efficient OLS deliver better results. Recall nevertheless that the OLS estimate of the barter coefficient is not significant at the usual level, and that we have to exclude too indebted firms for getting a significant coefficient.

Another possibility for improving the OLS specification is to include squared debt and an interaction term : indebtedness times the rate of capacity utilisation. Both variables are introduced to take into account the non linear impact of debt on barter : for heavily indebted debt, the correlation between debt and barter vanishes, while when productivity is high enough, the benefit from postponing the debt definitely overcomes the transformation risk, and all production if realised through cash transactions. Results are reported in column D. The impact of debt on barter is now significant at 5 per cent and higher than in the previous regression. For a given level of indebtedness, more productive firms use a lower amount of barter deals. The relationships between barter and debt is non linear and U-shaped, confirming that for heavily indebted firms, a further increase in indebtedness does not have any impact on barter.

3.3 Evidence from BRIF survey

Column A reports OLS estimates for the whole sample, in both 1996 and 1997. In addition to indebtedness we also control the firm's size, proxied by the logarithm of annual sales (*sales*), export orientation, measured by the share of export in sales, and include regional and industry dummies.

Column C presents the IV estimation, where *utc* is used as an instrument. Running the Hausman test (that is computing the difference in coefficients from columns A and C) concludes that debt is exogeneous, confirming the model's assumption, and here again that more efficient OLS deliver better results.

In column B, we run OLS for different sub-samples of firms, for whom the level of indebtedness is below a critical level[27]; in column D, we include squared debt and the rate of capacity utilisation times the debt. Both variables are introduced to take into account the non linear impact of debt on barter. For heavily indebted debt, or when productivity is high enough, the elasticity of barter with respect to debt is theoretically close to zero. By not taking care of the sample's heterogeneity we are likely to get an averaged coefficient biased towards zero.

The correlation between debt and barter is significant at the usual level in all the specifications. Export oriented firms are less likely to be indebted (the coefficient of *export* is highly positive and significant in all regressions), while *sales*, which is a proxy for size, is not significant, except in regression D : larger firms are more indebted. As predicted by the model, the impact of an increase in debt on barter is higher when we exclude too indebted firms (column B), or when we include squared debt and debt times the rate of capacity utilisation.

[27] The reported results are for the critical level of 1 (debt equal to annual sales). We also ran OLS for the critical levels varying from 0.75 to 2.00 and results were very similar.

Table 2 : OLS regressions with robust standard errors, IV regression, OLS augmented regression

	A		B		C		D	
	OLS Whole sample		*debt* < 1		*IV*[a] Whole sample		*OLS* Whole sample	
Barter	1996	1997	1996	1997	1996	1997	1996	1997
Debt	0.064** (0.032)	0.025** (0.011)	0.118** (0.055)	0.171*** (0.047)	0.685* (0.375)	0.257*** (0.114)	0.13** (0.073)	0.104*** (0.033)
Squared Debt							-0.008 (0.0274)	-0.011*** (0.003)
Debt times *utc*							-0.066 (0.064)	-0.050 (0.051)
Export	-0.2025*** (0.0683)	-0.325*** (0.109)		-0.385*** (0.140)	-0.316** (0.135)	-0.670** (0.314)	-0.195*** (0.068)	-0.309*** (0.115)
Sales	0.0159 (0.0109)	0.006 (0.009)	0.0114 (0.0111)	0.003 (0.104)	0.027* (0.018)	0.046* (0.025)	0.0170* (0.011)	0.006 (0.010)
Regional and industry dummies	***		***	***	***	***	***	***
Constant	-0.062 (0.2082)	0.183 (0.179)	0.0129 (0.211)	0.223 (0.188)	0.318 (0.341)	-0.548 (0.458)	-0.084 (0.211)	0.190 (0.181)
N	289	315	275	270	285	311	284	311
R2	0.31	0.33	0.32	0.38			0.30	0.35

1996 : Hausman statistics : 2.99 ; Prob > Chi(2) = 0.9996
1997 : Hausman statistics : 5.71 ; Prob > Chi(2) = 0.9843
*** - significance at 1% level, ** - significance at 5% level, * - significance at 10% level
Source : see annex 1
[a] : *utc* is used as an instrument.

4. Conclusions

In this paper, we have studied the relationship between indebtedness and barter in Russian firms. One interesting feature of the model is that it draws a link between the liquidity shortage argument and that of poor creditor right protection. Our model incorporates the argument that barter helps to protect working capital needed for sustaining production and the argument that barter comes as a strategic reaction of managers that may be costly for outside investors.

We explicitly model the possibility of relaxing the liquidity constraint by re-financing debt. Since the firm has a liquidity rather than a solvency problem, replenishing its working capital is socially efficient, so debt restructuring should be in the mutual interest of the firm and the creditors. However, the creditors face a difficult choice: postponing too much of the debt will provide incentives for the manager to divert cash rather than to finance the firm's working capital. Therefore the lack of manager's commitment not to divert cash becomes a constraint for debt restructuring. If debt overhang is too high, the negotiations fail and the debt is not restructured. This, in turn, provides *ex ante* incentives for the manager to prefer barter although barter involves higher transaction costs.

Another explanation for the failure of debt restructuring is the presence of the government bonds (GKO) bubble in 1995-1998. If the outside investment opportunity (GKO) yields a very high real interest rate, creditors will not be interested in refinancing the debt, which in turns provides managers with the incentives to use barter.

Our empirical analysis supports the predicted positive relationship between indebtedness and barter. Which of the two explanations of this relationship (the threat of cash diversion by the manager or the GKO bubble) is correct? Both are consistent with macro-economic evidence. The period of the highest GKO yields coincided with the highest levels of barter. Moreover, as the causality test in Brana and Maurel (1999) shows, higher real interest rates caused higher barter in 1995-98. On the other hand, the meltdown of August 1998 destroyed the GKO bubble bringing real interest rates to reasonably low levels. As one should have expected, barter has declined, too. But it has not disappeared altogether and is still much higher than in other economies.

Our model does not provide a consistent answer to the question debt overhang causes barter in Russia but not in other economies. The matter is that our model establishes a correlation between indebtedness and barter only if the transaction costs of barter are not too high. If barter is too costly, it will not occur in equilibrium no matter how indebted the firm is. Thus our model is essentially a microeconomic model that explains *variation* in barter given that average level of barter is quite high and search, transportation and legal costs of barter are rather low. For our model to work, we need to assume that barter is institutionalized, the economy has a large number of barter intermediaries, barter networks are established, so that the double-coincidence-of-wants becomes a much lesser problem. As Makarov and Kleiner (1999) argue, this is precisely what has happened in Russia in the recent years. Barter is costly but it is not as much more costly than in other economies. Therefore, we can apply our model that would explain a variation in barter across firms by variation in indebtedness.

Our model implies that hardening the bankruptcy procedures would have different effects in the presence and in the absence of a bubble. If the bubble is present, lack of bankruptcy leads to barter, which is definitely less efficient than money, but helps to protect the firm's working capital. Barter is a survival strategy that helps firms with high indebtedness to survive and

keep producing. The returns on production are lower than the GKO yield but since the latter is the bubble, production may be socially efficient. On the other hand if there is no bubble, lack of effective bankruptcy procedures and creditor rights protection results in barter which is simply less efficient than monetary exchange. Our analysis suggests two policies that can decrease barter: (i) to avoid high-yield debt financing of the budget deficit and (ii) to continue the efforts to introduce effective bankruptcy procedures and protect the rights of outside creditors.

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Appendix: Tables

Table A1 : REB: Summary statistics for the main variables in 1995 and 1996

Variable	Mean		Std. Dev.		Min		Max	
Year	1995	1996	1995	1996	1995	1996	1995	1996
br	24,05	38,11	20,15	25,83	0	0	55	65
utc	57,54	53,97	26,57	26,48	5	15	105	105
dt0	90,40	83,42	87,76	96,94	0	0	800	800

Source: REB quarterly survey, June and December 1995 and 1996.

Table A2. REB: Pairwise correlations in 1995 and 1996

	br		utc		dt0	
Year	1995	1996	1995	1996	1995	1996
br	1	1				
utc	-0,1586	-0,0946	1	1		
dt0	0,2505	0,1399	-0,1077	-0,0462	1	1

Source: REB quarterly survey, June and December 1995 and 1996.

Table A3. BRIF: Summary statistics.

Variable	Explanation	Mean	Std. Dev.	Min	Max
Barter_96	Share of barter in sales, 1996	0.37	0.24	0	.83
Barter_97	Share of barter in sales, 1997	0.42	0.25	0	.83
Debt96	Debt as of Jan 1, 1996 divided by annual sales	0.28	0.48	0	5.07
Debt97	Debt as of Jan 1, 1996 divided by annual sales	0.61	2.02	0	31.6
Ls96	Log sales 1996	17.0	1.72	11.1	22.3
Ls97	Log sales 1997	17.0	1.79	9.1	21.6
Export96	Share of export in sales, 1996	0.084	0.166	0	.97
Export97	Share of export in sales, 1997	0.063	0.146	0	.97

Table A4 BRIF The sample by 2-digit industries

	Industry	Number of firms
Ind1	Electricity	-
Ind2	Fuel	8
Ind3	Ferrous metals	48
Ind4	Non-ferrous metals	17
Ind5	Chemical and petro-chemical	78
Ind6	Machinery	201
Ind7	Pulp and forestry	82
Ind8	Construction materials	76
Ind9	Textile	94
Ind10	Food	101
Ind11	Other	18

Table A5: BRIF Pairwise correlations (*** denotes significance at 1% level, ** denotes significance at 5% level)

	Barter_96	Debt96	Ls96	Export96
Barter_96	1			
Debt96	0.25***	1		
Ls96	0.11	0.10	1	
Export96	0.10	0.27***	0.1836	1
	Barter_97	Debt97	ls97	export97
Barter_97	1			
Debt97	0.30***	1		
ls97	0.09	0.06	1	
Export97	-0.02	0.13**	0.20***	1