

Debt Overhang and Barter in Russia¹

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This paper develops a model in which costly barter is used by firms to protect working capital against outside creditors. Although creditors could agree to postpone debt payments

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and to avoid destroying the firm's working capital, if the firm cannot commit not to divert cash *ex post*, the outcome of renegotiation still provides *ex ante* incentives to use barter. We show that the greater is the debt overhang, the more likely is the use of barter, with and without the possibility of debt restructuring. Empirical evidence from Russian firm-level data is shown to be consistent with the model's predictions. *J. Comp. Econ.*, December 2002, **30**(4), pp. 635–656. New Economic School, CEFIR, CEPR, and WDI, Nakhimovsky pr. 47, Moscow 117418, Russia; Sloan School of Management, M.I.T., 50 Memorial Drive, Cambridge, Massachusetts 02142; and ROSES–CNRS and CEPR, Maison des Sciences économiques, 106–112 Bd de l'Hôpital, 75647 Paris Cedex 13, France. © 2002 Association for Comparative Economic Studies. Published by Elsevier Science (USA). All rights reserved.

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1. INTRODUCTION

The extent of demonetization of Russia's transition economy is striking. In 1998, according to the Russian Economic Barometer (1999), about 55% of interfirm transactions were made through barter, while the Institute for the Economy in Transition survey (1998) reports a share of 40%, with another 10% carried out in promissory notes. There are several competing explanations for the spread of barter in Russia; the most common is a liquidity squeeze. Commander and Mummsen (1998) report that most enterprise managers believe the lack of liquidity to be the major cause of barter. The other major explanation is that nonmonetary 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 tax authorities, and to delay restructuring.²

Brana and Maurel (2000) explicitly contrast these two theories, i.e., a lack of liquidity and the delay of restructuring, which are based on different assumptions and have rather different policy implications. The liquidity hypothesis assumes that there is no conflict of interest between managers and investors. The managers choose the best strategies for the firm. Barter is involuntary; there is no way to sell for cash since most of the firm's customers have no liquidity. The managers simply react to the temporary liquidity problems. Therefore, if barter is caused by a lack of liquidity, it is necessary to loosen monetary policy so that more credit is injected into firms to reduce barter transactions.

On the other hand, the lack of restructuring explanation assumes that outside investors have little control over managers and cannot insure that value-enhancing restructuring is undertaken. Therefore, this theory suggests that barter is a result of

² Due to the extent of demonetization, several theories and explanations are found in the literature. A detailed classification of explanations of barter in Russia is provided in Makarov and Kleiner (2000). The most common ones include (i) poor payment systems and tax evasion (Karpov, 1997, and Hendley et al., 1998), (ii) disorganization (Marin et al., 2000, and Carlin et al., 2000), (iii) price discrimination (Gurieva and Kvassov, 2000), (iv) government's subsidies to inefficient firms (Drebentsov et al., 2000), and (v) a firm's willingness to gain political capital (Keren, 2001). In this paper, we concentrate on the lack of liquidity and the lack of restructuring explanations because these are believed to be mutually exclusive while the other theories are compatible with either of them and with each other.

poor corporate governance.³ 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 transfer pricing and offshore accounts. Once the cash is taken out of the real sector, the firms' liquidity constraints are not relaxed, so that there is no change in real output. On the other hand, increased consumer demand results in inflation. Hence, the question of whether barter should be explained by temporary liquidity shocks or by the strategic behavior of managers is not of purely academic interest but also has important policy implications.

A closer look at the two explanations indicates that they are not mutually exclusive. The lack of restructuring theory assumes that nonmonetary transactions are less transparent; therefore they make transfer pricing and asset stripping easier for the incumbent management. The liquidity hypothesis states that barter is a response of managers to the lack of cash. However, this lack of cash may emerge as an equilibrium solution in a model in which managers are not controlled by outside investors. Suppose that 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. This argument 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 knows that B will accept barter because B knows that C will accept barter and so on. Hence, the managers of A use the cash for personal consumption.⁴ The other question that arises is why firms do not borrow cash from banks. The lack-of-liquidity explanation implies that the firms are profitable, so they have sufficient future revenues to make repayment possible. However, due to the moral hazard problem discussed above, there can be no credible commitment to pay back loans. Moreover, if B owes money to a bank, B may actually prefer A to pay in kind since nonmonetary transactions are much less transparent for outside creditors. This point is at the heart of the lack of restructuring theory; the choice of barter is endogenous because it is a consequence of the poor protection of creditors' rights.

Therefore, these two explanations of barter should not be discussed separately. Liquidity shortage is linked to a lack of credit which in turn is related to the 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.⁵ The

³ Formally, Russian law provides a rather high degree of investor rights protection. On the other hand, Gelfer et al. (2000) show that what really influences a firm's ability to raise external finance is not the legislation in place, but the failure to enforce it. Lambert-Mogiliansky et al. (2000) present the differences between intended and actual performance of bankruptcy procedures in Russia.

⁴ See Kuznetsov et al. (2000) and Yakovlev (1999) for a detailed account from case studies, and Guriev and Ickes (2000) for further evidence of this behavior.

⁵ Linz and Krueger (1998) and Aukutsionek (1998) interpret barter as a mechanism used to avoid undue bankruptcy when it is due to a liquidity shortage in an environment of imperfect financial market conditions and of credit market imperfections.

manager uses barter to avoid this tax, which would wipe out the firm's working capital and therefore would result in underutilization of capacities. Hence, barter is actually useful because it supports an efficient output level. However, the transaction costs of barter, including legal, search, transportation, and storage costs, are high. Therefore, it is not clear why the same outcome cannot be achieved without barter, namely, why creditors would not agree to postpone debt payments or refinance the debt. If the firm suffers only from a temporary liquidity shortage but is solvent in the long term, the creditor should agree to refinance or restructure the debt. Then the firm would have an incentive to sell for cash, use the cash to purchase inputs, and pay the debt later. We model explicitly 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 still prefer barter. This is the most striking and original feature of the model; debt renegotiation is not sufficient to eradicate the barter phenomenon because the risk of cash diversion distorts the creditor's incentive to renegotiate the debt.

Our model implies that, in the presence of a cash diversion risk, which is 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 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).⁶

Our model adds an interesting dimension to the literature on soft budget constraints. As shown in Roland and Berglöf (1998), soft budget constraints usually arise because creditors lack the ability to liquidate the indebted firm. In our model, only the *ex post* situation is considered. Creditors would like to refinance a firm that is productive *ex post* but refinancing fails due to a lack of commitment on the manager's side. Thus, the manager chooses inefficient barter transactions to be protected against liquidation.

The structure of the paper is as follows. In Section 2, we describe and solve the model. The empirical section, Section 3, presents firm-level evidence that is consistent with the model's predictions. Section 4 concludes and discusses the main policy implications.

⁶ Formally, our model applies to the relationship with outside creditors. However, it also describes 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 that the firm pays their wages whenever it has any cash available. To avoid paying off wage arrears, managers use barter. Earle and Sabirianova (2000) present a comprehensive analysis of wage arrears in Russia and provide empirical evidence on the strategic choice of wage arrears by the managers.

2. THE MODEL

2.1. Overview

Consider a liquidity-constrained firm that has outside debt. The firm faces the following choice: if it pays off the debt, it will be stripped of its working capital and will not be able to purchase inputs for the next round of production. Therefore the firm would rather hide the revenues. One way of doing this is to engage in barter because this exchange has no value to the outside creditor, and thus cannot be expropriated by the creditor. Even if barter transactions are costly, they make it possible to postpone debt payments and finance another round of production, which may then allow paying off the debt.

However, this explanation of the link between a liquidity constraint and barter is not fully consistent. Indeed, if the firm is efficient and if each additional round of production adds value, why would the creditor not restructure the debt voluntarily? Forgiving or refinancing the debt should lead to increased utilization of the firm's efficient capacities and therefore an increase in the joint surplus. This argument is common in the literature on financial contracting in developed countries (Hart, 1995) and debt relief in developing economies (Krugman, 1988). Why should it not apply as well to a transition economy?

We provide two alternative answers. First, even in the presence of potential renegotiation, the risk of cash diversion by the firm's manager, the transformation risk, may reduce the scope for renegotiation and therefore provide incentives for barter. Second, if the creditor has access to investment opportunities that are not available to the firm, and if these opportunities yield very high returns, as was the case in 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 only asset that the creditor can obtain is cash; barter transactions cannot be expropriated by the creditor, nor can creditors replace the manager.⁷

2.2. The Setting

There are two agents: a firm F and a creditor C . F owes C debt $D_0 > 0$. The firm has one unit of output and no cash. The firm may sell the output for cash and use the revenue to purchase inputs or engage in barter to obtain inputs. The relative prices in the cash market are better for the firm than those in the barter market because barter transactions involve high legal, transportation, and storage costs.

⁷ Makarov (2000) considers a conflict between management and outside investors, i.e., majority shareholders, who can replace the management at a cost. In his model, barter is used by the incumbent manager to secure his position because barter increases specificity and therefore raises the cost of firing the manager. However, Makarov's empirical analysis of a sample of 150 firms does not seem to support this story.

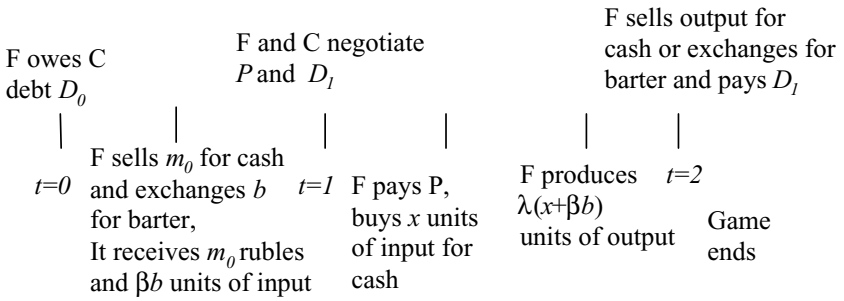


FIG. 1. The timing of decisions.

On the other hand, cash revenues can be captured by the creditor while the in-kind exchanges from barter 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 be used only as inputs in F's production.

There are two periods;⁸ the sequence is given in Fig. 1. At time $t = 0$, F has one unit of output and can choose whether to sell it for cash or to exchange it in a barter transaction. The share of output to be sold for cash is denoted m_0 and the share of output to be exchanged in barter is denoted b , with $m_0 + b \leq 1$. The cash prices of output and inputs are normalized to 1; by 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, by exchanging b for barter, F gets βb units of input. At time $t = 1$, the debt comes 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 succeeds, F's cash balance becomes $m_1 = m_0 - P$, and F promises to pay D_1 at $t = 2$. If the renegotiation fails, C takes $P = \min\{m_0, D_0\}$ and invests it elsewhere.⁹ In this case, F has only $m_1 = m_0 - \min\{m_0, D_0\} = [m_0 - D_0]_+$. The new debt is $D_1 = D_0 - \min\{m_0, D_0\} = [D_0 - m_0]_+$.¹⁰

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 remaining $m_1 - x$ rubles are diverted to personal consumption by the manager of F.

The firm has a linear technology that converts q units of inputs into λq units of output. The maximum capacity is one unit of input: $q \leq 1$. The capacity

⁸ The two-period setting is chosen to simplify the analysis. The finite horizon model with T periods or the infinite horizon model with discounting would produce similar results.

⁹ 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. Moreover, C cannot take over the firm due to imperfect bankruptcy procedures.

¹⁰ Hereafter, $[\cdot]_+$ denotes $\max\{\cdot, 0\}$.

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 exchange it in barter. The cash revenues $m_2 \in [0, \lambda q]$ can be confiscated by the creditor if the debt has not yet been repaid. The remaining cash is used for consumption by F's owners, and the game ends.

The gross interest rate in the economy is normalized at 1. Therefore the creditor payoff and the utility of the firm's manager are given by

$$U^C = P + \min\{m_2, D_1\} \quad (1)$$

and

$$U^F = m_1 - x + [m_2 - D_1]_+. \quad (2)$$

2.3. The Assumptions

For simplicity, we make the following assumption concerning the firm's productivity λ and the transaction costs of barter $1 - \beta$:

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

The first inequality implies that barter is less efficient than money because $\beta < 1$. The second inequality states that the firm's productivity is high enough to ensure that the firm adds value because $\lambda\beta > 1$ even under the relative prices given by β . Together, these two inequalities imply that the firm adds value under cash prices as well because $\lambda > 1$. The last technical condition rules out trivial cases. If the firm were too productive in that $\lambda > 2$, 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., cash diversion for current consumption.¹¹

For simplicity, we assume that F has all the bargaining power. In this situation, even if F is the residual claimant, there will still be incentives for barter. We also assume that the parties have symmetric information, so that creditors are perfectly aware that their rights may be violated. The problem is one of enforcement, which can be analyzed within the framework of incomplete contracts. C knows that there is no mechanism to enforce a contract that obliges the manager of F to use cash for buying inputs rather than taking it for personal consumption because, although x is observable, it is not verifiable. Finally, we note that cash has the same value for both parties but barter can be used as an input in production only with the

¹¹ This condition is related to the fact that we only have two periods. If there were T periods, the constraint would be $\lambda < T$.

technology owned by F.¹² Technology is inalienable. Even if F breaches the debt contract, C cannot take control of the productive assets.¹³

These assumptions make the model simple at the cost of neglecting many important aspects of the choice between barter and monetary transactions. In our model, all the transportation, storage, and search costs related to barter exchanges are taken as given and represented by the parameter $1 - \beta$. The nontransparency of barter is also modeled in a very crude way. Barter is perfectly transparent for insiders, but not transparent at all for outsiders. We also assume that goods that are sold for cash and those exchanged in barter are perfect substitutes. Thus there is no issue of price discrimination. Finally, we do not consider political aspects, issues related to public procurement and tax implications.

2.4. The First Best Outcome

The social optimum is to sell for cash, buy one unit of inputs, and produce at maximum capacity. In other words, $b = 0$, $m_0 = 1$, $q = 1$, $m_2 = \lambda q$. Then social welfare equals λ . There are three potential sources of inefficiency in the model. First, exchanging for barter rather than selling for cash involves transaction costs $(1 - \beta)b$. Second, debt renegotiation may fail; if C takes all the cash at $t = 1$, F produces below the social optimum $q < 1$, and therefore a dead weight loss of $(\lambda - 1)(1 - q)$ arises.

The third problem is cash diversion or transformation risk. Even if debt payments are postponed and F keeps some cash, the manager of F may prefer to spend it for consumption 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. Hence, the manager has more discretion in using liquid assets. Therefore, outside investors have less control over the manager the more liquid the assets are. Transformation risk often appears in the literature on incomplete financial contracts in which 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 transform cash for private benefit while in-kind payments, i.e., inputs, can be used only for production.

The first best outcome can be implemented by effective bankruptcy legislation.¹⁴ Assume for a moment that the assumption of inalienable technology does not hold.

¹² This rules out the case in which C is F's supplier of inputs, and a competitive market for C's product exists. In that situation, two assumptions are violated. First, barter is as valuable for C as it is for F. Second, F cannot produce, if it does not pay C. Hence, our model applies only to the relationships with banks, government, employees, or suppliers for which F is the only buyer.

¹³ The conventional explanation lies in the inalienability of human capital. Although it may also be applicable to Russia, we have in mind a much larger problem, namely, the absence of effective bankruptcy procedures. In Russia, creditors have a difficult time claiming the assets of bankrupt firms (Lambert-Mogiliansky et al., 2000). Thus even physical capital is inalienable. Certainly, it is much easier for creditors to obtain liquid assets, i.e., cash.

¹⁴ Formally, another simple solution is to write off the debt. However, this does not satisfy C's individual rationality constraint.

In this case, if F does not pay C, C can replace the manager. Then F knows that barter will not help, because if F exchanges for inputs in barter transactions and not enough cash is left to repay the debt, C assumes control over the assets. Then C uses the inputs b for production, and the replaced manager gets nothing.

2.5. Equilibrium without Renegotiation

We start when renegotiation at $t = 1$ is not allowed, and solve the model by backward induction. First, we find m_2 given x , P , D_1 , m_0 , and b . Second, we determine x given P , D_1 , m_0 , and b . Then we find P and D_1 , given m_0 and b . Finally, we describe the choice of m_0 and b . Our ultimate goal is to establish to what extent the choice between money, m_0 , and barter, b , depends on debt, D_0 . The choice between money and barter at $t = 2$ is trivial. Since goods received in barter can only be used for production, no barter exchanges will take place in the last period.¹⁵ Hence, $m_2 = \lambda q$.

The quantity of inputs bought for cash $x \in [0, m_0 - P]$ is chosen by the firm to maximize the utility of F's manager, given by

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

This function is convex with respect to x . Therefore the solution must be a corner one; i.e., either $x = 0$ or $x = m_0 - P$. F prefers $x = m_0 - P$, i.e., using all available cash to buy inputs, 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

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

Now consider the first-period payments P and the second-period debt D_1 . Since there is no renegotiation, $P = \min\{m_0, D_0\}$ and $D_1 = [D_0 - m_0]_+$. The choice between money and barter involves the firm choosing b and m_0 to maximize (2) subject to $b + m_0 \leq 1$. Two cases are possible. In the first case, the firm receives enough cash revenue to pay off the initial debt; i.e., $m_0 \geq D_0$. Hence, $P = D_0$ and $D_1 = 0$. Inequality (3) holds, so $x = m_0 - P$ 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 as much as possible for cash so that $m_0 = 1$ and $b = 0$. Obviously, this case is possible only if $D_0 \leq 1$. The utility of F's manager is $U_{m_0=1}^F = \lambda(1 - D_0)$.

In the second case, the firm does not have sufficient cash revenues to repay the debt; i.e., $m_0 < D_0$. F must pay all the cash to the creditor, so $P = m_0$ and $D_1 = D_0 - m_0$. The firm is left with no cash to buy inputs, so $x = 0$. The manager's utility is $U^F = [\lambda\beta b + m_0 - D_0]_+$. Since $\lambda\beta > 1$, the firm is better off exchanging

¹⁵ This is due to the finite horizon setting.

everything for barter; i.e., $m_0 = 0$ and $b = 1$. Then, the manager gets $U_{b=1}^F = [\lambda\beta - D_0]_+$. Comparing the two cases, the firm is better off exchanging for barter whenever debt is sufficiently high.

PROPOSITION 1. *In the model without renegotiation, the firm chooses to exchange all its output for barter if and only if $D_0 \geq D^* = \lambda(1 - \beta)/(\lambda - 1)$. Otherwise, the firm sells all its output for cash.¹⁶*

The proposition is quite intuitive. If there is no possibility of renegotiation, the creditor will seize all the cash that the firm obtains. Stripped of working capital, the firm will not be able to continue production at a reasonably high level. To protect its working capital, the firm chooses to hide the revenues from the creditor by exchanging for barter. Although this is inefficient because $\beta < 1$, barter avoids the expropriation of working capital and facilitates the acquisition of inputs. Able to produce in the second period, the firm obtains cash and partially or fully repays the debt.

2.6. The Model with Renegotiation

The creditor's behavior described in the previous section may be myopic. By restructuring the debt, the creditor would encourage the firm to produce more in the second period. Hence, the creditor's chance of being repaid eventually would increase. Therefore, debt restructuring may provide *ex ante* incentives for the firm to sell for cash rather than for barter. F knows that C will not expropriate all the cash immediately so that it is not necessary to hide revenues in barter transactions and to pay the additional cost. In this section, we construct a model that allows renegotiation and determine the extent to which renegotiation reduces barter activity.

As before, we solve the model by backward induction. Obviously, the choices of m_2 and x given P , D_1 , m_0 , and b are the same as in the previous model. In the second period, F sells for cash, so $m_2 = \lambda q$. 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 over P and D_1 to maximize their joint surplus at date $t = 1$. At this point, the choice between money and barter m_0 and b has already been made, so that renegotiation affects only the debt overhang in the last period and therefore F's incentives to produce more output. If P and D_1 are such that (3) holds, F uses whatever cash remains to buy inputs and produce more. Otherwise the manager diverts the remaining cash immediately for personal consumption and uses only inputs obtained by barter.

The returns to the respective parties, calculated at $t = 1$, are as follows. If inequality (3) holds, which is the no-diversion case, we have

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

¹⁶ The proof is straightforward and not provided.

On the other hand, if inequality (3) does not hold, which is the diversion case, we have

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

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

Case 2 never occurs in equilibrium. The objective of renegotiation is to postpone debt payments in order to leave some cash for input purchases. If the firm manager uses the cash for current consumption and if $x = 0$, there is no point in debt restructuring. To avoid case 2, the parties will agree in the first period on a contract, i.e., P and D_1 , that satisfies constraint (3) and therefore prevents the firm manager from diverting cash. Unfortunately, when constraint (3) is binding, the choices of P and D_1 are distorted. Diversion never occurs but the threat of diversion prevents the parties from achieving the first best outcome.

Formally, F chooses P and D_1 to maximize

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

subject to (3) and the creditor's individual rationality constraint, rewritten as

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

The solution to this problem is $P = (2 - \lambda)^{-1}[m_0 + \min\{\lambda\beta b, D_0 - m_0\} - \lambda\beta b - (\lambda - 1)m_0]_+$ and $D_1 = m_0 + \min\{\lambda\beta b, D_0 - m_0\} - P$. 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, providing F with wrong incentives. By 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 exchanged its output in a barter transaction. 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 so that $P = 0$.¹⁸

¹⁷ In particular, if $\lambda > 2$, condition (3) would not bind, and the solution would always be $P = 0$ and $D_1 = m_0 + \min\{\lambda\beta b, D_0 - m_0\}$. The intuition is straightforward. If the firm is very productive, the manager's incentives are aligned with those of creditors. The value of buying inputs is high so that manager is not interested in diverting the cash. Since there is no risk of managerial misconduct, renegotiation solves the liquidity problem, and barter does not emerge in equilibrium.

¹⁸ Constraint (3) assures that the utility derived from buying inputs with all available cash is higher than that derived from diverting cash and financing all production through barter. In other words, there is no risk of cash diversion. If the constraint is binding, the parties cannot agree on postponing all debt payments because of the threat of diversion.

Substituting P and D_1 into (4), we obtain the firm manager's utility 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 maximize (5) subject to $b + m_0 \leq 1$. Obviously, (5) increases with both b and m_0 , so that this constraint is binding and we have $b + m_0 = 1$. Substituting $b = 1 - m_0$ into (5) 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 exchange everything in barter ($m_0 = 0$). If F uses barter it gets $U_{b=1}^F = [\lambda\beta - D_0]_+$. If F sells everything for cash, it gets $U_{m_0=1}^F = 1 + ([1 - D_0]_+ - (2 - \lambda)) - (2 - \lambda)^{-1}(\lambda - 1)[(2 - \lambda) - [1 - D_0]_+]_+$. It is easy to show that $U_{b=1}^F > U_{m_0=1}^F$ if and only if $D_0 > D^{**} = (1 - \lambda\beta(2 - \lambda))/(\lambda - 1)$.

PROPOSITION 2. *In the model with renegotiation, the firm chooses to exchange all its output for barter if and only if $D_0 \geq D^{**} = (1 - \lambda\beta(2 - \lambda))/(\lambda - 1)$. Otherwise, the firm sells all its output for cash. In the presence of renegotiation, barter is less likely: $D^{**} - D^* = \lambda\beta - 1 > 0$.*

This proposition implies that introducing renegotiation makes barter less likely. If $D_0 \in (D^*, D^{**})$, barter does not occur with renegotiation although it would occur if renegotiation were not allowed. Thus, renegotiation reduces the tendency to use barter but it does not eliminate this tendency altogether. Why does renegotiation not eliminate any incentive to engage in barter? The firm's manager cannot commit not to divert cash for current consumption because of 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 in the second period m_2 . Therefore, diversion is likely to occur. Reducing the second-period debt overhang can prevent diversion, but this comes at a cost. 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 activity as possible.

We now compare the effect of productivity λ on barter with and without renegotiation. Without renegotiation, for all $\lambda \in (1/\beta, \infty)$ the likelihood of barter is greater in more productive firms because D^* decreases with λ . Since barter protects working capital, higher productivity results in higher incentives to use barter. If debt restructuring is allowed, the effect of productivity is more complex. For $\lambda \in (1/\beta, 2)$, D^{**} decreases with λ . For $\lambda \in [2, \infty)$ barter does not occur. In addition to the incentive to protect working capital, there is now an opposite effect. The more productive is the firm, the less is the incentive for the manager to divert cash; hence, the more likely it is that renegotiation results in debt postponement and that barter is chosen.

2.7. The Role of a Financial Bubble

Our analysis above indicates that renegotiation helps to decrease barter activity. However, renegotiation does not occur because of the free-rider problem. If there are many creditors, it will be difficult for them to agree on the renegotiation strategy because each creditor wants to free-ride at the others' expense. Further explanation of the failure of renegotiation to eliminate barter may be the presence of a financial bubble that results in a high real interest rate. From 1995 to 1998, the market in Russian government bonds, GKO, yielded very high real returns. After the bubble burst in August 1998, barter levels have been steadily decreasing. We model the GKO market in the following way.

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

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

Solving the model by backward induction, we obtain an equilibrium that is equivalent to the equilibrium without renegotiation in real terms. Indeed, $m_2 = \lambda q$ and $x = m_0 - P$, if (3) holds, but $x = 0$, otherwise. Renegotiation leads to $P = \min\{m_0, D_0\}$ and $D_1 = [D_0 - m_0]_+$. The creditor is not interested in second-period payments unless F offers δ second-period rubles for each first-period ruble. However, this cannot occur because 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. Stripping the firm of its working capital and buying bonds is locally efficient because the coalition of F and C makes more money by investing in GKOs, than it can obtain by buying inputs and producing output. However, δ is not a long-run market rate of return because of the bubble. The cost of capital in the economy is still normalized at one and, therefore, redirecting cash from the real sector to the bond market is not efficient.¹⁹

3. EMPIRICAL ANALYSIS

3.1. The Empirical Strategy

Our model predicts that a higher level of indebtedness causes a higher share of barter exchanges, because of the threat of cash diversion by the manager or because of the GKO bubble. Both explanations are consistent with Russian evidence. The highest levels of barter were observed in the period of poorest corporate governance, weakest market and government institutions and highest GKO

¹⁹ Clearly, this is not a closed and consistent model with rational players. We have looked only at one side of the GKO cash flows. Building a general equilibrium model of a Ponzi scheme is not the purpose of this paper. We assume that there were myopic agents who supported the high rate of return somewhere in the public or private sector.

yields.²⁰ In this section, we test empirically whether high indebtedness leads to more barter, while controlling for other determinants of barter, i.e., firm size, access to export markets, and location and industry specifics. From our model, we expect the effect of debt on barter to be nonlinear. If the firm is very highly indebted ($D > \lambda\beta$), using barter to protect working capital does not help to get out of the debt trap. Hence, debt increases barter only if the debt is not too high. We check this hypothesis by including debt squared in the regression and by excluding the most indebted firms.

We should also control for an alternative explanation for the correlation between barter and indebtedness. Barter occurs in firms that have not been able to adjust to the market economy, and these firms also happen to have accumulated large amounts of bad debt.²¹ To distinguish this effect from our hypothesis, we control for the output decline during the reform years which we take to be a proxy for the degree of adjustment of the firm to the market economy. Firms with higher real output decline, or lower capacity utilization, find it more difficult to compete in the market economy, and, therefore, they accumulate greater debts and use more barter.

We must also control for the endogeneity of debt. Our model takes the initial level of debt as given. However, if the creditors are aware that their rights may be violated through barter, they may choose to decrease loans to such firms. If the expected level of barter is high enough, the creditor anticipates that the firm will continue to confiscate cash by using barter, and reduces its credit supply *ex ante*. Hence, the effect of debt on barter obtained by estimating ordinary least squares regressions will be understated. To find the true effect, we need to control for endogeneity. To do so, we employ an instrumental variable approach using lagged debt as an instrument. Unfortunately, data limitations do not allow us to test directly whether firms with better corporate governance have less barter even if they are indebted, as is predicted by our theory. The usual proxies for corporate governance, e.g., shares and number of outside blockholders, require reliable data on ownership structure that are not available in our sample.

3.2. Data Description

We use the data set *Barter in Russian Industrial Firms* (BRIF) from the New Economic School Research Project “Non-monetary Transactions in Russian Economy.” This data set was created by matching the surveys of managers of Russian industrial firms conducted from 1996 to 1998 by Serguei Tsoukhlo (Institute of Economies in Transition, Moscow) with the Goskomstat database of Russian

²⁰ Moreover, as the causality test in Brana and Maurel (1999) shows, higher real interest rates caused higher barter in 1995–1998.

²¹ Gaddy and Ickes (1998) analyze the relationship between barter and distance to the market through relational capital.

firms (Federal Committee of Statistics of Russian Federation). Since Goskomstat data are most complete and reliable for 1996 and 1997, we ran regressions for the 1996 and 1997 data.

The barter data set includes six to seven hundred firms each year. The barter data consist of 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 that data base. 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 these, more than 150 firms appear in both 1996 and 1997. For those firms, we can run instrumental variables regressions using lagged debt as an instrument.

As a proxy for debt we use the firm's total short-term indebtedness at the beginning of the corresponding year, divided by annual sales. This variable includes bank loans and amounts owed to suppliers, subsidiaries, consolidated government, IOU holders, employees and other creditors.²² To control for size we include the logarithm of annual sales. To control for the export orientation, we include the share of exports in sales. The summary statistics and pairwise correlations are reported in Tables A1 and A2 in the Appendix. We also include regional and broad industry dummies. As for the regions, we introduce dummies for Moscow, the Urals and Siberia using European Russia as the base category. In order to control for output decline, we divide the previous year's real output by its prereform level.

3.3. Results

Table 1 reports Ordinary Least Squares (OLS) estimates for both 1996 and 1997. In addition to indebtedness, we control for firm size (LogSales), share of export in sales (Export), and capacity utilization, measured as real output in the previous year divided by the real output prior to the reform (Utc); we also include regional and industry dummies. In column A, we run the regression for the whole sample and find that barter positively and significantly depends on debt. Then, we include debt squared in the regression and find that the coefficients of both debt and debt squared have the expected signs but are not significant. In the last regression in Column A, we do not include debt squared but rather exclude the most indebted firms with $Debt > 1$, i.e., the firms whose debt is greater than their annual

²² An alternative approach would be to use overdue payables. Unfortunately, the data on overdue payables are incomplete. Since we use annual data for barter and the debt is short-term, due in less than one year, our approach is more appropriate. The total short-term debt stock at the beginning of each year is the important influence on the firm's finance within the year.

TABLE 1
 OLS Regressions with Robust Standard Errors (in Parentheses), IV Regression

	A OLS 1996			B OLS 1997			C IV 1997 ^a	
	Full sample	Full sample	Debt < 1	Full sample	Full sample	Debt < 1	Full sample	Debt < 1
Debt	0.074** (0.032)	0.077 (0.062)	0.105* (0.055)	0.023** (0.011)	0.179*** (0.045)	0.152*** (0.049)	0.097*** (0.032)	0.264** (0.111)
Squared debt		-0.017 (0.026)			-0.051*** (0.017)			
Utc	-0.049* (0.025)	-0.049* (0.025)	-0.043* (0.026)	-0.063*** (0.020)	-0.052*** (0.019)	-0.062*** (0.020)	-0.063*** (0.031)	-0.057** (0.029)
Export	-0.21*** (0.07)	-0.21*** (0.07)	-0.24*** (0.07)	-0.33*** (0.11)	-0.31*** (0.11)	-0.40*** (0.15)	-0.57** (0.16)	-0.76** (0.16)
LogSales	0.022** (0.012)	0.023* (0.011)	0.019 (0.012)	0.014 (0.011)	0.010 (0.011)	0.013 (0.011)	0.037** (0.017)	0.015 (0.015)
Regional and industry dummies	***	***	***	***	***	***	***	***
Constant	-0.11 (0.21)	-0.11 (0.21)	0.04 (0.24)	0.11 (0.30)	0.228 (0.242)	0.11 (0.32)	0.199 (0.185)	0.152 (0.283)
<i>N</i>	284	284	273	311	311	267	167	150
<i>R</i> ²	0.32	0.32	0.32	0.35	0.36	0.39	0.39	0.48

*** Indicates significance at 1% level.

** Indicates significance at 5% level.

* Indicates significance at 10% level.

^a debt96 is used as an instrument.

sales.²³ Approximately 5% of the firms in the sample fall in this category; by excluding these hopeless debtors, we do not lose many observations. The regression for the subsample of firms with Debt < 1 does support the nonlinearity hypothesis. The coefficient for debt is marginally significant and is greater than the one obtained for the entire sample.

Capacity utilization, which we take as a proxy for the firm's healthiness, is negatively related to barter. Larger firms, more likely benefiting from relational capital, use more barter. Finally, export-oriented firms engage in less barter, because their foreign partners are less likely to accept barter deals. Regional and industry dummies are also significant; there is 20% less barter in Moscow and 10% more barter in the Urals and Siberia than in European Russia.

Column B contains the estimations for 1997 and the results are stronger. The coefficient for debt in the full sample is significant although rather small. Once we include debt squared, this coefficient goes up and becomes highly significant. The coefficient of debt squared is negative and highly significant, which is consistent with our model, because the effect of debt on barter is stronger for less indebted

²³ We have tried other cutoff points for the level of indebtedness and the results were similar.

firms. In the regression for the subsample of firms with $\text{Debt} < 1$, the coefficient on debt is highly significant and relatively large. The estimated impact of debt on barter implies that, if the firm writes off debt equal to annual sales, the share of barter in sales goes down by 15%. This is quite substantial given that the average level of barter is 40%.

Column C presents the instrumented variables (IV) estimates for 1997, when debt96 is used as an instrument.²⁴ The IV estimates of the effect of debt on barter are higher than the OLS ones. For the entire sample, the coefficient on debt is 0.097 compared to 0.023, and the difference is significant. For the subsample $\text{Debt} < 1$, this coefficient is 0.26 compared to 0.15, but the difference is not significant. The difference in estimates in IV and OLS regressions suggests that debt might be endogenous to barter. Creditors that expect high barter activity in 1997 try to decrease lending in 1996.²⁵ This could explain the positive correlation between debt and barter; i.e., more indebted firms in 1997 were more indebted the year before and these firms have more barter in both years. Nevertheless, correcting for endogeneity does not eliminate the correlation between barter and debt. Hence, our model has even stronger empirical support than the OLS analysis suggests.

The fact that creditors still lend even though they expect to lose their money through barter or debt restructuring does not mean that they are irrational. As argued in the debt overhang literature by Krugman (1988), this follows from uncertainty about the debtor's future profits at the time of lending. With some probability, profits will be high and the debt can be repaid. In other contingencies, the debt payment is too high and debt restructuring is needed. In expected terms, lending is profitable and creditors are rational.

As an additional check of the alternative explanation that the debt-barter relationship may be caused by the inability of firms to adapt to the market economy, we run a regression for firms with high capacity utilization. For each of the regressions in Table 1, we sorted the firms by Utc and picked the upper half of the sample. The results are reported in Table A4 in the Appendix. As expected, the coefficients on debt are less significant, but they remain positive and similar in absolute value.

²⁴ Since we look only at short-term debt, debt96 includes claims due in 1996 and therefore should not directly influence barter in 1997.

²⁵ We also checked whether the creditors have rational rather than adaptive expectations, i.e., whether they reduce lending in response to higher future or higher current barter. We tested whether debt97 , i.e., indebtedness as of Jan. 1, 1997, depends on barter96 and found no relationship. The results are shown in Table A3 in the Appendix. Whether controlling or not controlling for debt96 , lending during 1996 does not depend on barter in 1996. This is quite striking given that both debt and barter are autocorrelated and correlated between each other in each year. Creditors lend less to firms with high future expected amounts of barter rather than focusing on the observed level of barter; hence, creditors are rational and have forward-looking expectations.

4. CONCLUSIONS

This paper analyzes the relationship between indebtedness and barter in Russian firms. Our model incorporates two theories of barter that are commonly believed to be mutually exclusive, namely the liquidity shortage argument and the managerial explanation. We assume that barter helps to protect the working capital needed to sustain production and also that barter is a strategic choice of managers, although it is costly for outside investors. We model explicitly the possibility of relaxing the liquidity constraint by refinancing debt. Since the firm has only temporary liquidity problems but is solvent in the long run, replenishing its working capital is socially efficient, so that debt restructuring should be in the mutual interest of the firm and the creditors. However, the creditors face a difficult choice. By postponing too much debt, they provide an incentive for the manager to divert cash rather than to finance the firm's working capital. Therefore, the lack of the manager's commitment not to divert cash becomes a constraint for debt restructuring. If the debt overhang is too high, negotiations fail and the debt is not restructured. This, in turn, provides *ex ante* incentives for the manager to prefer barter even though barter involves high transaction costs.

Empirical evidence supports the model's main prediction, that a higher level of indebtedness implies a higher level of barter transactions. Moreover, the expected effect of debt on barter is nonlinear. This latter hypothesis is tested by including debt squared and by excluding the most indebted firms. With and without debt squared and whatever the subsample, the correlation between indebtedness and barter is positive. By adding output decline to the equation, as a proxy for the degree of adjustment of the firm to the market economy, we control for the fact that firms that are unable to adapt to the new market conditions are more prone to accumulate large amounts of debt. Creditors may be aware that indebted firms are more likely to confiscate the cash and to engage in barter deals, so that they may reduce their supply of loans *ex ante*. We control for this endogeneity bias by instrumenting the potentially endogeneous explanatory variable. The correlation between debt and barter remains positive and significant.

Our model does not provide a consistent answer to the question why debt overhang causes barter in Russia but not in other economies. We establish 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 be an equilibrium strategy regardless of the indebtedness of the firm. Our microeconomic model explains variation in barter given that the average level of barter is quite high and that search, transportation and legal costs of barter are rather low. We require barter to be institutionalized in that the economy has a large number of barter intermediaries and barter networks are established so that double coincidence of wants is not a substantial problem. As Makarov and Kleiner (2000) argue, this is precisely what has happened in Russia in the recent years. Barter is costly but it is not as costly as in other economies. Therefore, we apply our model to explain a variation in barter across firms by variation in indebtedness. This argument may explain why creditors do not stop

lending to the firms that use barter. When everyone uses barter, it is hard to distinguish a strategic use of barter from an involuntary one.

The model implies that improving the bankruptcy procedures would have different effects in the presence and in the absence of an asset bubble, such as the government bonds bubble. In Russia, during a bubble, the lack of protection of creditor rights leads to barter activity that protects the firm's working capital so that it can keep producing. Although the returns to production are lower than the yield on the alternative assets, production may be socially efficient because of the bubble. On the other hand, without an asset bubble, the lack of effective bankruptcy procedures and the lack of protection of creditor rights also results in barter but this activity is now less efficient than monetary exchange. Our analysis suggests two policies that may decrease barter activity, namely avoiding high-yield debt financing of the budget deficit and continuing to introduce effective bankruptcy procedures that protect the rights of outside creditors.

Our analysis is mostly applicable to the Russian economy before the 1998 crash, but is also instrumental in understanding what has happened in recent years. Since 1999 barter has been declining steadily; it is finally reaching a level comparable to that in other economies. Our model points to at least three forces that crowd out barter in Russia. First, the default on government bonds lowered risk-free interest rates and made creditors more patient. Second, the devaluation of the exchange rate, combined with a surge in the oil export revenues, and high inflation reduced substantially the real value of ruble-denominated debt overhang. Third, the moratorium on external debts payments relieved Russian firms of their dollar-denominated obligations. These forces reduced the incentives to use barter and initiated a virtuous circle of remonetization. However, it is not clear that barter has been eliminated in Russia. Without proper protection of creditor rights, the oil price shocks and the high debt payments expected from 2003 to 2005 may reintroduce the incentive to engage in barter transactions.

APPENDIX

TABLE A1
Summary Statistics

Variable	Explanation	Mean	Std. Dev.	Min	Max
Barter_96	Share of barter in sales, 1996	0.37	0.24	0	0.83
Barter_97	Share of barter in sales, 1997	0.42	0.25	0	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	0.97
Export97	Share of export in sales, 1997	0.063	0.146	0	0.97

TABLE A2
Pairwise Correlations

	Barter_96	Debt96	Ls96	Export96	Utc96
Barter_96	1				
Debt96	0.25***	1			
Ls96	0.11	0.10	1		
Export96	0.10	0.27***	0.1836	1	
Utc96	-0.16***	-0.20***	0.28***	-0.09*	1
	Barter_97	Debt97	ls97	Export97	Utc97
Barter_97	1				
Debt97	0.30***	1			
ls97	0.09	0.06	1		
Export97	-0.02	0.13**	0.20***	1	
Utc97	-0.23***	-0.21***	0.32***	-0.03	1

*** Significance at 1% level.

** Significance at 5% level.

* Significance at 10% level.

TABLE A3
OLS Regressions for Debt97

	Full sample	Full sample	Debt97 < 1 & Debt96 < 1	Debt97 < 1 & Debt96 < 1
Barter96	-0.10 (0.43)	-0.58 (0.43)	0.07 (0.08)	0.01 (0.07)
Debt96		2.02*** (0.50)		0.69*** (0.12)
Utc96	-0.19*** (0.007)	-0.004 (0.042)	-0.05* (0.02)	-0.03 (0.02)
Export96	0.38 (0.33)	-0.40 (0.40)	0.50*** (0.15)	0.32** (0.14)
LogSales	0.002 (0.076)	-0.052 (0.074)	0.023 (0.018)	0.010 (0.015)
Regional and industry dummies	**	**	**	Not significant
Constant	0.65 (1.45)	0.93 (1.26)	-0.22 (0.31)	-0.12 (0.25)
<i>N</i>	167	167	149	149
<i>R</i> ²	0.12	0.47	0.26	0.48

Note. Robust standard errors are in parentheses.

*** Significance at 1% level.

** Significance at 5% level.

* Significance at 10% level.

TABLE A4
Regressions for the Firms with High Capacity Utilization

	A			B			C	
	OLS 1996			OLS 1997			IV 1997 ^a	
	Full sample	Full sample	Debt < 1	Full sample	Full sample	Debt < 1	Full sample	Debt < 1
Debt	0.054 (0.094)	0.382*** (0.146)	0.207** (0.101)	0.095 (0.077)	0.317*** (0.088)	0.139 (0.085)	0.211 (0.137)	0.099 (0.235)
Squared debt		-0.30*** (0.09)			-0.116*** (0.036)			
Utc	-0.035 (0.036)	-0.24 (0.036)	-0.025 (0.037)	-0.035 (0.023)	-0.033 (0.024)	-0.030 (0.025)	-0.012 (0.033)	-0.009 (0.034)
Export	-0.128 (0.110)	-0.164 (0.102)	-0.188* (0.103)	-0.322** (0.131)	-0.339*** (0.130)	-0.248 (0.180)	-0.449** (0.175)	-0.452** (0.211)
LogSales	0.033* (0.019)	0.021 (0.020)	0.023 (0.020)	0.022* (0.013)	0.017 (0.012)	0.021* (0.013)	0.027 (0.027)	0.003 (0.018)
Regional and industry dummies	***	***	***	***		***	***	***
Constant	-0.290 (0.330)	-0.121 (0.340)	-0.162 (0.340)	-0.026 (0.225)	0.027 (0.222)	-0.067 (0.232)	-0.147 (0.479)	0.242 (0.329)
N	142	142	137	156	156	133	84	75
R ²	0.40	0.43	0.42	0.42	0.46	0.45	0.38	0.49

Note. OLS regressions with robust standard errors in parentheses.

***Significance at 1% level.

**Significance at 5% level.

*Significance at 10% level.

^adebt96 is used as an instrument.

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