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Abstract

This paper proposes a theory to understand the nature of the barter in Russia and provides an explanation to the main stylized facts about the phenomenon during the 1990s. We argue that a strongly constrained credit market might make a barter economy emerge if firms have access to alternative transactions technologies, and that Russia’s virtual economy, often seen as an irreconcilable approach, may be a consequence rather than a cause of the phenomenon.

JEL: E0, E6, P20, P21, P23, P26
INTRODUCTION

Russian and Western scholars alike have devoted considerable attention to the causes and consequences of the growth in the number of transactions between commodities among Russian firms during the 1990s. Sometimes these transactions take the form of simple barter, if it happens to be a double coincidence of wants; some other times, firms accept commodities as media of exchange; and in some other occasions, these media of exchange have been widely accepted in some local areas of the country. In Russia, objects used as temporary store of value include not only common articles of trade but also: (1) veksels, promissory notes issued by firms to suppliers; (2) zachety, debt offsets between firms, and tax offsets between firms and local governments; and (3) debt swaps. In any case, no credit market has ever arisen using these commodities as units of accounts. Although some of these items may have evolved to a sort of commodity money in some areas, for the sake of simplicity, in this essay we refer to all transactions between two commodities as barter.

According to the Institute for the Economy in Transition, barter has increased in Russia from 5-10% in industrial sales in 1992 to a high of 50-60% in 1998 before falling to 20-30% in 2000. Numerous surveys of Russian firms between 1996 and 1999 suggest

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1 See Commander and Mumssen (1998).
2 IET January 2000.
that the “normal” volume of commodity barter Russia between 1996 and 1999 hovered between 40% and 70% of total transactions, depending upon the industry and location of the firm.3

Although barter is usually viewed as a costly anomaly in the transition process, preserving features of the planned economy which impede the development of efficient market relations, any modern academic economist should accept that the transaction technology used in Russia must be the result of the optimal choice firms have available. The “virtual economy” proposed by Gaddy and Ickes (1999), Guriev and Kvassov (2001), and Hendley et al (1998) asserts that firms choose to barter to evade the official economy, impeding enterprise restructuring efforts. This has the “hard-to-believe” consequence that the recent decline in barter must be the result of structural changes in Russia that have encouraged firms to return to the official economy.

On the other hand, a number of empirical works documenting the phenomenon look for the cause of growth in barter in the credit market.4 They claim that barter is imposed upon the firm as a result liquidity constraints stemming from macro or microeconomic circumstances: a firm owning no cash to finance its operations and subject to credit rationing, as in Jaffee and Stiglitz (1990), will choose to barter, if that technology is available. This situation enhances the need of enterprise restructuring efforts that have yet to be established.

This paper also looks upon the credit market as the cause of growth of barter in Russia. Although there is abundant documental literature, the phenomenon has not

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received much theoretical attention. This paper, then, develops a simple general equilibrium model to propose a theory that explains the main stylized facts about the growth of barter in Russia during the 1990s. Yet unlike the current belief in most of the literature, no credit rationing is necessary for this to occur. In an economy with access to a barter technology and a tight enough credit market, because of the high opportunity cost of using fiat money to make transactions, it may be optimal for some firms to barter. We also claim that Russia’s virtual economy, often seen as an irreconcilable with the credit market approach, may be a consequence rather than a cause of the phenomenon: in the short run, Russian managers might avoid restructuring because it jeopardizes their access to alternative transaction technologies; and that the phenomenon might well also take place in a well-developed market economy.

The paper is organized in five sections. Section 1 rationalizes the key assumption that Russian firms have access to a barter technology, and why this may occur as well in a well-developed market economy. Section 2 summarizes the main stylized facts about the barter phenomenon in Russia. Section 3 develops the model and analyzes its working. Section 4 contains the central analysis of the paper; it provides an explanation to the main stylized facts and analyzes the circumstances under which some firms choose to barter. Finally, section 5 concludes, and discusses the significance and limitations of the analysis.

I. ACCESS TO A COMMODITY TRANSACTION TECHNOLOGY

Two major factors inherited from the Soviets have given the Russian economy access to a barter technology: shortages in the official economy system and the payment system.

*Circumventing shortages in the official economy.* Barter is not new to enterprise managers in Russia’s transition economy. In the simplest view, the Soviet economy was
a barter economy, with Gosplan and Gosnab acting as mediators between ministries. Quinquennial plans designated the flow of materials and goods, with little regard to financial aspects. Above-plan production in the Soviet economy was frequently traded between firms in barter arrangements (Berliner 1957 1976, Gregory and Stuart 1986). Moreover, failures in vertical linkages caused persistent and pervasive shortages in the Soviet economy that were overcome by unofficial horizontal linkages through the establishment of barter trade between firms to obtain the requisite materials that the planning authorities failed to deliver.\(^5\) Makarov and Kleiner (1996) estimate that between 2\% and 6\% of transactions between firms prior to perestroika were established by the firms themselves in order to smooth out plan fulfillment, and in many instances, local party officials acted as a clearinghouse for barter transactions, thereby reducing the time and energy required to establish a “double coincidence of wants.”

Woodruff (1999) documents the role of barter transactions by local, regional and provincial leaders to extend their control over resources (trading food, fuel, paper, tires, construction materials, and consumer durables), as well as to diminish control exerted by Moscow.\(^6\) This activity intensified during perestroika, as more goods were siphoned off from the official economy. New forms of ownership like cooperatives, leased firms, and joint ventures were legalized. These firms were not part of the planned allocation of materials, thus had to compete for resources with state organizations.\(^7\) Efforts to increase the independence of firms from planning authorities without changing the price formation

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\(^6\) Yeltsin (1990) describes how he and Gorbachev met during an exchange of metal and timber from the Urals for food products from Stavropol. The role of official and unofficial commodity exchanges is documented in Grossman (1982).

\(^7\) For detailed discussion, see Jones and Moskoff (1990).
system increased the demand for materials without establishing a corresponding mechanism to meet that demand. The resulting shortages caused firms to resort to trading in-kind: cars, building materials, and video equipment replaced rubles as the currency of exchange. Provincial leaders, seeking ways to prohibit scarce goods from leaving their region, used commodity transactions to circumvent planned allocations, and formed interregional alliances to facilitate commodity transactions. Indeed, Yeltsin signed special decrees in 1990 and 1991 which granted provincial leaders rights to 10% of enterprise production in their region for barter purposes, as well as partial rights to exports and hard currency earnings.\textsuperscript{8} Nesterovich (????) estimates that between 1985 and 1990, the acute scarcity of goods and materials generated during perestroika increased commodity transactions to at least 35% of all sales.

\textit{The payment system.} Soviet state-owned firms typically settled accounts with one another through the “payment order” system. At the time the contracted goods were shipped, the supplying enterprise sent a payment order to the bank of its customer, which would then pay it automatically from the funds on the customer’s account. When the customer had no available funds, unpaid bills accumulated on the “card file number 2” and were paid in the order of arrival (Woodruff 1999). In short, customers were automatically extended short-term credit by producers.

This payment system was kept by the Russian state-owned firm counterparts during the first stages of the transition process. Thus, once the privatization process was undertaken, the newly privatized firms had at their disposal the production chains and supplier-customer relationships inherited from the Soviets, that is, the necessary network to commit barter transactions.

\textsuperscript{8} Yeltsin tried to reverse this trend at the end of 1991 (see Presidential order #143 and #269).
As a matter of fact, during the high inflation episode between 1992 and 1995, despite the significant increase in accounts in arrears, producers did not worry much about whether their customers paid. Enterprise directors formed a strong political lobby enabling them to secure the continuation of credits and subsidies, and thus continued producing. Cash received was frequently hoarded for speculative purposes, especially in the foreign currency market, rather than paying for materials or wages, and was rarely deposited in banks since frequently it was too hard to get it back out and bank accounts were raided by tax authorities. When large amounts of debt accumulated and debt obligations were clarified, Russian authorities authorized debt offsets (zachety), using a procedure available since the Soviets, and payments could be made in-kind rather than in cash (Ickes and Ryterman 1993).

*Barter transactions in well-advance economies.* Although barter has been usually seen as an inefficient form of exchange, there exists a significant amount of barter between firms in well-advance economies. Prendergast and Stole (2001) summarize some of the facts. First, there is a large amount of trade between firms take place in organized barter markets. In the United States, approximately 300,000 firms participate in such exchanges, trading a great diversity of goods and services for an amount estimated in US$ 10 billions; and second, data prior 1990 shows that between 10% and 20% of world trade was conducted by some form of barter, although a large portion of this trade involved exchanges between the Soviet-block and free-market economies, and has diminished during the 1990s. Prendergast and Stole (2001) explain that barter facilitates exchanges for cash-constrained firms, and is a mean of market segmentation that allows firms increase their profits and welfare. Noguera (2001) shows that how a barter transaction
technology can dominate a monetary economy when the scope of the economy is small enough, even if firms are not cash-constrained.

II. THE STILYZED FACTS

Over the last ten years, there has appeared an interesting empirical literature documenting the barter phenomenon in Russia. Looking at the time series of the phenomenon we find:

**Stylized Fact 1**: Barter transactions increased continuously up to the late 1990s and show a tendency to decrease since the end of the last decade [Krueger and Linz (2001)].

Some studies find some relationships between the use of barter and a number of macroeconomic indicators:

**Stylized Fact 2**: There is a negative correlation between real cash balances and the use of barter [Krueger and Linz (2001)].

**Stylized Fact 3**: There is a negative correlation between the inflation rate and the use of barter [Brana and Maurel (2001)].

**Stylized Fact 4**: There is a positive correlation between the real interest rate and the use of barter [Brana and Maurel (2001)].

**Stylized Fact 5**: There is a negative correlation between the good performance of firms and the use of barter [Brana and Maurel (2001)].

They also study managers’ desire of using either barter or money to conduct transactions

**Stylized Fact 6**: Firms use barter even though they would like to avoid it [Krueger and Linz (2001)]

**Stylized Fact 7**: Many firms use barter because their partner traders lack of liquidity [Commander and Mumssen (1998), Linz and Krueger (1998)].
Stylized Fact 8: Many firms use barter to maintain output, facilitate sales and continue operating [Blanchard and Kremer (1997), Carlin et al (2000)].

Stylized Fact 9: Barter allows money to be used to better effect [Ickes and Ryterman (1993), Commander and Mumssen (1998)]

Finally, the use of barter varies among industries. Indeed, Brana and Maurel (2001) find that, in average,

Stylized Fact 10: Intermediate goods firms use barter more intensively (42.3% of total transactions) than investment goods firms (32.1%), and the latter more than consumer goods firms (25.3%).

The model below offers an explanation to these stylized facts.

III. THE MODEL:

Consider an economy with four kinds of agents: households, firms, lenders and a government. Suppose that each household has an inter-temporal utility function

\[ U = \sum_{t=0}^{\infty} u(\vec{d}_t), \]

where \( \vec{d}_t \) is a consumption vector \( \vec{d}_t = (d_{jt})_{j=0,1} \), and \( d_j \) is household’s consumption of good \( j \). Let \( P_{jt} \) be the price of good \( j \). The subscript \( t \) denotes time. The household’s problem is to maximize her utility function subject a budget constraint. Suppose that from this problem, households’ demand for consumption of good \( j \) is given by the following constant elasticity demand function \( D^b_{jt} = (P_{jt} / P_t)^{-b} \), where \( P_t \) is the economy’s money price index. Observe that \( P_t \), even though is a price level index measured in some unit of account, does not imply that all transactions must be made using such a unit as a medium of exchange.
There is also a government whose total expenditure is $G$, and for the sake of simplicity we assume it distribute its expenditure in the same way as households do, so its demand function for good $j$ is $D_j^g = (P_j / P) \cdot G$. Thus, total demand for good $j$ is

$$D_j = (P_j / P)^{-b} (1 + G).$$

Since firms have market power in this model, to ensure an interior equilibrium with positive output we require $b > 1$.

There are to be assumed that there is a continuum $[0,1]$ of firms, and each of them has a project. Each firm’s cost function is $C(x) = cx$, $c > 0$. Firm $j$ produces good $j$, and to make the transactions it needs, it can use either use cash or barter. Firms own no cash; thus, to make purchases using fiat money, they must borrow it.

Exchanging Using Money. Consider first a firm desiring conducting transactions using cash. During period $t$, firm $j$ has a project to produce $x_j$ units of output and sells it for a unit price $P_j$. To acquire inputs with money, the firm must obtain a loan, which will be repaid at a nominal gross interest rate $I$, if the project succeeds. Assume that each firm $j$ is a monopoly and its project succeeds with probability $q_j$. Thus, the expected profit function for firm $j$ is

$$EB_j = q_j P_j x_j - q_j I P_{j-1} c x_j.$$  

The monopoly chooses the combination price-quantity that maximizes its real profits. Thus, using (1) to solve the monopoly problem, we find

$$\frac{P_j}{P} \cdot \left( \frac{c}{1 - 1/b} \right) R,$$
where \( R_t = I_t/\pi_t \) is the local real interest rate and \( \pi_t (= P_t/P_{t-1}) \) is the inflation rate. This means that the higher the real interest rate, the higher the relative price firm \( j \) sets. From (1) and (2), we obtain the firm’s output

\[
(3) \quad x_{jt} = \left(1 + G_t \right) \left( \frac{c}{1 - 1/b} \right)^{-b} R_t^{-b}.
\]

Notice that the firm’s output and relative price are independent of the firm’s initial real money balances and the project risk. The firm’s optimal output decreases with the expected real cost of output and risk. Thus, firm \( j \)'s expected profit if it uses cash for transactions is

\[
(4) \quad EB_{jt} = \left(1 + G_t \right)^{q_j} \left( \frac{c}{1 - 1/b} \right)^{1-b} R_t^{1-b} P_t.
\]

In a monetary economy, that is, an economy where all transactions are conducted using cash, we would obtain the CIA constraint

\[
E_t \int_0^1 P_t x_{jt} dq_j \leq M_t \quad \text{or} \quad \int_0^1 q_j P_t x_{jt} dq_j \leq M_t,
\]

where \( M_t \) denotes the aggregate money supply, and \( E_t \) is the expected value operator. Thus, using (2) and (3) in the CIA constrain we obtain

\[
(5) \quad P_t Q_t^m \leq M_t \quad \text{where} \quad Q_t^m = \left(1 + G_t \right) \left( \frac{c}{1 - 1/b} \right)^{1-b} q^\mu R_t^{1-b}.
\]

\( Q_t^m \) denotes the expected aggregate real output and \( q^\mu = \frac{1}{\mu} \int_0^\mu \sigma(j) q_j dq_j \) represents a measure of risk of those firms conducting monetary transactions, where \( \sigma(j) \) denotes the Lebesgue measure of those firms that succeed with probability \( q_j \). Notice that \( q^\mu \)
decreases with respect to $\mu$. Inequality (5) represents a quantitative equation where the price index is proportional to money supply.

**Exchanging Using Barter.** Based on the discussion in section 2, assume that firms have the necessary network so they have access to a barter technology. Barter transactions impose costs on the firm and on society that would not be incurred in an economy dominated by cash transactions. For example, it requires the firm to expend time and energy to establish a double coincidence of wants, and to dispose of goods acquired but not needed in the production process. It also carries other costs like transportation, storage, perishability, search, etc. To avoid the complications of modeling such technology, assume that barter transaction costs take the Samuelson (1952)’s iceberg form: if one unit of good $j$ is exchanged, a fraction $\tau > 0$ evaporates. The firm’s profit function under bartering is

$$EB_{j\mu} = q_j(1-\tau)P_{j\mu}x_{j\mu} - P_{j-1}cx_{j\mu}$$

In this case, from the monopoly’s problem we obtain

$$\frac{P_{j\mu}}{P_j} = \frac{c}{q_j\pi_r(1-1/b)(1-\tau)}.$$  \hspace{1cm} (6)

Notice that the variance of prices distribution is lower when the inflation rate is higher, the barter technology becomes less cumbersome (lower $c$) or the project is riskier (higher $q$). From (1), the firm’s output is

$$x_{j\mu} = (1 + G_j)q_j^b(1-\tau)^b(\frac{c}{1-1/b})^{-b}\pi_j^b.$$  \hspace{1cm} (7)

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9 Samuelson uses this term to refer particularly to transport costs, here we use it in a broader context to refer not only to the transport cost, but all other costs involved in bartering.
The optimal output increases if there is a lower barter cost, higher inflation or projects are riskier. The latter reflects the firm’s moral hazard incentive. The expected profit for firm $j$ if it barter is

$$\text{(8)} \quad EB_j = (1 + G_j) q_j^b (1 - \tau)^t \left( \frac{c}{(1 - 1/b) \pi_t} \right)^{1 - b} \frac{P_t}{b}.$$ 

Unlike the credit case, the risk factor $q_j$ is present here. This occurs because when bartering, the firm faces the whole risk, while asking for a credit, only lenders assume risk.

**Barter and Money.** Let’s now study the firm’s decision whether to borrow or barter. Firm $j$ will be willing to ask for a loan if this allows it to obtain higher profits. Using (4), (8), and a bit of algebra, this occurs if

$$\text{(9)} \quad 1 > (1 - \tau)^{b/(b-1)} q_j \pi_t R_t.$$ 

Since $b > 1$, a higher barter cost (higher $\tau$) makes the right-hand expression in (9) decrease. Eventually, as $\tau$ tends to one, the barter technology make unaffordable to fulfill transactions through bartering. This reflects the traditional literature that considers barter so inefficient that it is always dominated by some medium of exchange. In this paper, assume that $\tau$ is small enough so as to make the barter technology feasible. Notice also that, given the real interest rate, higher inflation also makes the right-hand side in (9) decrease, fostering barter transactions.

Consider Figure One to analyze the effect of a change in risk. The right-hand expression in (9) is an increasing straight line that goes from the origins to $(1 - \tau)^{b/(b-1)} \pi_t R_t$, when the probability of succeeds $q_j$ goes from zero to one. Given the rate of inflation, if the real interest rate is small enough, say $R_0$, this line can be represented by $L_0$. In this
case, the use of credit is cheaper than bartering regardless any project risk, and all firms will choose to borrow and use money to make their purchases. On the other hand, if the real interest rate increases too much, say $R_1$, so curve $L_0$ rotates to $L_1$, the cost of borrowing become so onerous that low risk firms with $q_j > \mu$ will prefer to transact through barter. Only the riskiest firms will keep in the credit market. Therefore, borrowers’ project risk lies on the interval $[0, \mu]$, $0 < \mu < 1$, and monetary transactions are subject to

$$\int_{0}^{\mu} q_j P_{j} x_j dj = M_t.$$ 

From (6) and (7) we have

$$P_Q Q^{h} \leq M_t,$$

where

$$Q^{h} = \left(1 + G_t \left(\frac{c}{1-1/b}\right)^{1-b} q^\mu R^{1-b}.$$ 

and $q^\mu$ is defined as in (5). $Q^{h}$ measures of the expected output that is transacted using money. Notice that $Q^{m} \geq Q^{h}$, that is, the expected output transacted using money is greater in a fully monetized economy than in a mixed monetary-barter exchange economy. Therefore, from (5) and (10), the price index in a fully monetized economy must be higher than if a mixed monetary-barter economy. Thereby, the growth in barter transactions lowers consumers’ standard of living by raising prices paid for goods acquired through a monetary exchange.

The Government. Suppose that every period the government plans to spend a real amount $G_t$, and for that purpose, it acquires new debt $B$ units, prints $(\theta - 1)M_{t-1}$ units of money and collects lump sum taxes or other real revenues $L_t$ during period $t$. Thus, the government budget constraint is
\[ P_t G_t + (1 + i_t) B_{i-1} = L_t + B_t + (\theta - 1) M_{i-1}. \]

**Lenders.** There is a continuum \([0, 1]\) of lenders; each of them owns \(W_t\) units of financial wealth. Financial wealth is divisible and consists only in local and foreign currency. Only lenders and the government own currency. Lenders can buy foreign denominated currency, say US$, and obtain a real return \(R^*\). They can also make loans to local firms and ask for a nominal interest \(I_t\). However, since firms’ projects are risky, loans may not be repaid.

Suppose that lenders face an adverse selection problem, and cannot distinguish among borrowers. However, they know the distribution of risk among borrowers, and will give loans to projects whose risk is in the interval \([0, \mu]\). Then, lenders expect to be repaid every unit of her wealth with probability \(q^\mu\). Denote by \(\lambda_t\) the share of lenders’ portfolio assigned to local loans, and let \(u(W_t) = \log(W_t)\) be the Bernoulli utility function, where \(W_t\) denote wealth. Therefore, the lender’s expected utility is

\[ EU = q^\mu \ln((1 - \lambda_t)(1 + i^*) + \lambda_t R_t) W_t + (1 - q^\mu) \ln(1 - \lambda_t) R^* W_t. \]

The lender’s problem is to choose \(\lambda_t\) so as to maximize her expected utility function. From the first order conditions we obtain:

\[ \lambda_t = \frac{q^\mu R_t - R^*}{R_t - R^*}. \]

This equation determines the share of wealth that lenders invest locally. They will have a long position in local loans as long as \(q^\mu R_t \geq R^*\). The greater \(q^\mu\) is, the greater the probability that the loan will be repaid, and the lower the necessary local real interest rate for making lenders willing to give loans to local firms.
The last expression also allows determining the cash balances supplied for loans, \( M_t^l = \lambda_t W_t P_t \), that is,

\[
M_t^l = \left( \frac{q^\mu R_t - R^*}{R_t - R^*} \right) P_t W_t.
\]

where \( M_t^l \) is the amount of nominal cash balances hold by lenders at the end of period \( t \).

**Steady State.** Given a government policy, \( \theta \) and \( G \), and parameters \( \tau, b, c \) and \( q_j \), let’s determine steady state values for output, inflation, interest rates, real money balance, and the set of firms that use money to fulfill transactions. Steady state real money balances \( (m) \) must be constant; thus, from either (5) or (10), nominal money supply and inflation increase at the same rate, that is, \( \pi = \theta \).

In the credit market, at the beginning of period \( t \), the amount that lenders assign to the local economy in their portfolio determines the total real supply for loans \( (m') \). Then, from (11) we have that steady state real supply for loans is

\[
m_t' = \left( \frac{q^\mu R - R^*}{R - R^*} \right) W_t.
\]

Notice that the real supply for loans is an increasing function with respect to total wealth. Although wealth usually increase over time, it is an exogenous variable in this model; thus, to get rid of unnecessary complications, we will assume that it is constant, so the steady state real supply for loans can be written as

\[
m' = \left( \frac{q^\mu R - R^*}{R - R^*} \right) W.
\]
which is a concave increasing function with respect to the local real interest rate, $R$. On the demand side, the total demand for loans ($D_l$) is the sum of government bonds ($B_t$) plus the production cost of those firms who plan to borrow cash, that is,

$$D_l = B_t + \sum_{j=0}^{\mu} q_{j}P_{j}c_{j}x_{j}t_{j}d_{j}.$$

Using the price-output combination of borrowing firms, equations (2) and (3), in the last expression, we find the steady state real demand for loans,

$$d = b + K \frac{q_{\mu}}{R} (1 + G),$$

where $K = c^{1-b}(1-1/b)^b$ is constant and, $b$ and $d$ denote the steady state value for government real issue of bonds ($B_t/P_t$) and the real demand for loan ($D_t/P_t$) respectively. The loans demand function decreasing with respect to the real interest rate.

Credit market equilibrium requires $m = d$. Suppose that the economy is fully monetized, so $\mu = 1$. Then from (12) and (13) we obtain the equilibrium interest rate. Let’s analyze this result more carefully. Consider Figure Two. Suppose the equilibrium interest rate is initially $R_0$, the intersection between the credit supply and demand curves, $m_0$ and $d_0$, respectively. If the government increases its demand for loans ($b$), curve $d_0$ shifts to the right, say up to $d_1$, and the interest rate increases up to $R_1$. Thus, as in the case for Russia during the 1990s, if the government switches its budget funding from seigniorage to borrowing simultaneously, given $G$, there will be a fall in $\theta$ and an increase in $b$. Thus, the rate of inflation falls and the real interest rate goes up. The increase in the real interest rate makes $L$ rotates to the left until it eventually reaches $L_2$ (see Figure One). After that point, if the government keeps substituting seigniorage for debt as a source of income, the less risky firms will increasingly stop asking for loans.
Firms holding a project with risk greater or equal to $\mu$ will choose to barter, where $\mu$ is determined when (9) holds in equality, that is, $q_{\mu} = \left(1 - \frac{\tau}{(1-b)I_t} \right) / I_t$.

IV. EXPLAINING THE FACTS

This section provides a discussion on how the model explains the facts that motivates the article. After the initial hyperinflationary period at the beginning of the post-communist period, the Russian government made a major change in its monetary policy from the mid 1990s on. An important share of the government finance source switched from seigniorage to government debt with the private sector. This change, although lowered inflation and the money growth rate ($\theta$), increased the debt holdings ($b$), and pressured upward both, the nominal and real interest rates. If the effect on the interest rate is strong enough, having firms access to a barter technology, an increasing barter economy emerges. This result, illustrated in the previous section, allows explaining stylized facts 3 and 4, that is, the negative correlation between inflation and the use of barter, and the positive correlation between the real interest rate and the use of barter. The Russian government kept during most of the 90s, after the initial hyperinflation episode at the beginning of the decade, and abandoned it after the Russian crisis in 1998. This has made barter decreases too and explains fact 1: barter increase during the 90s and the tendency to decrease by the end of the decade.

Suppose the increase in the interest rate is high enough, so a barter economy emerges, that is, the interest rate increases to a level higher or equal than $I_t$ in Figure One. The more constraint the credit market, the lowers $\mu$ is. This means that the less risky firms will choose to barter. This shrinks the share of the economy conducting monetary
transactions, and increases its risk. This means that $Q^b_{mt}$ in equation (8) decreases and, given $M_t$, the price level measured in monetary units increases. Thus, real money balances also decreases. This explains fact 2, the negative correlation between real cash balances and the use of barter.

As the interest rates increases, firms borrowing in the credit market face higher production costs, lowering their economic performance. This explains fact 5, the negative correlation between firms’ good performance and the use of barter. Notice, however, that the lower firm’s performance occurs until they make the decision of conducting barter transactions instead of keep borrowing in the credit market.

Let’s now turn our attention to those stylized facts not directly related to macroeconomic indicators. Firms switch to barter because access to credit, and therefore to pay in cash, becomes too expensive. They, however, would prefer to receive payments in cash rather than bartering, since they will save in transaction costs. This explains fact 6, firms use barter but they would like to avoid it. Notice, however, that firms whose projects have a high probability of success, were they receive payments in cash, they will prefer to keep bartering and lend the cash. This way they can offset the barter cost and obtain some additional earning, that is, the high opportunity cost of using cash for transactions make low risk firms avoid using that cash to finance its cost and use it for a better purpose. This explains fact 9.

Consider a situation in which a higher risk firm borrows cash in the credit market, and needs to make a transaction with a lower risk firm that choose to make barter transactions. If the higher risk firm is buying, it will pay in cash, and this will be a monetary transaction; yet, if the higher risk firm is selling, the low risk firm will prefer to
barter whether or not it has cash at its disposal. This explains fact 7: many firms barter because their partner traders lack of cash.

Given the macroeconomic conditions, firms choose barter because it is optimal for them to do it. As the credit market becomes more constrained, keep borrowing will cause them to make lower output and profits (equations 3 and 4). Eventually, this may lead them to bankruptcy. The decline in output will stop once the firm makes the decision to switch to barter. Thus, the choice for bartering is a way to maintain output. This explains fact 8.

It should be clear at this point that riskier firms will use barter more intensively. This result can be use to explain the stylized fact 10: intermediate goods firms use barter more intensively than investment goods firms, and the latter more intensively than consumer goods firms. The model, then, suggests that Russian consumer goods firms are riskier than investment goods firms, and these ones riskier than intermediate goods firms.

Finally, an interesting consequence of the model is that by lowering the risk of the economy, the access to a barter technology would impose a ceiling on the interest rate. To illustrate the argument, consider Figure One again, and suppose that the riskiest firm succeeds with probability $\mu$, and that the government credit needs far never fill the supply for loans. Then, a real interest rate higher than $R_1$ would render lenders without customers since all firms will choose to barter.

V. CONCLUSION

Much of the literature on the growth of barter in Russia focuses on the consequence of using barter transactions instead of the causes and stresses the importance of reducing barter transactions among Russian firms to lower the costs imposed by that transaction
technology on firms and the society. However, we showed above that barter is the optimal transaction system under some given circumstances: high risk economy with access to a barter technology and a very constrained credit market. In this scenario, firms choose to barter to reduce risk, and avoid lowering production or closing down. On the other hand, the expansion of barter transactions, whose access is a legacy of the Soviets, locks firms into specific arrangements that reproduces the socialist inefficient production and employment patterns, thereby reducing entry of new firms and restricting competition as a force to lower prices and improve quality, forcing workers to trade in-kind wages and easing tax evasion; it also fosters the moral hazard problem, rendering the credit market riskier, making more fragile the banking system and reducing financial innovation. Thus, Russia’s virtual economy, value-subtracting firms relying on relational capital to continue to produce goods for exchange, may be a consequence rather than a cause of barter transactions, that is, in the short run, Russian managers might avoid restructuring because it jeopardizes their access to alternative transaction technologies.

Yet, it is not barter itself, but the conditions of the credit market that must be attacked. The model offers a direct policy suggestion, which is related to the government finances. Since one major source of pressure on the credit market is the government borrowing, the solution must undergo finding alternative revenue sources, and this means raising more taxes, lowering the public expenditure or both.

On interesting consequence of the model suggests that consumer goods firms are riskier than investment goods firms, and these ones riskier than intermediate goods firms. Although we are not aware of any empirical study supporting this conclusion, it seems to be the case in Russia, where retail stories disposed of big amount of cash, and in the lack
of an appropriate legal system made quite difficult to enforce them to repay their obligations. One of the authors observed the facility with which some retail firms suddenly appear and disappear to avoid legal consequence and obligations. Yet, to clarify the point, more research must be conducted.

REFERENCES


All firms borrow

Firms barter

Firms borrow

\[ (1 + \tau)^{b/(b-1)} \pi R_1 \]

\[ (1 + \tau)^{b/(b-1)} \pi R_2 \]

\[ (1 + \tau)^{b/(b-1)} \pi R_0 \]

\( q \)

\( L_0 \)

\( L_1 \)

\( L_2 \)

\( \mu \)
FIGURE TWO

![Graph showing two curves, one labeled $m_0$, the other labeled $d_1$, and a horizontal line labeled $d_0$. The x-axis is labeled $R$ with points $R_0$ and $R_1$.]