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Working Paper

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Foreword

IIASA has just completed a project sponsored, in part, by the USSR State Committee on Economic Reform. Among the considerable number of economists from different Eastern and Western countries involved with the project, Il'dar Karimov, co-author of this paper, has closely collaborated in research activities. Although his study has begun prior to his association with IIASA, the final version of the paper was completed at the Institute.

In this study, the institutional structures which restrict the activities of managers in export sectors in the Soviet Union are formulated in a theoretical model. Given this structure, enterprise managers determine the division of output between internal sale and export, and determine how much of their hard currency earnings will be supplied to auctions or interbank currency markets. The effects of a range of government policy tools, such as official exchange rates, hard currency appropriation rates, market structure, and profit tax rates on the volume and destination of producer output and use of hard currency revenues are emphasized. The study facilitates an identification and evaluation of key determinants of internal currency trade and singles out cornerstones in the evolution of the dual exchange rate system that was in place in the USSR in 1990 and 1991.

September, 1991

Merton J. Peck
Project Leader
Economic Transition and
Integration Project

Internal Currency Markets and Production in the Soviet Union

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Abstract

Changes in macroeconomic and microeconomic policies may yield surprising results when applied within an economy in the process of economic reform. This paper examines the effectiveness of policy instruments introduced as components of partial economic-reform programs, as in the Soviet Union. It is shown that the market power of producers in domestic industries and the design of currency auctions or interbank markets are key determinants, respectively, of the magnitude and direction of the enterprise responses to policy changes and external shocks. Policy-induced shifts in production and the hard currency allocation decisions of producers are determined. These optimizing choices have implications for: the supply of goods available for domestic consumption; domestic goods prices; the supply of hard currency to internal auctions or interbank markets; the free internal price of foreign exchange; export volumes; and the overall trade balance.

This research was initiated during the joint U.S. and USSR National Academies of Science program on "Restructuring the Soviet Economy" (Boston, 1990 and Moscow, 1991). The authors are grateful for comments by Bill Ethier, Barry Ickes, anonymous referees and especially those of Randi Ryterman. Participants in seminars at the University of Pennsylvania, Harvard, Rochester, University of Colorado at Boulder, and the Federal Reserve Board also provided useful insights. Goldberg is grateful for the technical support provided by The C.V.Starr Center at New York University. Karimov is grateful for the technical support provided by the Economic Reform and Integration Project at International Institute for Applied Systems Analysis.

I. Introduction

It is tempting to recommend that policy instruments used in the developed economies of the West be applied to the reforming economies of Eastern Europe and the Soviet Union. This paper considers whether conventional policy instruments have conventional effects in an economy undergoing economic reform. Drawing on the particular institutional features in the Soviet Union, we formalize the constraints on the activities of managers in exportables sectors of a reforming economy. Due to the distortions introduced by institutional constraints and due to the degree of competition in various markets, it is shown that economists must proceed cautiously when accepting the conventional wisdom on the possible output and foreign-exchange-market responses of enterprises to policy changes. Specifically, the choice of exchange rate regime and the design of internal currency markets may enable large enterprises to exert considerable monopoly power on the supply side of internal currency markets. Consequently, production responses to policy changes may be precisely the opposite of those generally predicted. Furthermore, the attainment of currency convertibility and the ability of a government to attract hard currency supplies to auctions or interbank markets critically depends on both the system of taxation and the structure of surrender requirements and compensation for appropriated foreign currency earnings.

Although the model of this paper and the conclusions are discussed in the context of the Soviet Union and Eastern Europe, the key points raised in the text are of broader applicability. Any country which adopts an exchange-rate regime which includes currency auctions or interbank currency markets should recognize that the market design could impart monopoly power to enterprises and lead to policy outcomes counter to those predicted by conventional wisdom.

To develop these points, the choices faced by enterprise managers operating under a stylized dual exchange rate regime in a planned economy which has undergone partial economic reform are modelled. The optimal response of production and currency allocation choices of

mangers to a range of policy changes are derived, where the changes include alterations in the system of compensation for exports, in turnover taxes, in official production quotas, and in external influences, as measured by changes in world market prices for export goods. The implications of these measures are traced for the levels and destination markets of output, domestic goods prices, shortages, external trade balances, the supply side of freely functioning internal currency auctions or interbank markets and for the internal "flexible" exchange rate.

Moreover, the results can be used to address a frequent concern of officials in economies undergoing economic reform that the reduced regulation of foreign exchange flows will trigger a reallocation of a substantial portion of domestic production toward export markets, thereby exacerbating or creating domestic shortages. The grounds for these concerns depend on the stage of economic reform that has been achieved. While the competitive structure of markets for foreign exchange can determine the direction of producer response, the extent of reforms of tax codes and in demonopolizing goods markets determine the magnitude of firm-level output versus price responses to policy changes.

The remainder of the paper is divided into four sections. Section 2 details some of the relevant features of the Soviet economy. Section 3 solves the static optimization problem of the managers in the economy's exportables sectors. Section 4 provides comparative statics results and determines the effects on production allocation and hard currency supplies to internal currency markets of changes in: the enterprise tax; turnover tax rates; official exchange rates; world market prices for exportables; government hard currency appropriation shares; and production quotas. The sensitivity of the results to the market power of producers in their respective industries and the structure of demand and supply to regional internal currency markets are stressed as important determinants of producer responses. Section 5 concludes.

II. Features of the Soviet Economy

Certain institutional features of the Soviet Economy motivate this joint analysis of goods markets and currency markets. Of particular interest are the stipulation of exchange regime operations, the structure of compensation for exports, and the separation in the accounting of foreign currency and rouble transaction related flows. Many of these features also are common to other countries in Eastern Europe.

In 1991 the structure of "differentiated-exchange-coefficients" formerly operational in the USSR was replaced by a more unified controlled-exchange-rate regime. The differentiated-exchange-coefficients previously applied to traded goods were an analog of multiple exchange rates and include several thousand coefficients broken down by different regions, currencies and commodities. The movement away from multiple exchange rates was the message of the October 1990 decree by President Mikhail Gorbachev. In the aggregate economy, a new commercial exchange rate replaced the complex system of foreign currency coefficients: while some transactions are conducted at the old official rate (for example, repayment of official foreign currency debts), others are conducted at a "personal exchange rate" (tourism, for instance), and still others conducted at a flexible "market rate".¹ For an enterprise, the existence of a fixed official exchange rate and a "market" rate determined on currency auctions or in interbank exchanges suggests an analogy with the types of dual-exchange-rate systems that have been observed in many developing countries, including Latin America. However, especially within economies in transition from a centrally planned to a market system, the design of these auctions or currency exchanges can significantly affect the magnitude of certain distortions on enterprise behavior.

A distinct literature examines the effectiveness of policy changes under dual exchange rates, albeit in much different contexts. That body of literature, typified by the models of

¹As of June 1991, four types of (legal) arrangements existed in the USSR for trade in foreign currencies. These include currency auctions, bilateral operations between enterprises, interbank transactions, and foreign currency exchange through the Gosbank (the Central Bank of the USSR).

Dornbusch et al. (1983), Obstfeld (1986), and Lizondo (1987), emphasize the importance of portfolio allocation (currency-demand side) decisions for determining internal exchange rates. In important contrast to that literature, our specification takes the currency demand side as given and emphasizes a specific producer- based channel through which policy changes affect hard currency supplies to internal currency auctions or interbank markets. Our approach provides particularly clear insights valid for reforming economies, such as the Soviet Union and Eastern European economies, especially those which have not yet succeeded at accomplishing extensive banking and capital-market reforms.

The production scenario described in this paper is applicable to enterprises producing exportable goods. For the Soviet Union, the key export sectors are fuels, non-food raw materials, and machinery and equipment. In 1989 Soviet fuel exports accounted for over one third of Soviet export revenues from non-socialist countries. Non-food raw materials exports accounted for an additional one quarter of export earnings. Taken together, over sixty percent of Soviet hard-currency revenues from the nonsocialist- developed West and developing countries are associated with fuel and non-fuel raw materials.²

Traditionally, almost all hard currency revenues generated by the export sales of enterprises have been appropriated by the central government. The act of appropriating export earnings is not unique to the Soviet Union. Many countries have had rigid foreign-exchange-surrender requirements.³ However, the Soviet and, to some extent, the Eastern European systems have differed from these other countries in a fundamental feature. While all exporters receive the domestic-currency value of hard-currency revenues converted at a government determined rate, in the Soviet Union producers have been compensated for their exports at centrally determined rouble prices that were often unrelated to the world market prices.

²The Soviet foreign trade performance during the second half of the 1980s is detailed in PlanEcon Report no.20-21 vol.VI May 25, 1990. These statistics may be misleading since many of the transactions included in the aggregates may not be competitively priced and took place in the form of bilateral barter and trade credit arrangements.

³Surrender requirements are broadly applied in Eastern European economies. Quirk et al. (1987) details the surrender requirements of a range of countries outside of Eastern Europe, including Bolivia, Gambia, Ghana, Jamaica, Nigeria, the Philippines, Sierra Leone, South Africa, Uruguay and Zambia.

Enterprise reforms proposed or enacted since 1987 were intended to alter this mechanism by which enterprises are compensated for their export sales. Specifically, while the government still appropriates a significant share of enterprise foreign-currency earnings, the earnings are valued in relation to world-market prices and some residual hard currency is captured directly by enterprises. The managers of these enterprises can determine, subject to certain institutional constraints, how the foreign currency will be utilized. This decision by the managers amounts to a choice between selling the hard currency in "free" internal markets, such as currency auctions or interbank markets, or retaining the hard currency for discretionary foreign currency expenditures. In such "free" internal markets, the procedure for selling foreign currency earnings may be heavily regulated. Indeed, the government remains involved in foreign currency auctions and interbank markets, and may limit participants to a certain class of agents on both the supply side and the demand side. Instead of entering these markets, if the manager opts to hold foreign currency receipts in the form of retained earnings, these receipts can be held either as cash or in foreign currency accounts. The managers use these resources to provide goods and benefits to workers, or to purchase imports that are only available when the transactions are conducted in hard currencies.

In sum, our simplified representation of the Soviet economy focuses on the export sectors which produce enough output to fulfill "state orders" (government-production quotas known as *goszakazy*), and then produce additional output for sale on external and internal goods markets. The net receipts of hard currency by these producers are determined by their export sales, adjusted for the share of hard-currency earnings retained by the government and by the producers' expenditures on hard-currency imported inputs into the production process. The optimizing activity of these producers yields a supply-side driven model of goods and hard currency made available to internal markets. As previously noted, the structure of internal goods markets and internal currency markets are key determinants of the expected effects of policy changes within the institutional structure of the Soviet Union. This is especially important for

predicting the impact of policy changes on production flows, internal currency auctions and internal "free" exchange rates, and the balance of trade.

The model embeds a number of premises about the extent of reforms in place in the Soviet Union. First, it is assumed that some price reforms have already been accomplished so that the home-currency prices of raw materials are closer to world levels than in the pre-reform period. This enables us to abstract from determining which industries will emerge with comparative advantages in export production.

Second, some reforms of enterprise activities are in place, including the imposition of "hard budget constraints": enterprises must generate revenues from output sales to cover their expenditures. However, banking reforms are not yet completed suggesting that the borrowing and lending activities of firms are rationed. Free capital markets are not yet in existence and the export and import of capital is extremely limited.⁴

Third, free unimpeded trade in hard currencies is permitted with the Soviet Union, but enterprises are prohibited from making direct hard-currency transfers to employees in the form of salaries. This distortion has two effects: i) hard-currency- allocation decisions remain the domain of enterprise managers; and ii) payments-in-kind rather than direct distributions are provided to workers if the enterprise chooses to retain hard currency rather than selling in internal-currency markets.

⁴Thus, interest rates are not fundamental determinants of firm or consumer level activities. Nonetheless, the problem of distributing profits across consumption and investment could be appended to our model without modifying any of our results. The only access to capital markets is for the financing of expenditures incurred within a single fiscal year. It is difficult to obtain credits for financing longer term projects and standard repayment terms do not exist for those credits which currently are granted. Although the static framework invoked is consistent with the lack of complete perfect capital markets observed in the current Soviet system, parameters in our model can be used to reflect intertemporal valuations.

III. Producer Behavior

The producer behavior applies to those industries that produce both for internal consumption and for export to foreign markets.⁵ Managers in this sector choose, subject to certain constraints: 1) levels of production for export sales⁶; 2) levels of production for sale in internal goods markets; and 3) the allocation of hard currency receipts across retained earnings and for sale to internal currency markets. The total production of a firm producing exportables, Y , is divided into three parts: Y is the government or quota portion of output; Y_h is the portion of output sold in the free internal *home* market; and Y_x is the portion of output sold as *exports* on the free external market.⁷ The revenues from production are described as either primary rouble revenues, secondary rouble revenues or hard currency revenues. This distinction is important: regulations on separate accounting of rouble and hard currency flows make these flows nonfungible and introduce arbitrage opportunities.

Primary Rouble Revenues: The primary rouble revenues of the producer are the sum of three components, each of which is related to the destination market of output. Quota production Y is sold at the government-controlled-wholesale price, p .⁸ Output quantity Y_h is sold in internal markets at p_h , the free internal wholesale price of the product. The firm is paid in roubles for quota production and for the goods sold in internal markets.

Although the firm realizes p_h as unit revenues on goods sold in internal markets, a wedge between consumer and producer prices is created by the existence of consumer turnover taxes, represented by q . The internal market demand for exportables is represented by the residual

⁵Clearly, each export sector is distinguishable in terms of the structure (and parameterization) of market demands, production expenditures, and specific policy measures applied by the central government. However, firms within a sector can be viewed as identical.

⁶As modelled below, these export earnings must yield sufficient foreign currency revenues to cover the expenditures by the enterprise on its imported inputs into production.

⁷During the late 1980s, the percentage share of total production distributed by the central government was quite high in the raw materials sector. While this share varies across regions and types of materials, for oil it remains almost everywhere more than 95 percent; for brown coal 70 percent, and for coke 95 percent and higher. The quota share of production is lower for other exportables.

⁸This price does not include the turnover tax accumulated by the central government in its resale of raw materials to other firms or individuals.

inverse demand function $p_h = p_h(Y_h, q)$.⁹ The shape of this demand curve is denoted by its slope p_h' . The general case of $p_h' < 0$ describes a market where producers have some market power in influencing the sale price in internal markets. The larger is p_h' , the more monopolistic the industry.

Production for sale to external markets, Y_x , is transacted at world market prices. It is assumed that the producer is small in world markets so that p^* , the foreign-currency price of the export good, is exogenous to the firm.¹⁰ Due to the institutional constraint that foreign currency must flow through official channels, the producer does not receive all of the hard currency generated by its export sales. Instead, it receives some government-determined share of its hard-currency earnings and compensation in roubles, at the official exchange rate, for the hard-currency earnings retained by the government. Define w as the share of hard currency revenues retained by the producer, and $(1-w)$ as the share of hard currency revenues appropriated by the central government. The producers are compensated in roubles for this appropriation, where the compensation rate is the official exchange rate, e , in domestic currency per unit of foreign exchange.¹¹

Taken together, this compensation structure yields "primary rouble revenues" from: i) fixed revenues pY from quota sales; ii) revenues $p_h(Y_h, q)Y_h$ from free trade in internal markets; and iii) rouble compensation for the portion of the total hard-currency export revenues seized by the government. This compensation is

$$p^* Y_x (1-w) e \quad (1)$$

Summing, total primary rouble revenues to the enterprise are:

⁹The residual demand function is assumed to be smooth enough (continuously differentiable) to guarantee uniqueness of this representation. The specification of the turnover tax is general enough to capture any type of shock to internal demand for raw materials.

¹⁰The assumption that the Soviet Union is a price taker in world markets is reasonable for most export goods, and for raw materials such as oil, natural gas, coal and metals. It is less reasonable in the context of trade in diamonds and chromium, or for some trade with the smaller Eastern European economies.

¹¹Previously, the hard currency retention rate also could vary according to production levels within an industry and across industries. The exchange rate system was also complex, with different exchange rates used for taxation and compensation purposes. Recent announcements have declared intended movements toward a single or effective exchange rate which would apply to all transactions between the central government and businesses.

$$R = pY + p_h(Y_b, q) Y_b + p^* e (1-w) Y_x \quad (2)$$

The total gross hard currency receipts of the firm are given by:

$$R^* = p^* w Y_x \quad (3)$$

Of these hard currency receipts by the firm, secondary rouble revenues are generated only when some portion of the R^* is sold in internal currency markets in exchange for roubles.

Production Costs: In order to produce total output level Y ($Y = Y + Y_h + Y_x$), managers undertake replacement "primary expenditures" in terms of both rouble goods and imported hard currency goods. These expenditure functions are, respectively, $E(Y)$ and $E^*(Y)$, and are assumed to be separable, continuous and differentiable.¹² Domestic currency expenses must be paid out of primary and secondary rouble earnings: foreign currency expenses must be paid out of the remaining hard currency export earnings. Expenditure functions are assumed to reflect all necessary production costs, including: normal wages and salaries, depreciation charges in roubles and in hard currency, rental payments, and employee taxes.¹³

The shape of the expenditure functions depends upon the industry under discussion. Throughout, it is assumed that marginal costs are positive, $E'(Y) > 0$ and $E^{*'}(Y) > 0$. In regions of diminishing returns, as generally characterizes the depletable resource sectors (fuels and non-food raw materials) and technologies with capacity constraints, the expenditure function will be convex to the origin, $E''(Y) > 0$ and $E^{*''}(Y) > 0$.

Co-evaluation of Rouble and Hard Currency Flows : Under the dual-exchange-rate regime, different exchange rates are used for valuation of different foreign-currency transactions. An

¹²An alternative specification could introduce domestic and foreign inputs as complementary rather than separable. This would not fundamentally change the results. The continuity assumption implicitly treats enterprises as able to expand production activities without facing rigid constraints imposed by the scarcity of inputs into the production process.

¹³These expenditure functions are the only mechanism in our model through which technological progress, input productivity shifts, or alterations in input mixtures can influence the equilibrium outcomes. While investment and intertemporal growth decisions are not explicitly modelled, the State can impose some minimal level of desired growth through Y requirements.

official fixed-exchange rate is used when the government calculates the rouble value of appropriated export earnings. An official fixed rate also is applied when the government computes taxes on the foreign-currency earnings retained by the enterprise. The exchange rate used for valuing other foreign-currency-related flows depends on the particular flow.

The hard currency earned by firms, R^* , is divided between three uses:

i) R_1^* is the amount of foreign currency retained by the enterprise. This amount is required to be at least as great as the firm's expenditures on imported inputs into production. These hard-currency revenues (re-calculated at the official exchange rate e for taxation purposes) are included in the firm's taxable income. The after-tax revenues net of $E^*(Y)$ can be applied toward the purchase of foreign-currency valued investment or consumption goods or used to secure benefits for employees.¹⁴

ii) R_2^* is the amount of foreign currency sold by the firm in internal foreign-currency markets. The rouble receipts from these hard-currency sales are referred to as secondary rouble revenues. These roubles can be combined with primary rouble revenues to cover domestic currency expenditures on goods or capital and domestic currency taxes or to pay workers salaries.¹⁵

iii) $E^*(Y)$ is the enterprise's expenditure on imported inputs into production.

Therefore,

$$R^* = R_1^* + R_2^* ; \quad (4)$$

$$R_1^* \geq E^*(Y); \quad (5)$$

¹⁴For example, the managers can send workers abroad for professional education and training. While opportunities for consumption good expenditures are limited, opportunities of this second type are sufficiently large to absorb any additional revenues.

¹⁵The theoretical framework is general enough to encompass the possibility of $R_2^* < 0$. Under negative R_2^* , the enterprise buys rather than sells foreign exchange in these markets. However, due to the institutional constraints on specific classes of firms, we emphasize in the text the activities of net exporters or hard currency suppliers, rather the activities of net importers. All comparative statics results are signed for the net exporter case.

The value to the enterprise of holding retained-earnings in excess of foreign-currency costs [$R_1^* > E^*(Y)$] is denoted by the exchange rate e_1 .¹⁶ The value to the enterprise of selling hard currency R_2^* in auctions or internal currency markets is the price offered in internal markets for currency, e_2 . This flexible-exchange-rate on internal-market sales, e_2 , is assumed to be higher (more depreciated) than the official fixed-conversion rate, e .

Although the official exchange rate e is exogenous to the firm, the enterprise recognizes that it may have some *market power* in influencing prices in internal markets for hard currencies. The manager can determine the extent to which the foreign currency supplied by his enterprise to the auction or interbank market can move the internal price of foreign exchange. The price of foreign exchange in "free" internal currency markets (e_2) declines as the supply of hard currency made available internally increases. This inverse relationship between the market exchange rate and the hard currency supplied by managers, R_2^* , is expressed as:

$$e_2 = e_2(R_2^*) \quad (6)$$

where $e_2'(R_2^*) < 0$ represents the slope of the residual currency demand curve relevant to the firm, thereby subsuming the demand side of the internal foreign exchange markets which is exogenously given to the enterprise manager. $e_2'(R_2^*)$ can be interpreted as the ability of this enterprise to influence the exchange rate in the internal currency markets. In most developed countries, it is expected that $e_2'(R_2^*)$ is close to zero. In that case, the activities of any single enterprise would not have a large effect on the exchange rate.¹⁷

However, $e_2'(R_2^*)$ could be large (in absolute terms) and significant in countries in which the government tightly regulates the participation in foreign exchange auctions. Indeed, early currency auctions in the Soviet Union were characterized by relatively few participants on the supply side, suggesting that each large participant had more than a marginal ability to

¹⁶Throughout, $E^*(Y)$ is the minimum amount of hard currency which must be earned by the firm to support production level Y . At the very least, the firm holds retained earnings to cover $E^*(Y)$. If optimal, the firm can choose to retain greater amounts of its hard currency earnings than the minimum holdings defined by $E^*(Y)$.

¹⁷Alternatively, $e_2'(R_2^*)$ close to zero can depict currency auctions run with government intervention in order to strictly control the supply of currency to internal markets.

influence internal auction prices.¹⁸ This is supported by the evidence on currency auctions provided in Table 1.

Table 1: **Selected Currency Auctions in the USSR**

Date	Location	Volume (mln\$ equiv.)	# suppliers	# buyers	official rate (SUR/US\$)	auction rate (SUR/US\$)
11/03/89	Moscow, V.	14.0	31	210	0.60	8.38
05/11/90	Vilnius, V.	0.098	1	8	0.60	14.70
07/19/90	Moscow, V.	15.0	27	88	0.59	22.70
12/10/90	Tallin, BE.	.371/ .212*	19	57	1.66	25.28**
02/05/91	Kemerovo, K.	2.0	7	8	1.65	27.00
02/13/91	Moscow, V.	21.04	61	156	1.63	29.40
03/14/91	Moscow, V.	6.10	50	26	1.65	35.36

Source: Authors compilation from various issues of Commersant, USSR publication.

V= Vnesheconombank (bank for foreign economic affairs in USSR): this bank does not transact in "fast dollars".; BE= Bank of Estonia: all banks located in Estonia have the right to transact in "fast dollars". These dollars are independent of the Vnesheconombank and associated constraints on time of transference of dollars.; K = Kouzbassotsbank: not permitted to transact in "fast dollars".

"Fast dollars" have a delivery period of three to four days. Slow dollars normally are delivered in two months. A premium is paid for fast dollars.

* slow dollars (\$.3715 mln) + fast dollars (\$.212 mln) = total transacted (\$.583 mln)

** weighted average of the exchange rate on "slow dollars" and "fast dollars"

¹⁸Our discussion of the auctions or interbank foreign currency markets basically assumes a separation of markets for foreign exchange transactions along the lines of the October 1990 decree of Gorbachev. However, if internal currency markets were designed to integrate different types of flows, so that small enterprise activities, clandestine black markets and officially tolerated parallel markets are absorbed, the market power of an individual enterprise would decline. For example, this could occur if the official "free" markets absorbed the activities of: the export smugglers who remit hard currency earnings through the black market; the import smugglers who purchase hard currency in order to make payments; and tourists who sell hard currency internally to black marketeers.

The data in Table 1 show that the number of participants in auctions were limited. For example, on 7/19/90 there were 27 suppliers of currency to the auction and 88 demanders of currency. Nonetheless, these data do not provide a concrete enough image of the concentration of market power among these few participants. Such market power is illustrated at an auction on 12/14/90 in Moscow when a total of \$14.4 million was traded. Of this amount, \$5.52 million (38 percent of the total) was presented to the auction by a single supplier.

Further proof of the existence of market power in internal markets is drawn from an examination of recent interbank operations in foreign currency conducted at the Moscow Currency Exchange (MCE). Forty-five licences which permit banks to engage in interbank foreign currency trade have been issued. Of these, only twelve licenses are in use. Even among these twelve banks, the market is thinned further by limitations on minimum transactions size (at \$10,000).

In sum, high values of $e_2'(R_2^*)$ can arise under either highly inelastic currency demand (which is unlikely in these economies during the reform process) or, more likely, when an enterprise has power to affect significantly the volume of total flow supplies of hard currency to internal currency markets.

The Objective Function of the Firm's Manager : When both rouble and hard currency revenues are included in the same balance sheet, the taxable income of the enterprise is the sum of primary rouble revenues from sales, secondary rouble revenues from the auction or interbank currency-market sales of R_2^* , the official valuation of revenues retained by the firm minus its expenditure on foreign-currency inputs into production, $e(R_1^* - E^*(Y))$.

Defining T as the fixed profit-tax rate, the net after-tax profit in exportables has two components:

$$i) \text{ the rouble part: } (1-T)(R + R_2^* e_2 - E(Y)) - T e(R_1^* - E^*(Y)) \geq 0 \quad (7)$$

where the first term is the after tax value of all rouble valued flows and the latter term represents rouble taxes paid on the government's valuation of the enterprise's retained earnings. The second component of net profits is:

ii) the hard currency part: $R_1^* - E^*(Y) \geq 0$ (8)

where this second flow is the foreign currency retained by the firm after it has determined how much of its hard currency earnings to sell in auction or interbank currency markets. It is assumed that the profit function maximized by enterprise managers introduces these flows according to their rouble valuations.

Table 2: Variables Defined in the Model

e	official exchange rate (roubles/ foreign currency)
$e_2(R_2^*)$	free internal market exchange rate (roubles/foreign currency)
e_1	value to the firm of retained earnings in excess of necessary expenditure on imported inputs into production (roubles/foreign currency)
ϕ	investment or consumption value premium if positive; transactions cost and risk premium on purchases in the secondary goods market if negative.
Y	production for state order (<i>goszakazy</i>)
Y_h	production for sale in free internal markets
Y_x	production for export sale
Y	total production, $Y+Y_h+Y_x$
p	unit price on production for state order
p_h	unit price on production for sale in internal markets
p^*	world market price of export good (in foreign currency)
q	turnover tax (sales tax): per unit tax charged internal market consumers of good
w	share of hard currency revenues from exporting available to the enterprise
T	profit tax rate
$E(Y)$	domestic currency expenditures/costs for production level Y
$E^*(Y)$	foreign currency expenditure/costs for production level Y
R_1^*	foreign currency earnings of firm retained for payment of $E^*(Y)$ and purchases of consumer goods/ foreign training, etc. for employees.
R_2^*	foreign currency earnings of firm sold at internal hard currency auctions or in free internal currency markets

The firms's rouble valuation of net retained-hard-currency earnings differs from the valuation applied by the government for taxation purposes. The firm's conversion rate for

valuation of retained earnings, e_1 , is determined by the investment or consumption value of having readily-available foreign exchange. The wedge between the auction price and the secondary value (or opportunity cost) is defined as ϕ , so that $e_1 = e_2 + \phi$. ϕ is a firm-specific function which represents the premium on hard currency.

ϕ 's value depends, in part, on the design of internal markets. One can consider two distinct cases. The first case, $\phi < 0$, arises if there are high premiums demanded by money dealers for operating in secondary markets or if there are high transactions costs associated with getting goods from abroad without using official channels.

The second case, $\phi > 0$, can arise because a firm may not be able to easily obtain foreign currency in the future when additional foreign currency investment opportunities arise.¹⁹ As will be shown below, under these circumstances the enterprise will retain all hard currency earnings and avoid participation in the auctions or interbank markets.

In general, if internal currency markets are sufficiently open to permit spontaneous and unfettered transactions, e_2 will be close to e_1 (ϕ will be small). At present, some currency auctions in the Soviet Union allow enterprises access to hard currency, but the foreign currency is not transferred to the enterprises until some later date. At the Vnesheconombank auctions and at the MCE the time of transfer of currency from buyers to sellers is approximately two months. At the Tallin auctions, the time of transfers are approximately 4 days. Under this type of structure, the enterprises permitted to participate in these auctions would place a higher premium on retaining foreign exchange than would the enterprises participating in the Tallin auctions. In all locations, institutionally imposed constraints on the volumes of purchase of hard currency by enterprises also increases the firm's valuation of ϕ .

The manager's objective is to maximize the value of combined net rouble and foreign currency after-tax earnings:

¹⁹It is possible to model ϕ as a decreasing but positive function of R_1^* . The marginal value of the foreign currency premium associated with holding additional retained earnings could decline as the stock increases. This interpretation is most suitable for the case of $\phi > 0$, but is not as reasonable for the more interesting case of $\phi < 0$.

$$\begin{aligned} \text{maximize } & L = (1-T)[pY + p_h(Y_h, q) Y_h + p^* e(1-w) Y_x + R_2^* e_2(R_2^*) - E(Y)] \\ & + (e_2(R_2^*) + \phi)[R_1^* - E^*(Y)] - Te(R_1^* - E^*(Y)) \end{aligned} \quad (9)$$

subject to

$$(1-T)[pY + p_h(Y_h, q) Y_h + p^* e(1-w) Y_x + R_2^* e_2(R_2^*) - E(Y)] \quad (10)$$

$$-Te[R_1^* - E^*(Y)] \geq 0$$

$$R_1^* - E^*(Y) \geq 0 \quad (11)$$

where $R_1^* = p^* w Y_x - R_2^*$.

Equation (9) is the domestic-currency valuation of the after-tax profits of the enterprise. Equation (10) states that the firm must generate enough primary- and secondary-rouble revenues to cover rouble expenses, including taxes paid in roubles on retained hard-currency earnings. Equation (11) states that retained foreign-currency earnings must be at least as large as expenditures on imported inputs into production.

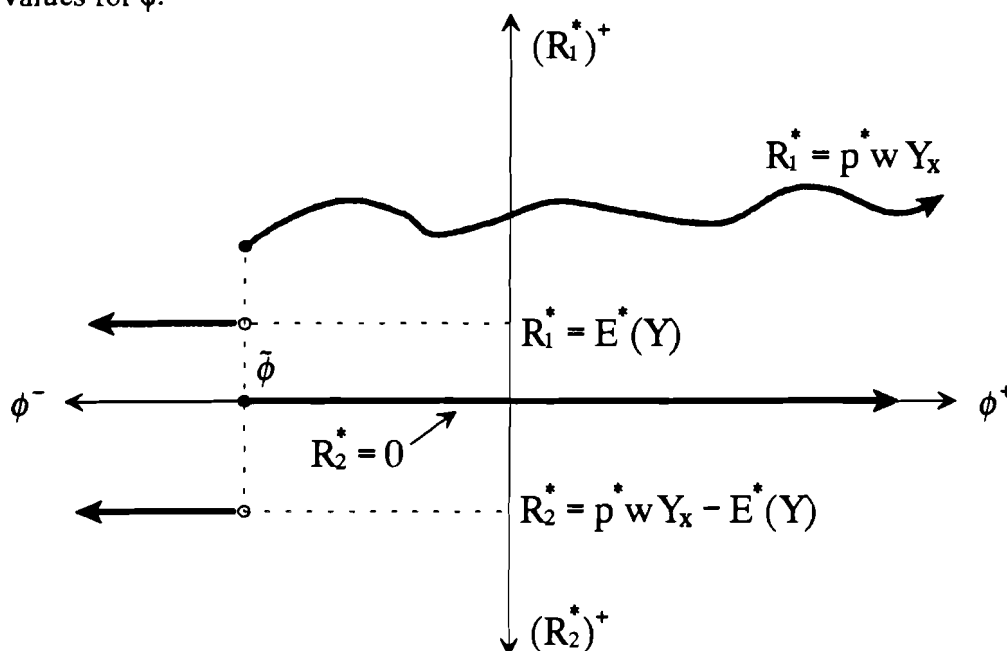
This structure has a number of interesting features. The first of these is a tax-haven effect. The hard-currency revenues earned by the firm are taxed at the official exchange rate times the marginal tax rate if they are kept as retained earnings whereas they are taxed at the auction rate times the marginal tax rate if they are sold in auction or interbank markets for foreign exchange. This increases the desirability of retained earnings relative to selling hard currency at auctions. Another interesting feature is that the choice of allocation of foreign currency earnings might have a knife-edge property whereby all foreign currency earnings (in excess of $E^*(Y)$) are sold at auctions or, alternatively, all are held as retained earnings.

The Hard Currency Allocation Choice: The value of R_2^* to the manager is $(1-T)e_2(R_2^*)$ whereas the value of R_1^* is $e_2(R_2^*) + \phi - Te$. In general, the hard currency allocation choice has a knife-edge property.²⁰ If $(1-T)e_2(R_2^*) > e_2(R_2^*) + \phi(R_1^*) - Te$, all hard currency earnings in

²⁰We have a full-information set-up in which the interior solution to the hard currency allocation choice is an unstable equilibrium. This equilibrium is only possible if this enterprise has a large enough effect on $e_2(R_2^*)$ when it varies R_2^* . It then can eliminate the inequality between the returns on the alternative forms of hard currency allocations. However, this choice minimizes rather than maximizes the criterion function. We need not examine the transition to the boundaries in this problem since the portfolio adjustment occurs instantaneously. This interpretation is consistent with the methodology of dynamic models of the Dornbusch (1976) "overshooting" class.

excess of $E^*(Y)$ will be sold in internal currency markets and none would be retained by the firm. If the inequality is reversed, the enterprise will retain all of its excess hard currency and refuse to supply hard currency to internal currency markets.

Figure 1 illustrates the hard currency allocation choice made by the enterprises along the range of values for ϕ .



$$\text{where } \tilde{\phi} = \operatorname{argmax} [L(R_1^* = E^*(Y)) \text{ or } L(R_1^* = p^* w Y_x)]$$

Figure 1

If $\phi > 0$, all foreign-exchange earnings will take the form of R_1^* , with nothing supplied by the enterprise to the foreign-currency auctions. If many exporters pursue similar behavior, the auction of foreign-currency export receipts will be characterized by little voluntary activity on the supply-side. As a result, if funds are to be supplied to auctions, they will have to be drawn from the coffers of the central bank.

On the upper and lower vertical axes are allocations of R_1^* and R_2^* , respectively. On the horizontal axis are values of ϕ , positive and increasing to the right and negative and decreasing to the left. At values of ϕ greater than $\tilde{\phi}$ all hard currency is kept as retained earnings. At values

of ϕ below $\tilde{\phi}$, retained earnings are at the minimum required level, equal to $E^*(Y)$, while any residual hard currency receipts are sold in internal currency markets.

This is precisely the phenomenon observed in the hard-currency auctions conducted in the Soviet Union in the late 1980s and early 1990s, and in Bulgaria during the same period. The currency auctions conducted were extraordinarily thin on the supply-side. The high consumption and investment value attributed by enterprises to the retention of scarce hard currency and the lack of internal-currency convertibility of the home currency²¹ led enterprises to prefer to hold onto any excess hard currency under their control. Hard-currency earnings were used to purchase scarce imported investment resources and for expenditures on hard-currency perks for employees such as those made evident by the dramatic increase in the numbers of workers sent abroad for training programs. In terms of the model, these early currency auctions were designed so that the wedge represented by ϕ was large and positive.²²

By contrast, the case where $\phi < 0$ can arise when currency auctions or interbank markets defined broadly enough to yield an economic penalty for holding retained earnings. Initially, one might think that such a penalty would shift all excess earnings away from retained earnings and toward sales in the auction or interbank currency markets. However, closer inspection reveals that the distortions of the tax system create the potential for the opposite result.

$$\text{If } \phi > 0 : \quad \text{all } R_1^* \text{ (} R_2^* = 0, R_1^* = p^* wY_x \text{)} \quad (13a)$$

$$\text{If } \phi < 0 : \quad \phi < \tilde{\phi} \text{ all } R_2^* \text{ (} R_1^* = E^*(Y), R_2^* = p^* wY_x - E^*(Y) \text{)} \quad (13b)$$

$$\phi > \tilde{\phi} \text{ all } R_1^* \text{ (} R_2^* = 0, R_1^* = p^* wY_x \text{)} \quad (13c)$$

Under the condition defined by (13c), the tax haven benefit from holding retained earnings dominates the penalty. Producers still would not participate on the supply-side of auction or

²¹By lack of internal convertibility we are referring to the scarcity of goods available for purchase with the soft home currency.

²²Some hard currency was sold to internal currency markets by those enterprises which were confronted by the constraint given by equation (10).

interbank currency exchanges. This arises under high tax rates or if there is a large gap between the official and free-market exchange rate.

By this knife-edge property of the currency-allocation choice, incremental policy changes can lead to large shifts in the allocation of hard currency across usages. The margins determining this allocation, in addition to being functions of tax rates, the official exchange rate and the size of penalties for holding retained earnings, depend on the size of export revenues and necessary imported inputs into production.

Optimum Choices of Enterprise Managers: The profit maximizing choices of enterprise managers, given the institutional features embedded in the model, are derived by replacing R_1^* by $R_1^* = wp^*Y_x - R_2^*$ and differentiating the objective function with respect to R_2^* , Y_b and Y_x . The resulting system of first-order conditions (provided in the Appendix) and the associated Hessian matrix yield solutions for Y_b and Y_x which clearly are interior maxima. For these variables, the second-order sufficient conditions for an interior maxima²³ are always satisfied in a region of diminishing returns and are always satisfied under linear demand specifications ($e_2''=p_b''=0$).

However, as emphasized in our discussion of the knife-edge properties of the currency allocation choice, interior solutions for the R_2^* chosen by an enterprise are expected only under restrictive conditions. In general, the Hessian matrix shows that the R_2^* resulting from the full system of first-order conditions will locally minimize rather than maximize the profits of the enterprise (i.e., the solution for an enterprise that is a net exporter has saddle properties: it is maximized in Y_b and Y_x , but minimized in R_2^*). Therefore, for a net exporter, the general solution is that R_2^* will be set at one of the two margins. Either $R_2^*=wp^*Y_x - E^*(Y)$ and $R_1^*=E^*(Y)$, or $R_2^*=0$ and $R_1^*=wp^*Y_x - E^*(Y)$. In the former case there will be no retained hard currency in excess of that needed for payment of necessary imported inputs into production.

²³A maximization of the objective function is achieved if the Hessian matrix is negative definite.

In the latter case, all foreign-currency revenues in excess of necessary expenditures are held as retained earnings and not offered for sale in interbank markets or currency auctions.

IV. Policy Effectiveness

The sensitivity of the optimal production levels and hard-currency supplies to changes in exogenous policy variables and world-market prices is signed by differentiating the first-order conditions and conducting comparative statics exercises. When the hard-currency allocation choices occur at the margins, the relevant comparative statics matrices take the form:

$$\begin{bmatrix} \delta Y_h \\ \delta Y_x \end{bmatrix} = [A]^{-1} [B] [u]' \quad (14)$$

where $[u] = [\delta e, \delta p^*, \delta w, \delta Y, \delta q]$ and the A and B matrices depend on the choice of margin. Below, the comparative statics results are provided for the two equilibrium solutions.²⁴

IV. 1 Policy Effectiveness Under Currency Convertibility

If currency convertibility is interpreted as the voluntary conversion of foreign currency earnings into domestic currency, this is achieved at the margin defined by $R_2^* > 0$.²⁵ The first-order conditions are given by equations (15) and (16):

$$\frac{\partial L}{\partial Y_h} = (1-T) \{ p_h' Y_h + p_h - E' - p^* w Y_x e_2'(E^*) - e_2(R_2^*)(E^*) + e_2'(E^*)(E^*) \} \quad (15)$$

$$\frac{\partial L}{\partial Y_x} = (1-T) [p^*(e(1-w) + e_2(R_2^*)w) + e_2'(R_2^*)(w p^* - E^*)(w p^* Y_x - E^*) - (e_2 E^* + E')] \quad (16)$$

²⁴Matrices A and B are derived by imposing one of the alternative margin constraints on R_2^* and then fully differentiating the first order conditions. For the case where $R_2^* > 0$ and $R_1^* = E^*(Y)$, changing the tax rate T does not elicit any change in the production mix. Consequently, this column is omitted from the B matrix.

²⁵Recall that this can occur when $\phi < 0$ and $-\phi > T(e_2 - e)$.

Differentiation of these equations yields the matrices for comparative statics calculations, provided in the Appendix as matrices A^{cc} and B^{cc} , and derived with respect to: the official exchange rate, e ; the world price of raw materials, p^* ; the share of hard-currency earnings retained by the government, w ; the turnover tax paid by consumers, q ; and the official production quota, Y .²⁶ The results of this analysis are summarized in Table 3. Therein, the signs of the comparative-statics results are distinguished for the cases of low and high e_2' .

When enterprises voluntarily supply hard currency to auction or interbank markets, production responses to policy changes can differ dramatically from the responses predicted by conventional wisdom. The underlying intuition is that if enterprises have the ability to significantly influence the terms of trade on their transactions, they will adjust their export and domestic destination production to achieve a volume of hard currency earnings and a corresponding terms of trade consistent with profit maximization. Consequently, the direction of production responses to policy changes depends critically on the size of e_2' , the competitiveness of auction and interbank markets for foreign exchange. To illustrate this point, equations (17) through (21) show the effects on production of a devaluation of the official exchange rate and a change in the hard-currency retention rate. These equations underlie the results summarized in rows two and three of Table 3, respectively.

$$\delta Y_h / \delta e = (\det A^{cc})^{-1} \left[-p^*(1-w) [e_2 E^{**} + E'' + e_2' (E^{**} (p^* w Y_x - E^*) + 2E^{*'} (p^* w - E^{*'}))] \right] \quad (17)$$

$$\delta Y_x / \delta e = (\det A^{cc})^{-1} \left[p^*(1-w) [e_2 E^{**} + E'' + e_2' (E^{**} (p^* w Y_x - E^*) - 2(E^{*'})^2) - 2p_h'] \right] \quad (18)$$

$$\begin{aligned} \delta Y_h / \delta w = (\det A^{cc})^{-1} & \left[[e_2 E^{**} + E'' + e_2' (E^{**} (p^* w Y_x - E^*) + 2E^{*'} (p^* w - E^{*'}))] \right. \\ & \cdot (-p^*) [(e_2 - e) + e_2' (3p^* w Y_x - E^*)] \\ & \left. + 2e_2' p^* w Y_x E^{*'} (p^* w - E^{*'}) \right] \quad (19) \end{aligned}$$

$$\begin{aligned} \delta Y_x / \delta w = (\det A^{cc})^{-1} p^* & \left[[e_2 E^{**} + E'' + e_2' (E^{**} (p^* w Y_x - E^*) - 2(E^{*'})^2)] [(e_2 - e) + e_2' (3p^* w Y_x - E^*)] \right. \\ & \left. - 2p_h' [(e_2 - e) + e_2' ((p^* w Y_x - E^*) + 2Y_x (p^* w - E^{*'}))] \right] \end{aligned}$$

²⁶For simplicity, the results are provided under the assumption that both internal goods' demand and internal currency demands are normal, differentiable, and linear.

$$+ (2e_2'E^*)^2 p^* w Y_x] \quad (20)$$

$$\det A^{cc} = [e_2 E^{**} + E'' + e_2' E^{**} (p^* w Y_x - E^*) - 2e_2' (p^* w - E^*)^2] \cdot [-2p_h' - 2e_2' (p^* w)^2] - (2e_2' p^* w (p^* w - E^*))^2 \quad (21)$$

Table 3: **Effect of Policy Instruments on Production Volumes**
Convertible Currency Case

	<u>For Internal Sales</u>		<u>For Export</u>		<u>Total</u>	
(+)	small e_2'	large e_2'	small e_2'	large e_2'	small e_2'	large e_2'
p^*	-	+ ¹	+	-	+	+ ¹
e	-	-	+	+	+	-
w	-	+ ²	+	-	+	+ ²
Y	-	-	0	0	0	0
q	-	-	+	+	-/+ ³	-

+ = increase; - = decrease. Total production = $Y + Y_h + Y_x$

Results assume $(p^* w - E^*) > 0$. Conditions for $(p^* w - E^*) < 0$ available on request.

"small" defined by the sufficient condition: $-e_2' < e_2 / [(p^* w Y_x - E^*)]$

"large" defined by the necessary condition: $-e_2' > e_2 / [(p^* w Y_x - E^*)]$

1: sufficient condition when $(p^* w - E^*) > 0$
 $-e_2' > [e(1-w) + e_2 w] / [w(p^* w Y_x - E^*)]$.

2: sufficient condition when $(p^* w - E^*) > 0$
 $-e_2' > [e_2 - e] / [w(p^* w Y_x - E^*)]$.

3: negative when $(p^* w - E^*) > 0$; positive when $(p^* w - E^*) < 0$.

Policy Effectiveness and the Design of Currency Markets: A devaluation of the official exchange rate stimulates production for export and reduces production for internal

markets. This occurs because the devaluation increases the relative price of exportables. For the case of low e_2' firms, this yields a positive overall effect on production. Although an official exchange rate devaluation is not contractionary in terms of aggregate production, it will increase the scarcity of the exportable goods in internal markets.

In important contrast, for the case of high e_2' firms, a depreciation of the official exchange rate increases external sales by a considerably smaller amount. This response is motivated by the exertion of monopolistic pricing power in sales of hard-currency earnings in the auction or interbank markets. By reducing net exports in comparison with the low e_2' case, the producer achieves higher profits and a more favorable terms-of-trade on export sales.

This force that market power in internal currency markets exerts on production activity also is vividly shown by the production responses of enterprises to altered hard-currency appropriation rates (surrender requirements) by the government. Recall that w is the share of hard-currency earnings which is not appropriated by the government. For the case of small e_2' the production responses again are "normal" and in line with conventional wisdom: increasing the ability of the firm to retain valuable hard-currency earnings shifts production away from internal markets toward exports. This yields an overall expansion of production volumes. Significantly, reductions in official surrender requirements (increase in w) have entirely the opposite effect when e_2' is large: there will be a contraction of exports and an expansion of production for internal distribution. Both of these production reallocations reduce the downward pressure on the terms-of-trade on exports which was accomplished by the initial increase in w .

Clearly, the real effects of changing hard-currency surrender requirements or the official exchange rate depend on the design of the internal markets for hard currency trade. Analogously, the real effects of shifts in p^* , the world-market price of the export good, also depend on e_2' . Increasing the world-market price of exports can lead to contractions in export volumes rather than expansions.

Increasing the production order of the state (*goszakazy*) first increases expenditures denominated in both domestic and foreign currency. Regardless of the level of e_2' , enterprises

respond by offsetting this in domestic markets. This contraction of production for sale to internal markets mitigate the increase in marginal costs of production, and optimality requires no further response from production for export. While the overall profits of the enterprise decline (assuming that state orders yield lower unit revenues than sales on the open market), the total production levels of the enterprise will be unaffected.

This discussion has emphasized that the *direction* of production responses to policy changes critically depends on the ability of the producer to influence the price of foreign exchange. In general, when internal currency markets are competitive and firms are unable to significantly effect the terms-of-trade, the expected responses of the production mix to policy changes are fairly standard. By contrast, when e_2' is high, either because currency demands are inelastic or because firms have the power to significantly influence the auction or interbank currency price, the optimal responses of managers can differ substantially from "conventional wisdom". Profit-maximizing "large" producers will use their ability to influence the internal terms-of-trade to optimally distort their revenues from exporting. Succinctly put, the simple introduction of exchange rate flexibility through auction or interbank markets during economic reform does not guarantee that policy initiatives will have "normal" effects. For this guarantee, our framework shows that a necessary precondition is that the foreign exchange markets must achieve a sufficient degree of competitiveness.

Policy Effectiveness and Monopoly Power in Internal Goods Markets: The effectiveness of policy instruments also critically depends on the extent of reforms undertaken to increase the competitive structure of domestic goods markets. While it was noted that e_2' can determine the direction of an enterprise's response to shocks, p_h' determines the magnitude of the enterprise's response to shocks.

Suppose that prices are not fixed in internal markets, so that $p_h' < 0$. Under high p_h' (in absolute value), internal prices for the good are highly sensitive to changes in its internal goods supply. If internal prices are allowed to vary, high p_h' describes a situation of inelastic internal

demand or monopolistic supply. This could arise under reform characterized by decontrolled internal goods prices without the break-up of large state monopolies. Low p_h' either describes the situation of more regulated internal-sales prices, highly-elastic internal demand, or highly competitive industries.

In general, the more competitive the goods markets, the greater will be the response of production volumes to policy changes, and the lesser will be the response of prices of goods sold in internal markets. To demonstrate this, consider the effect of p_h' on the ability of a devaluation of the official exchange rate to influence the supply of goods to internal markets. From equation (17) it is straight-forward to show that as p_h' rises (in absolute value), an official devaluation (e increase) leads to smaller Y_h contractions for low e_2' firms and smaller Y_h expansions for high e_2' firms. In part, the relative-price effect of the official devaluation is reduced when p_h is very responsive, leading to a lower internal-market supply adjustment. Likewise, increases in p_h' leads to reduced responsiveness of Y_h to shifts in state orders, the turnover tax, foreign price shocks, and government hard-currency surrender requirements. Similarly, the responsiveness of export volumes to policy changes also generally declines as the producers' monopoly power in domestic-goods markets rises.

The impact of policy changes on the internal price of the exportable good is inversely related to the change in Y_h . Therefore, for any policy change the corresponding domestic-goods price changes are:

$$\delta p_h / \delta [u] = p_h' \delta Y_h / \delta [u] \quad (22)$$

The price impact of policy changes depends on the competitiveness of internal goods markets. Changes in p_h' , whether caused by efforts to demonopolize existing industries or by opening of domestic markets to foreign competition, operate through two channels: as a direct multiplier of $\delta Y_h / \delta [u]$ and as a determinant of $\delta Y_h / \delta [u]$, since as p_h' rises the responsiveness of output Y_h to shocks declines. As p_h' rises, the "inflationary" impact of a shock increases although less than proportionately. Conversely, as p_h' falls, the "inflationary" impact of a parameter

change declines, although the output response rises. As p_h' tends toward zero, policy changes induce the greatest output effects and the weakest price effects.

Effects of Policy Changes on Internal Hard Currency Sales

The functioning of internal currency markets and the level of the exchange rate which results in currency auctions and interbank markets are important to the reform program in the transition economy. Given the functioning of these markets, we can determine the effects of policy changes on the supplies of hard currency sold in internal currency markets, R_2^* , and the associated flexible exchange rate, e_2 . To accomplish this, we solve:

$$\delta R_2^* / \delta [u] = \delta (wp^* Y_x - E^*(Y)) / \delta [u] \quad (23)$$

for each $[u] = [p^*, e, w, Y, q]$. Table 4 provides a summary of the results, when the currency is convertible.²⁷

The second row of Table 4 states that an official devaluation will increase hard currency sales by net exporters to auction and interbank markets.²⁸ This appreciates the free internal exchange rate. By contrast, an increase in world market prices of export goods either can increase or decrease in hard-currency sales to internal markets. This depends on the design of these currency markets and the ability of the exporters to exert monopoly power therein. For low e_2' firms, enterprises will increase their sales of hard currency to auction or interbank markets and appreciate the internal market exchange rate when: i) the official rate is devalued; ii) the world market price of the export increases; iii) the government appropriation rate declines (w increases); and iv) turnover taxes increase.

²⁷These results are provided for the case when the marginal hard-currency revenue from exports exceeds marginal production costs ($p^* w - E^*$) > 0. Otherwise, the conditions for signing many of the results are complicated and unintuitive.

²⁸Herein, we are not discussing the possibility of shifting between the margins of convertible and unconvertible currency.

Table 4: Policy Changes, Hard Currency Sales and the Internal Exchange Rate

	R_2^*		internal exchange rate, e_2	
	small e_2'	large e_2'	small e_2'	large e_2'
if $(p^*w - E^*) > 0$:				
p^*	increase ¹	decrease ^{1,2}	appreciation ¹	depreciation ^{1,2}
e	increase	increase	appreciation	appreciation
w	increase ³	decrease ⁴	appreciation ³	depreciation ⁴
Y	no effect	no effect	no effect	no effect
q	increase	increase	appreciation	appreciation
¹ : sufficient condition when $(p^*w - E^*) > 0$: for small: $-e_2' < [e(1-w) + e_2w] / [w((p^*wY_x - E^*) + 2p^*wY_x)]$				
² : satisfied when $Y_x + p^*(\delta Y_x / \delta p^*) < 0$.				
³ : sufficient condition when $(p^*w - E^*) > 0$: for small: $-e_2' < [e_2 - e] / [(p^*wY_x - E^*) + 2p^*wY_x]$				
⁴ : satisfied when $Y_x + w(\delta Y_x / \delta w) < 0$.				

For high e_2' firms, it is more difficult to determine the effect of policy changes on these internal currency markets. It is clear that enterprises will increase their sales of hard currency to auction or interbank markets and the internal exchange rate will appreciate when: i) the official rate is devalued; and ii) turnover taxes are increased. The effects of other policy measures depend on the size of marginal revenues and marginal costs in production.

IV.II Policy Effectiveness Under Currency Inconvertibility

Herein, currency inconvertibility is defined as the unwillingness of firms to sell hard-currency earnings in exchange for roubles at given market conditions. At this margin solution of

the model, defined by $R_2^* = 0$ with all hard currency of the enterprise held as retained earnings, the first-order conditions are given by:

$$\frac{\partial L}{\partial Y_h} = (1-T)[p_h' Y_h + p_h - E'] - [e_2 + \phi - Te] E^{*'}(Y) \quad (24)$$

$$\frac{\partial L}{\partial Y_x} = (1-T)[p^* e(1-w) - E'(Y)] + [e_2 + \phi - Te][p^* w - E^{*'}(Y)] \quad (25)$$

Differentiating the first order conditions yields the matrices for comparative statics when the currency is not convertible, A^{ic} and B^{ic} (see the Appendix). Table 5 summarizes the resulting production responses to policy changes. In contrast to the results provided in Section IV.I for policy effectiveness under currency convertibility, when no funds are supplied to auction or interbank markets, the role of market power in currency markets as determining the direction of production effects disappears.²⁹ Furthermore, when the currency is not convertible changes in the profit tax rate have real effects. The mechanism for this result is that the higher the tax rate, the higher the tax haven associated with retained earnings and the greater the relative attractiveness of exports.

Specific examples of production responsiveness to policy changes are provided in equations (26) through (29). In the Soviet Union, where profit tax rates are generally around forty percent and the firms' unappropriated share of hard currency earnings is between ten and fifty percent, an official devaluation will reduce production for internal markets. In this case, an official devaluation will also increase export volumes.³⁰ An increase in the firms' share of its hard currency earnings will also decrease production for home markets and increase export volumes. Both of these policy changes will increase overall production levels of the enterprise.

²⁹Obviously, since $R_2^* = 0$ at this margin, it is unnecessary to examine the effects of policy changes on currency supplies to auction and interbank markets.

³⁰The opposite results could arise for extremely profitable firms which have high marginal tax rates.

Table 5: Policy Effectiveness Without Currency Convertibility

Production Response to Policy Changes

	<u>For Internal Sales</u>	<u>For Export</u>	<u>Total Volume</u>
p^*	-	+	+
e	-/+ ¹	+/- ²	+/- ³
w	-	+	+
Y	0	-	+
q	- ⁴	+ ⁴	0
T	-/+ ⁵	+/- ⁶	+/- ⁷

+ = increase; - = decrease. Total production= $Y+Y_h+Y_x$

¹: $\partial Y_h/\partial e < 0$ if $(1-T-w) > 0$; $\partial Y_h/\partial e > 0$ if $(1-T-w) < 0$.

²: $\partial Y_x/\partial e < 0$ requires $(1-T-w) > 0$; sufficient condition $\epsilon p^*(1-T-w) - 2(1-T)p_h'[p^*(1-T-w) + TE^{*'}] < 0$
Otherwise, $\partial Y_x/\partial e > 0$.

³: $\partial Y/\partial e > 0$ if $(1-T-w) > 0$; If $(1-T-w) < 0$, $\partial Y/\partial e > 0$ if $p^*(1-T-w) + TE^{*'} > 0$;
Otherwise $\partial Y/\partial e < 0$.

⁴: assumes the cross derivative (quantity then q) is small relative to p_h^q .

⁵: $\partial Y_h/\partial T < 0$ if $p^*e - p_h^1 Y_h - p_h < 0$; $\partial Y_h/\partial T > 0$ if $p^*e - p_h^1 Y_h - p_h > 0$.

⁶: $\partial Y_x/\partial T > 0$ if $p^*e - p_h^1 Y_h - p_h < 0$ and $p^*e - (E' + eE^{*'}) < 0$ (sufficient, not necessary);

$\partial Y_x/\partial T < 0$ if $p^*e - p_h^1 Y_h - p_h > 0$ and $p^*e - (E' + eE^{*'}) > 0$ (sufficient, not necessary).

⁷: $\partial Y/\partial T > 0$ if $p^*e - (E' + eE^{*'}) < 0$; $\partial Y/\partial T < 0$ if $p^*e - (E' + eE^{*'}) > 0$.

$$\delta Y_h/\delta e = (\det A^{ic})^{-1}[-\epsilon p^*(1-T-w)] \quad (26)$$

$$\delta Y_x/\delta e = (\det A^{ic})^{-1}[-\epsilon [(1-T)e(1-w) + w(e_2 + \phi - e)]] \quad (27)$$

$$\delta Y_h/\delta w = (\det A^{ic})^{-1}[-\epsilon p^*(e_2 + \phi - e)] \quad (28)$$

$$\delta Y_x/\delta w = (\det A^{ic})^{-1}[(-\epsilon + 2p_h^1)(-p^*)(e_2 + \phi - e)] \quad (29)$$

$$\det A^{ic} = -\epsilon 2p_h^1 \text{ where } \epsilon = (1-T)E'' + (e_2 + \phi - Te)E^{*''} \quad (30)$$

The competitiveness of the internal goods markets determines the magnitude of production responses to policy changes, as was concluded in the convertible-currency case. When the currency is not convertible, decreasing the monopolistic power of the enterprises leads to greater output effects of policy changes for both production for export and production for internal sales. Nonetheless, changes in p_h' do not effect the responsiveness to policy of total production levels. While p_h' matters for the composition of the responses to policy changes, it does not matter for the impact on total production volumes or for total demands for domestic and imported inputs into production.

IV.III Policy Changes and the Balance of Payments

The effects of policy instruments on the trade accounts of the balance of payments depend on whether or not the domestic currency is convertible and on the design of the markets. Recall that our model and discussion has focussed only on the activities of net exporters. Consequently, the partial-equilibrium framework supports analysis of the sectoral trade balance, but not the trade balance for the aggregated economy.³¹ Define the sectoral trade balance (in hard currency) as:³²

$$p^* Y_x - E^*(Y) \tag{31}$$

The effects of the policy changes on the trade balance are summarized in Table 6 for both the convertible currency and the inconvertible-currency cases. The effects are disaggregated by changes in exports, imports, and the total sectoral balance. An additional effect due to export valuation occurs when p^* changes.

If e_2' is small, improvements in the trade balance are associated with increases in the world price of exports, official devaluations, increased official hard-currency retention rates (reductions in foreign-exchange surrender requirements), and increases in the turnover tax on internal sales of the export goods. If e_2' is large, stronger conditions are required to determine

³¹This is a partial equilibrium model and does not consider spillover effects on other markets or across enterprises.

³²This definition of the sectoral trade balance includes both the hard currency received by the enterprise and the hard currency surrendered to the central government.

whether policy changes will improve or worsen the trade balance. Indeed, in this case it is possible that the trade balance will be worsened by increased world-market prices for exports and by reduced government foreign-exchange surrender requirements, and the expansionary effects of official exchange-rate devaluations are diminished. The power of exports to influence the domestic currency terms-of-trade on their transactions in internal and external markets weakens and potential reverses the strength of conventionally accepted policy effects.

In conclusion, the effects of policy changes on the balance-of-payments are highly sensitive to the extent of economic reforms undertaken in goods markets and currency markets. Without competitive markets for the exchange of hard currency earnings, the beneficial effects of official devaluations on the trade balance are reduced if not altogether reversed.

V. Concluding Remarks

The stage of reforms undertaken in currency markets and goods markets determine the effectiveness of policy-instruments in a transition economy. In this paper we have shown that the decisions of exporters depend on the amount of monopoly power that they can exert in two distinct markets: (1) the internal goods market in which output is sold and (2) the internal market in which the enterprises sell hard currency earnings.

If the domestic currency becomes convertible, the *direction* of an enterprises' output response to shocks is determined by its ability to influence the effective-exchange-rate received on exports. This monopoly-power in currency markets can reverse the conventional wisdom about the expect impact of policy measures. This implies that the introduction of some exchange rate flexibility, achieved through the establishment of auction or interbank markets, is not a sufficient condition for movement toward a normal and competitive market structure. If these currency markets are not sufficiently competitive, exporter responses to standard policy prescriptions could undermine the intended outcome of the policies.

It was also shown that the magnitude of production response to policy changes depends on the enterprises' ability to exert monopoly-power and influence the price it receives on this

Table 6: Policy Changes and the Sectoral Trade Balance

I. With Currency Convertibility (cases: small e_2' / large e_2')

	<u>Exports</u>	<u>Imports</u>	<u>Trade Balance</u>
p^*	increase/ decrease	increase	improves/ worsens
e	increase	increase/decrease	improves
w	increase/decrease	increase	improves/ worsens
Y	no effect	no effect	no effect
q	increase	decrease/increase	improves

II. Without Currency Convertibility

	<u>Exports</u>	<u>Imports</u>	<u>Trade Balance</u>
p^*	increase	increase	improves
e	increase	decrease	improves
w	decrease	increase	worsens
Y	no effect	no effect	no effect
q	increase	decrease	improves
T	increase/decrease	increase/decrease	ambiguous

Assumes $(1-T-w)>0$ and $(p^* - E^*)>0$.

Endnotes of Table 4 provide sufficient conditions on output responses for the convertible currency case.

good. The higher the firm's ability to influence the price of the good in internal markets, the greater its ability to offset the effects of policy changes by shifting the internal terms-of-trade in production. The higher the monopolistic pricing-behavior in internal goods markets in a transition economy, the higher the probability that policy changes will be the manifested in

domestic goods prices rather than in supplies of goods to domestic markets. This is true regardless of whether currency convertibility has been achieved.

A puzzle to policy-makers in the Soviet Union and Eastern Europe has been the reluctance of enterprises to participate, on the supply-side in auctions of hard currency. The willingness of enterprises to supply currency is clearly associated with the structure of after-tax returns from selling hard currency internally versus holding foreign currency in the form of retained earnings. Even if such convertibility is achieved, stabilization programs targeted at production and the balance-of-payments should proceed cautiously until both internal goods markets and internal currency markets reach sufficient stages of competitiveness.

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Comparative Statics Matrices for Currency Convertibility Case:

Matrix A^{cc}:

$$a_{11} = e_2 E^{**} + E'' + e_2' [E^{**}(p^* w Y_x - E^*) - 2(p^* w - E^*)^2 + 2p^* w(p^* w - 2E^*)] - 2p_h'$$

$$a_{12} = a_{21} = e_2 E^{**} + E'' + e_2' [E^{**}(p^* w Y_x - E^*) - 2(p^* w - E^*)^2 + 2p^* w(p^* w - E^*)]$$

$$a_{22} = e_2 E^{**} + E'' + e_2' [E^{**}(p^* w Y_x - E^*) - 2(p^* w - E^*)^2]$$

The determinant of A^{cc} is given by:

$$\text{Det } A^{cc} = a_{22} [-Y_h p_h'' - 2p_h' - 2e_2'(p^* w)^2] - [2e_2' p^* w(p^* w - E^*)]^2$$

Matrix B^{cc} (in transpose form):

$\frac{\delta e}{\delta p^*}$	0	$p^*(1-w)$
$\frac{\delta p^*}{\delta w}$	$-2e_2' Y_x w E^{**}$	$[e(1-w) + e_2 w] + e_2' w [(p^* w Y_x - E^*) + 2Y_x(p^* w - E^*)]$
$\frac{\delta w}{\delta Y}$	$-2e_2' Y_x p^* E^{**}$	$p^*(e_2 - e) + p^* e_2' [(p^* w Y_x - E^*) + 2Y_x(p^* w - E^*)]$
$\frac{\delta Y}{\delta q}$	$-e_2' [E^{**}(p^* w Y_x - E^*) - 2(E^*)^2] - (e_2 E^{**} + E'')$	$-e_2' [E^{**}(p^* w Y_x - E^*) + 2(E^*)(p^* w - E^*)] - (e_2 E^{**} + p_h' q Y_h + p_h' q)$
		0

Comparative Statics Matrices under Currency Inconvertibility:

Matrix A^{ic}: (Y_h, Y_x)

$$a_{11} = -\epsilon + 2p_h'$$

$$a_{12} = a_{21} = -\epsilon$$

$$a_{22} = -\epsilon$$

where $\epsilon = (1-T)E'' + (e_2 + \phi - Te)E^{**}$

The determinant of A^{ic} is given by:

$$\text{Det } A^{ic} = -\epsilon 2p_h' > 0$$

Matrix B^{ic} (in transpose form):

$\frac{\delta e}{\delta p^*}$	$-TE^{**}$	$-(1-T)p^*(1-w) + T(p^* w - E^*)$
$\frac{\delta p^*}{\delta w}$	0	$-(1-T)e(1-w) - w(e_2 + \phi - Te)$
$\frac{\delta w}{\delta Y}$	0	$-p^*(e_2 + \phi - Te)$
$\frac{\delta Y}{\delta q}$	ϵ	ϵ
$\frac{\delta q}{\delta T}$	$-(1-T)(p_h' q Y_h + p_h' q)$	0
	$(p_h' Y_h + p_h) - [E' + eE^{**}]$	$p^* e - [E' + eE^{**}]$

Further Comparative Statics Results

The interior solution to the comparative statics problem has a non-margin solution for R_2^* . This solution is a saddlepoint and an unstable equilibrium. Nonetheless, the comparative statics results are available on request. Below, we present the matrices which could be used for generating the results for the solution to the system given by :

$$\begin{bmatrix} \delta R_2^* \\ \delta Y_b \\ \delta Y_x \end{bmatrix} = [A]^{-1} [B] [u]'$$

The corresponding Matrix A is :

$$\begin{bmatrix} E^* e_2' & E^* e_2' - p^* w e_2' & 2T e_2' - e_2'' s \\ \varepsilon - (1-T)(2p_b' + p_b'' Y_b) & \varepsilon & E^* e_2' \\ \varepsilon & \varepsilon & -e_2'(p^* w - E^*) \end{bmatrix}$$

and the Matrix B corresponding to $(T, e, p^* | w, Y, \phi, q)$ and partitioned as $[B_1 | B_2]$ is:

Matrix B₁

$$\begin{bmatrix} e - e_2 - R_2^* e_2' & T & Y_x w e_2' \\ -p_b' Y_b - p_b + E' + e E^* & T E^* & 0 \\ -e p^* + E' + e E^* & (1-w-T)p^* + T E^* & w(e_2 + \phi - e) + (1-T)e \end{bmatrix}$$

Matrix B₂

$$\begin{bmatrix} p^* Y_x e_2' & -E^* e_2' & 1 & 0 \\ 0 & -\varepsilon & E^* & (1-T)(p_b' q Y_b + p_b' q) \\ p^*(e_2 + \phi - e) & -\varepsilon & -(w p^* - E^*) & 0 \end{bmatrix}$$

where $\varepsilon = (1-T)E'' + (e_2 + \phi - T e)E^*$, and $s = p^* Y_x w - E^* - T R_2^* > 0$. For the case of interior solutions for all variables, the determinant of A equals

$$(1-T)(p^* w - E^*)(e_2')^2(p_b'' Y_b + p_b') + \varepsilon [e_2''(1-T)(2p_b' + p_b'' Y_b) s - e_2'(e_2' E^* p^* w + 2T(1-T)(p_b' + p_b'' Y_b))].$$

DetA < 0 is guaranteed by $\varepsilon > 0$ as in a diminishing returns production structure.