Second-Best Foreign Exchange Policy in the Presence of Domestic Price Controls and Export Subsidies

David Tarr

Poland, like many developing countries, has required its exporters to surrender a share of their foreign exchange earnings to the government at an overvalued exchange rate. During the late 1980s, it progressively increased the share which exporters were allowed to retain (the retention ratio), but other distortions to the trade regime remained. A model developed here estimates the effects of these policies on welfare under different foreign exchange elasticities, export and import subsidies, official exchange rates, and policies on exporter retention of foreign exchange earnings. The retention ratios in effect in early 1989 were equivalent to a 51 percent tax on exports or an import tariff of 130 percent. As economic theory would suggest, maximum social benefit would derive from removal of the full range of distortions. Full retention of foreign exchange by exporters in the absence of other distortions would provide social benefits equivalent to 8 percent of gross domestic product. But the net effect of the other policies together is a bias toward tradables, so that a policy of somewhat less than full retention of foreign exchange is optimal in this second-best world.

Foreign exchange restraints are not uncommon in developing countries, and they are typical in centrally planned economies. Exporting enterprises are required to remit to the government all or part of their foreign exchange earnings, and they receive payment at the official (overvalued) exchange rate. In this article I develop a model to analyze the welfare consequences of partial or full liberalization of foreign exchange restraints, in which enterprises are allowed to retain a greater share or all of their foreign exchange earnings.

In the empirical application of the model, I estimate the welfare costs of foreign exchange restraints in Poland, incorporating all significant distortions to the trade regime. As of early 1989, that involved export subsidies and—a novelty—implicit subsidies to imports because of domestic price controls. In January of 1990, as part of its “shock” stabilization program, Poland massively devalued its exchange rate, unifying its official and parallel market rates (see Lipton and Sachs 1990). Thus the findings here can be viewed as estimates of...
the benefits Poland will likely receive from the foreign exchange reforms of 1990.

The estimates confirm the conventional wisdom that if there were no other trade distortions, full foreign exchange liberalization would be optimal, or that if other distortions were removed, full foreign exchange liberalization would be the best policy. In Poland, however, foreign exchange restraints are an offsetting distortion to the export subsidies and implicit subsidies to imports, so that full liberalization of foreign exchange is not optimal. Thus the optimal share of foreign exchange to be retained by the firm (the retention ratio), from the government's perspective, is estimated as a function of the level of other distortions.

The model is also used to calculate the anti-export bias of less than full retention of foreign exchange. Moreover, because a tax on exports is equivalent to a tax on imports (in that both will lower the equilibrium level of foreign exchange use), this calculation is also made in terms of the equivalent level of tariff protection.

The Polish trade and exchange rate regime, as it existed in 1989, is first described. The model is then presented and the benefits to Poland from various retention ratios are estimated, and the optimal retention ratio is calculated, given various assumptions regarding the extent of subsidies to imports. I have also estimated the benefits to Poland of foreign exchange liberalization, with subsidies to imports and exports removed. In the concluding section, most of the important simulations in the article are consolidated in the two summary figures.

I. The Trade and Exchange Rate Regime in Poland: 1989

In 1989 Poland embarked on a dramatic trade liberalization effort. Principally this occurred through three institutional changes: the state monopoly on importing was greatly liberalized, foreign exchange was made available at market rates, and foreign exchange obtained through the market was expected to finance the majority of imports.

Previously, importing and exporting were restricted to state foreign trade organizations, which are organized along product lines. Exporters turned over to the government their foreign exchange, and the government allocated it to those imports it desired.

The first liberalization in this area came with the introduction of accounts for exporters that allowed them to retain a share of their foreign exchange earnings (known as ROD accounts). For 1989, in addition, the government intended to auction a substantial share of the foreign exchange, so that only about one-third of it would be obtained through central allocation. The majority of imports thus were to be financed out of ROD accounts or from foreign exchange purchased at market rates. The combination of these two reforms
meant that importers could purchase foreign exchange at market rates and import most goods through competitive trade organizations.

Given these reforms, the principal (but not only) distortions which remained in the trade regime involved foreign exchange, for which there were multiple exchange rates. The three most important were the official rate for centrally allocated foreign exchange, the parallel market rate for nonrestricted and illegal transactions, and the rate received by exporters for the dollar value of their exports.

First, those institutions that received centrally allocated foreign exchange paid the official price. This included in 1989 the import demands of the health and education sectors, which had little income. The official exchange rate, which was frequently subject to devaluation, was 239 zloty to one U.S. dollar as of March 1987; 400 in March of 1988; and slightly less than 550 as of March 10, 1989.

Second, there is the parallel or black market exchange rate, which in the three years before July 1988 was between 3.3 and 4.6 times the official exchange rate. The parallel market rate has been very volatile: it began to rise in August 1988 and by December 1988 reached 3,380 zloty to the dollar, or 6.7 times the official rate. By March 1989 it was about 2,900, and it rose by about 1,000 zloty per dollar in April 1989.

In early 1989 there were a variety of auctions at which foreign exchange could be purchased, yielding a variety of parallel exchange rates. Enterprises could sell their unrestricted foreign exchange from ROD accounts at the Export Development Bank auctions. Early in 1989 these rates closely approximated the parallel market rate, and it was expected that $200 million would be auctioned there in 1989. Foreign exchange to import any one of fifty-two important intermediate products was sold at the Bank Handlowy auctions. It was expected that between $1.5 and $2 billion (billion = 1,000 million) would be auctioned through Bank Handlowy. At the first auction, prices varied from 100 zloty above the official rate to 3,100 above it. Generally, lower prices were paid for larger contracts and for contracts further in the future. Lower prices for the future contracts were efficient because the buyer had to pay immediately, forwent interest, and bore the risk of exchange rate changes. Lower prices for the larger contracts were the result of lack of competition. As of April 1, 1989, individuals have been able to purchase foreign exchange at exchange counters established for this purpose. In addition, about $60 million was expected to be auctioned for the import of consumer goods, for which mostly wholesale enterprises were to be the buyers. These auctions were new and a considerable amount of inefficiency in the markets existed, most notably at Bank Handlowy, so that one price for similar transactions did not emerge.

The third important exchange rate is the rate received by exporters for their export earnings. Exporters retain a share of their foreign exchange and must sell the balance to the government at the official exchange rate. The ratio that
they are allowed to retain varies by product but is generally between 10 and 50 percent and averages about 30 percent overall. This means that the exchange rate received by the exporter is a weighted average of the official exchange rate and the parallel market exchange rate. Given the average retention ratio of 30 percent, in March 1989 exporters were receiving on average an exchange rate of 1,255 zloty per dollar, compared with the 2,900 parallel market rate.

II. FOREIGN CURRENCY MARKETS: THE MODEL

The model estimated here is explained in detail in Harberger (1988) and discussed in other international trade texts, such as Salvatore (1987) and Dornbusch and Helmers (1988). This model has been widely used to estimate the effects on the real exchange rate of policy changes generally, and specifically of foreign exchange restraints (Bhagwati 1978). I focus here on the hard currency market and convert all hard currencies to U.S. dollars, so that we can use the term “dollars” interchangeably with “hard currency foreign exchange.” The model formulates a system of supply and demand for foreign exchange.

The supply of dollars comes principally from the sale of exports. Exporters in each industry have a supply function that expresses their willingness to export as a function of their real exchange rate received, $E_r$. Nominal Polish exchange rates deflated by the ratio of Polish to world prices are real exchange rates. Exchange rates used in the model are real unless otherwise specified.

If units of each commodity are chosen so that one unit yields one dollar at world prices, then the aggregate of the supply functions of all of the exporters of the economy is the total supply function of dollars (Harberger 1988). Exporters are willing to supply more dollars the higher the exchange rate that they receive. Thus the supply of foreign exchange, $F_s$, is written as a linear function of the real exchange rate received:

$$F_s = a + bE(1 + s)$$

In equation 1, $E$ is the real exchange rate received (it is derived by deflating the ratio of Polish to world prices), and $s$ is the rate of subsidies on exports. If exporting firms receive subsidies at a positive rate, they will be willing to supply foreign currency (dollars) at a lower exchange rate. Equation 1 is depicted in figure 1; with no subsidy ($s = 0$), foreign exchange supplied is curve SS. Given a positive subsidy rate, the curve shifts down and to the right and is labeled $S(1 + s)$. (Other sources of foreign exchange that are sensitive to the real exchange rate are discussed in the appendix.)

The exchange rate received is a weighted average of the official exchange rate, $E_o$, and the parallel market exchange rate, $E_p$:

$$E_r = RE_p + (1 - R)E_o$$

where $R$ is the firm’s foreign exchange retention ratio. Note that when $R = 1$, $E_r = E_p$. 
Figure 1. *Model of Real Exchange Rate Determination*

The demand for foreign exchange derives from a number of sources, but first from the demand for imports. Real exchange rate depreciation raises the number of zloty required per dollar and reduces the quantity of imports demanded. Demand (and supply) in individual sectors will also be affected by nontariff barriers. The aggregate of these sectoral demand functions represents the import demand for dollars, $F_d$, which is assumed to be a linear function and is written as

\[ F_d = c - dE_p(1 + t) \]

where $t$, most easily thought of as the tariff rate, is a parameter that measures the policy-induced bias against imports. Payments for external debt would be incorporated in the parameter $c$. Equation 3 is depicted in figure 1 as the curve $DD$, and is drawn with $t = 0$. With a positive tariff rate, equation 3 would shift in and to the left, as is depicted in figure 1 as the dotted line $D'D'$. Finally, we require equilibrium between demand and supply of foreign exchange:

\[ F_d = F_s \]

In most economies we think of the parameter $t$ as positive, reflecting a tariff rate that discourages purchase of imports. This does not appear appropriate for Poland, because tariffs average less than 10 percent and price controls and
shortages produce implicit import subsidies. This occurs because price controls generate widespread shortages, that is, the quantity supplied is less than the quantity demanded, given Polish incomes. Given that imports could be purchased if dollars were obtained, the excess demand for domestic goods spills over into increased demand for imported consumer goods. Thus, the demand for imports would decrease if the shortages in the economy were reduced through the removal of price controls. That is, the price controls induce a bias toward import purchases that we think of as an implicit "subsidy equivalent," creating a negative value for $t$ in equation 3 ($D'D'$ in figure 1).

In related analyses (Tarr 1990a), I have estimated this implicit subsidy equivalent for imports in automobiles and color televisions, two industries which have been subject to severe shortages and price controls. It was found that the elimination of the price controls in autos and color televisions would result in a sizable reduction in imports in the long run. Although obviously the government of Poland did not wish to subsidize the import of autos or color televisions, and there was no financial payment for their import, the impact on import demand of price controls on the domestically produced products was equivalent to a subsidy for the import of autos of 43 percent and imports of color televisions of 22 percent. Similar general results were found in the Polish butter market (see Tarr 1990b).

One cannot, however, generalize these partial equilibrium results of the television and auto industries to all goods simultaneously. If only price controls on autos are removed, producers can attract labor and capital from other sectors of the economy. If price controls are removed in the aggregate, when all sectors attempt to increase supply, the limited factors of production will result in a bidding up of the prices of those factors, and not all sectors will be able to expand. After a period of adjustment, however, one would expect that liberalization of price controls would result in a more efficient allocation of resources across industries, producing some increase in the value of Polish gross domestic product (GDP).

On the basis of these considerations, it is assumed (given best-guess estimates) that the import-increasing effect of the price controls is moderately stronger than the disincentive from the tariff, shifting the demand for imports out and to the right. The parameter $t$ in equation 3 is interpreted as the difference between the tariff rate and the import subsidy equivalent of the price controls. That is, if $t'$ is the tariff rate and $p$ is the rate at which imports are encouraged as a result of price controls, then the net ad valorem effect on import demand is: $t = t' - p$. Given the uncertainty regarding its value, however, I simulate the effects of a number of positive and negative values of $t$.

These equations constitute the model. In a full general equilibrium model, a firm's export supply function depends on all its output and factor prices, not just the relative price of exports to domestic sales. This model, however, focuses on the relative price of exports, including taxes and subsidies, because this is the most important of the variables that affects export supply. In com-
comparison with literally dozens of variants of general equilibrium models, this simple model has always reliably predicted the qualitative change in the real exchange rate found in the full general equilibrium models (including versions which incorporate labor-leisure choice). (These comparisons are presented in detail in de Melo and Tarr, forthcoming.)

The welfare analysis is based on the concept of net consumers’ and producers’ surplus, using measurement of Harberger triangles. Welfare estimates based on consumers’ surplus have been shown to be good proxies for exact welfare estimates because measures of consumers’ surplus are found to lie between the two “exact” measures: the Hicksian equivalent and compensating variations (Willig 1976). Hausman (1981) has taken a critical view of consumers’ surplus; he has managed to construct examples in which the Hicksian equivalent and compensating variations differ by a significant amount. But to the extent that consumers’ surplus differs from the equivalent variation, it will be closer to the compensating variation, and the latter is as good a welfare measure in most instances. Moreover, in hundreds of simulations using a general equilibrium model we found values based on the Hicksian equivalent and compensating variation measures to be within 1 percent of each other (de Melo and Tarr, forthcoming).

III. LIBERALIZATION OF FOREIGN EXCHANGE POLICY: THE SIMULATION RESULTS

Impact of Full Retention of Foreign Exchange Earnings

The model described above is used to simulate an increase in the firms’ retention ratio to 100 percent and to simulate the effects on the real exchange rate, welfare, and foreign exchange earnings. Six initial simulations are performed assuming: (1) high elasticities; (2) low elasticities; (3) high elasticities but a (high) initial parallel market exchange rate of 4,000 zloty to the dollar; and for (4), (5), and (6), high elasticities and net implicit subsidies to imports of 5, 20, and 50 percent, respectively. Aside from these varying parameter values, the values of the macroeconomic variables are based on best estimates for March 1989.

High elasticities. For this simulation we begin with the official exchange rate at 550, the parallel market exchange rate in the initial equilibrium at 2,900, the initial retention ratio at 0.3, net tariffs at zero, net subsidies at 0.121, initial foreign exchange supplied at $9.644 billion, and the elasticities of foreign exchange supply and demand at 1.16 and −1.0, respectively. The effects of increasing the retention ratio to 1 are presented in figure 2. With full retention, Polish exporters received real exchange rate increases, inducing additional exports and thus a greater supply of foreign exchange. The additional supply of foreign exchange drives down the price of the dollar in the parallel market until
Figure 2. Simulation of Welfare Effects of Foreign Exchange Liberalization
Assuming High Elasticity of Foreign Exchange Supply and Demand

Note: $D = foreign exchange demand; $S = foreign exchange supplied; $s = export subsidy rate.

demand and supply equalize and the market is in equilibrium at a parallel market exchange rate of 1,702 zloty. Note that, excluding subsidies, exporters were receiving a weighted average rate of exchange of 1,255 in the initial equilibrium as a result of partial retention, so that 1,702 is an increase of only 477 zloty; that is, one should not consider 1,702 an increase to exporters of 1,152 from the official exchange rate of 550. Including the average 12.1 percent export subsidy, exporters received 1,407 zloty for every dollar of export earnings in the initial equilibrium, 1,255 zloty from foreign exchange earnings, and 152 zloty from a government subsidy. The increased real exchange rate raises foreign exchange earnings by 41 percent—an additional $3.984 billion dollars—for total earnings of $13.628 billion.

What are the welfare costs and benefits of these shifts? The demand curve $DD$ represents at any point the marginal value of an additional unit of foreign exchange to the Polish economy. The supply curve $SS$ represents the marginal opportunity costs to the Polish economy of providing the goods and services that yield the foreign exchange. As long as $DD$ exceeds $SS$, the economy benefits from raising the firms' retention ratios to increase the supply of foreign exchange. But 100 percent retention is not optimal, because of the presence of the export subsidies. The large triangle, $A$, represents the benefits of increasing retention ratios. To the left of $\$13.145 billion, $DD$ exceeds $SS$, so that the
### Table 1. Welfare and Exchange Rate Effects of Full Retention of Foreign Exchange Earnings

<table>
<thead>
<tr>
<th>Macroeconomic variable</th>
<th>No import subsidies</th>
<th>High elasticity and import subsidies of:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High elasticity (1)</td>
<td>Low elasticity (2)</td>
</tr>
<tr>
<td>Welfare</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In billions of zloty</td>
<td>2,564</td>
<td>733</td>
</tr>
<tr>
<td>In percentage of GDP</td>
<td>9.1</td>
<td>2.6</td>
</tr>
<tr>
<td>Shadow exchange rate (zloty per dollar)</td>
<td>1,847</td>
<td>1,895</td>
</tr>
<tr>
<td>Equilibrium exchange rate (zloty per dollar)</td>
<td>1,702</td>
<td>1,752</td>
</tr>
<tr>
<td>Optimal retention ratio</td>
<td>0.85</td>
<td>0.85</td>
</tr>
<tr>
<td>Increased foreign exchange earnings at optimal retention ratio (billions of dollars)</td>
<td>3.501</td>
<td>1.003</td>
</tr>
<tr>
<td>Increased foreign exchange earnings at 100 percent retention (billions of dollars)</td>
<td>3.984</td>
<td>1.145</td>
</tr>
</tbody>
</table>

Note: The estimates assume existing export subsidies (at 0.121). Column numbers refer to the respective simulations.

a. 4,000 zloty to the U.S. dollar.

Source: Author's calculations, based on data sources described in the appendix.

The value of an additional dollar exceeds the cost of supplying it. The exchange rate is 1,847 at this “optimal” quantity of foreign exchange.

Because subsidies encourage exports, however, the economy will supply more foreign exchange than is optimal once full retention is granted. This will drive down the exchange rate to 1,702, which is slightly appreciated relative to the optimal rate (or shadow price of foreign exchange). The small triangle, B, represents the cost to the economy of supplying too much foreign exchange. The net benefits of providing full retention, given the export subsidies, are equal to the value of area A less that of B—2,564 billion zloty, which is about 9 percent of the estimated GDP for 1988. These results are summarized in column 1 of table 1.

We calculate the optimal retention ratio of foreign exchange to be 85 percent, given the official exchange rate of 550 and the continuation of export subsidies. Once full retention of export earnings is achieved, there is no anti-export bias in the system, and there would be no value in continuing with the export...
subsidies, which are justified as a means of countering the net anti-export bias. Thus, having a retention ratio of 100 percent and simultaneously removing the export subsidies would yield optimal results; this would increase welfare by a further 49 billion zloty (or 0.1 percent of GDP).

If we consider only the foreign exchange market, this model indicates that a retention ratio of 85 percent and a 12 percent export subsidy yield the same benefits as 100 percent retention ratios without subsidies. But both subsidies and the multiple exchange rate regime create administrative and lobbying costs and incentives to seek rents. When lobbying or administrative failures result in uneven application of subsidies or exchange rates across sectors, this will also distort intersectoral allocation and production. Thus 100 percent retention rates without subsidies is the preferred policy.

Low elasticities. The elasticities of supply and demand are now assumed to be 0.3 and -0.3, respectively; otherwise, parameter selection is identical to the high-elasticity case.

Because of the lower elasticities, the increase from 30 percent to full retention brings forth a much smaller rise in foreign exchange earnings—only 1.145 billion dollars. The equilibrium exchange rate (given the subsidies) falls to 1,752, but the shadow exchange rate is 1,895; these are not dramatically different from the high-elasticity case. Only if the difference in the supply elasticities in the two cases is much larger or smaller than the difference between the demand elasticities will significantly different exchange rates be generated.

There is, however, a considerable decrease in the estimate of the benefits to the economy from full retention. The benefit is equal to 733 billion zloty; this is equal to 2.6 percent of estimated GDP. Because the economy makes a smaller adjustment to the change in retention policy, there is less to be gained from liberalization. Again, there is an overadjustment because of the subsidies, and the optimal retention ratio is 85 percent, given the continuation of subsidies. A policy of 100 percent foreign exchange retention and elimination of the subsidies would also yield the optimal result. These results are summarized in column 2 of table 1.

High initial parallel exchange rate and high elasticities. Inasmuch as the parallel exchange rate is somewhat volatile, and depreciated during April 1989 by more than 1,000 zloty relative to the value that we simulated for March 1989, we have also simulated the results with an initial parallel exchange rate of 4,000 zloty to the U.S. dollar. With a more depreciated parallel exchange rate, the tax on exports from less than full retention of foreign exchange earnings is greater. Thus, as shown in column 3 of table 1, the benefits of full retention reach 15 percent of GDP in this case.

Simulations 4, 5, and 6—high elasticities and subsidies to imports. Empirical evidence suggests and the final set of simulations assumes that the
bias to import purchases as a result of price controls is stronger than the import
taxes (that is, in equation 3, $t < 0$). Otherwise, parameter values are set as in
the high-elasticity case.

Compared with the high-elasticity case without import subsidies, the optimal
increase in foreign exchange supplied is smaller and the optimal retention ratio
lower for all levels of import subsidy (see table 1). A retention ratio of 100
percent will now lead to greater excess foreign exchange supplied, so that net
benefits are reduced. At an import subsidy of 50 percent, the bias to importing
is so great that full retention of foreign exchange reduces welfare by 7 percent
of GDP. As discussed above, our best assessment of the actual distortions in the
Polish economy is that net implicit subsidies to imports in Poland are about 5
percent. Thus, the benefits of full retention are best characterized by the results
of simulation 4, shown in column 4 in table 1.

The Anti-Export Bias and the Level of Protection

Calculating the anti-export bias. The system of less than full retention of
foreign exchange earnings creates a disincentive to export. The model is now
used to estimate how high the tax rate on exports would have to be to produce
the initial (lower) level of exports if full retention of foreign exchange were in
effect, assuming high elasticities and no import subsidy. In order to offset the
3.984 billion dollar increase in exports which would result from a 100 percent
retention ratio, it would be necessary to impose a net export tax of 51.5 percent
without the existing 12.1 percent export subsidy, or 63.6 percent if the subsi-
dies remained in effect. That is, it would require an average net export tax of
51.5 percent just to prevent an increase in export earnings if full retention of
export earnings were allowed.

Calculating the equivalent level of protection. It is intuitive to think of less
than full retention of foreign exchange as a tax on exports. But a basic theorem
of international economics (the Lerner symmetry theorem, first established in
the 1930s) states that a tax on imports is equivalent to a tax on exports.
Applied in this situation it means that the same effects of less than full retention
of exchange earnings would result from full retention and imposing a tax on
imports. This results because a tax on exports reduces foreign exchange earn-
ings and, because the quantity of foreign exchange demanded and supplied
must be equal, demand must be reduced to reestablish equilibrium. This occurs
as the excess demand for foreign currency drives up its price, raising import
prices and lowering import quantities. Thus giving full retention would increase
the amount of imports in the economy, not just increase the amount of exports.
By identical reasoning, a subsidy to imports is equivalent to a subsidy to
exports. In particular, to the extent that domestic price controls induce addi-
tional imports, they depreciate the real exchange rate and encourage additional
exports.

An import tax of 131 percent would be necessary to reduce imports to their
original level if 100 percent retention rates were granted. Thus the overvalued
average exchange rate at which exporters were paid for the surrendered foreign
exchange was equivalent to providing import protection of 131 percent. Be-
cause the majority of Latin American and Asian countries have had average
tariff rates of between 20 and 40 percent, the system of foreign exchange
surrender meant that Poland was highly protected in early 1989.

Varying the Retention Ratio and Trade Distortions

No implicit net subsidies to imports; existing subsidies to exports. I first
assume that the average 12.1 percent export subsidy remains in place and there
are no net subsidies to imports. That is, I assume that the implicit subsidy to
imports from price controls is 8.1 percent, which exactly offsets the 8.1 percent
import tariff. In table 2, welfare estimates and the exchange rates vary with
alternate retention ratios under these assumptions. The greatest welfare in-
crease occurs at a retention ratio of 85 percent; at ratios greater than that, the
cost of foreign exchange supplied is greater than the benefits, because of the
export subsidy.

The Polish government increased retention rates by about 5 percent between
1985 and 1989. The first column in table 2 shows the costs of a 5 percent
duction of retention ratios from the 30 percent base. Thus the absolute value
of the welfare changes shown there could be interpreted as the benefits Poland
has gained from its policy of increasing the retention ratio in the four years
before 1989.

Implicit net subsidies to imports of 5 or 20 percent; existing export subsidies
retained. As shown in tables 3 and 4, with implicit net import subsidies of 5
and 20 percent, the optimal retention ratios (which yield the maximum gain in
welfare) are reduced to 79 and 60 percent, and the benefits to the economy of
full retention are reduced to 7.4 and 2.6 percent of GDP, respectively. As
suggested above, given macroeconomic resource constraints, it is unlikely that
the true net import subsidy is above 5 percent. Thus, the results of tables 2 and
3 are most relevant for the Polish case.

Table 2. Simulated Effects of Different Foreign Exchange Retention Ratios
with No Implicit Import Subsidies

<table>
<thead>
<tr>
<th>Macroeconomic variable</th>
<th>Retention ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.25</td>
</tr>
<tr>
<td>Welfare changes</td>
<td></td>
</tr>
<tr>
<td>In billions of zloty</td>
<td>-1,020</td>
</tr>
<tr>
<td>As a percentage of GDP (1988)</td>
<td>-3.6</td>
</tr>
<tr>
<td>Shadow exchange rate</td>
<td>1,847</td>
</tr>
<tr>
<td>Equilibrium parallel exchange rate</td>
<td>3,089</td>
</tr>
</tbody>
</table>

Note: Assumes 12.1 percent export subsidy and initial retention ratio of 30 percent.
Source: Author's calculations, based on data sources described in the appendix.
Table 3. Simulated Effects of Different Foreign Exchange Retention Ratios with 5 Percent Implicit Import Subsidies

<table>
<thead>
<tr>
<th>Macroeconomic variable</th>
<th>Retention ratio</th>
<th>0.25</th>
<th>0.5</th>
<th>0.75</th>
<th>0.79</th>
<th>1.0</th>
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<tbody>
<tr>
<td>Welfare changes</td>
<td>In billions of zloty</td>
<td>926</td>
<td>1,754</td>
<td>2,204</td>
<td>2,209</td>
<td>2,106</td>
</tr>
<tr>
<td></td>
<td>As a percentage of GDP (1988)</td>
<td>-3.3</td>
<td>6.2</td>
<td>7.8</td>
<td>7.8</td>
<td>7.4</td>
</tr>
<tr>
<td>Shadow exchange rate</td>
<td>1,819</td>
<td>1,819</td>
<td>1,819</td>
<td>1,819</td>
<td>1,819</td>
<td></td>
</tr>
<tr>
<td>Equilibrium parallel exchange rate</td>
<td>3,089</td>
<td>2,361</td>
<td>1,958</td>
<td>1,910</td>
<td>1,702</td>
<td></td>
</tr>
</tbody>
</table>

Note: Assumes 12.1 percent export subsidy and initial retention ratio of 30 percent.
Source: Author’s calculations, based on data sources described in the appendix.

Implicit net subsidies to imports of 50 percent; existing export subsidies retained. Under this simulation (not shown), any retention ratio in excess of 32 percent has a negative impact on welfare. The optimum retention ratio is about a 2 percent increase from the assumed existing retention ratio, to 32 percent. Thus, if existing implicit import subsidies are this high, the import incentives are so great that a liberalization of the foreign exchange regime almost immediately becomes counterproductive.

No net subsidies to imports or subsidies to exports. In this experiment, initially, export subsidies are removed and net subsidies to imports are set at zero; subsequently the effects of different retention ratios are simulated and reported. Because liberalization of the other trade distortions occurs first, increasing the retention ratio is unambiguously beneficial (table 5). The most striking result is that a reduction of 5 percent in the retention ratio (to 25 percent) results in a loss of 9.1 percent of GDP, which is considerably greater than the losses from a reduction in the retention ratio to 25 percent in the previous simulations. This occurs because at the initial equilibrium (given the 30 percent retention ratio) there is already too little foreign exchange supplied. Reduction of the export subsidies in addition to the reduction in the retention ratio further reduces foreign exchange supplied, exacerbating losses.

Table 4. Simulated Effects of Different Foreign Exchange Retention Ratios with 20 Percent Implicit Import Subsidies

<table>
<thead>
<tr>
<th>Macroeconomic variable</th>
<th>Retention ratio</th>
<th>0.25</th>
<th>0.5</th>
<th>0.6</th>
<th>0.7</th>
<th>1.0</th>
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<tbody>
<tr>
<td>Welfare changes</td>
<td>In billions of zloty</td>
<td>-645</td>
<td>1,048</td>
<td>1,137</td>
<td>1,106</td>
<td>730</td>
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<tr>
<td></td>
<td>As a percentage of GDP (1988)</td>
<td>-2.3</td>
<td>3.7</td>
<td>4.0</td>
<td>3.9</td>
<td>2.6</td>
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<tr>
<td>Shadow exchange rate</td>
<td>1,720</td>
<td>1,720</td>
<td>1,720</td>
<td>1,720</td>
<td>1,720</td>
<td></td>
</tr>
<tr>
<td>Equilibrium parallel exchange rate</td>
<td>3,089</td>
<td>2,362</td>
<td>2,175</td>
<td>2,024</td>
<td>1,701</td>
<td></td>
</tr>
</tbody>
</table>

Note: Assumes 12.1 percent export subsidy and initial retention ratio of 30 percent.
Source: Author’s calculations, based on data sources described in the appendix.
Table 5. Simulated Effects of Foreign Exchange Restraints, Export Subsidies, and Implicit Import Subsidies

<table>
<thead>
<tr>
<th>Macroeconomic variable</th>
<th>Retention ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.25</td>
</tr>
<tr>
<td>Welfare changes</td>
<td></td>
</tr>
<tr>
<td>In billions of zloty</td>
<td>-2,584</td>
</tr>
<tr>
<td>As a percentage of GDP (1988)</td>
<td>-9.1</td>
</tr>
<tr>
<td>Shadow exchange rate</td>
<td>1,819</td>
</tr>
<tr>
<td>Equilibrium parallel exchange rate</td>
<td>3,198</td>
</tr>
</tbody>
</table>

Note: Initial 12.1 percent export subsidies and 5 percent implicit net import subsidies are reduced to zero, and the initial retention ratio is 30 percent.

Source: Author’s calculations, based on data sources described in the appendix.

IV. LIMITATIONS OF THE ANALYSIS

There are two weaknesses in the methodology used here that should be noted. First, the model does not account for the demand or supply of dollars created by asset accumulation. People may wish to hold dollars as an asset, not as a means to purchase imports, especially during periods of domestic inflation. In the short run, these financial reasons may dominate the trade-related factors emphasized above. In the long run, however, people will not continue to acquire dollars as an asset, without those dollars entering the market for goods and services. Moreover, elasticities of trade-driven foreign exchange supply and demand are greater in the long than the short run, and should dominate in a longer time frame. As Caves and Jones (1985, p. 361) have stated: “We can hardly imagine commodity markets running permanently out of equilibrium with unexploited opportunities to arbitrage goods from one country to another. . . . Therefore we expect that financial forces will determine the exchange rate in the short run following any disturbance to equilibrium, but trade flows must dominate the long run result.” Thus this model appears to be a reasonable representation of the factors which influence the exchange rate in the long run.

Second, the supply of and demand for dollars here is derived from the supply of exports and demand for imports. These underlying demand and supply schedules are dependent on domestic prices, including factor market prices. To the extent that the underlying prices are distorted, the demand and supply schedules may not represent the marginal social costs or benefits of the goods. In that case, the supply and demand for dollars similarly may not represent society’s valuation of the benefits or costs of an additional dollar. This implies that our measure of welfare is subject to error.

In a related paper (Tarr 1989, available upon written request), a model is constructed in which the price of foreign exchange differs from the marginal social benefits and costs. Those differences are characterized by random variables which may be interpreted as reflecting measurement error from all the sources of uncertainty, but most notably from uncertainty about the difference.
between the price of foreign exchange and marginal social benefits and costs. The paper shows that the variance of the net benefits of a foreign exchange retention policy increases as the retention ratio increases. Consequently, the risk-averse decisionmaker will desire a lower foreign exchange retention ratio than either a decisionmaker who is risk-neutral or a decisionmaker who operates under less uncertainty as a result of less distortion in the underlying supply and demand curves. The qualitative impact of risk aversion under uncertainty is the same as the effect of export subsidies: a further departure from 100 percent retention of foreign exchange is optimal.

V. Conclusions

Using the model outlined above in an application to Poland in 1989, changes in welfare have been related to the share of foreign exchange earnings retained by exporters given various foreign exchange elasticities, degrees of overvaluation, and trade subsidy levels. On the basis of the results of the various simulations (tables 2-4), the change in welfare (as a percentage of GDP) is graphed against the foreign exchange retention ratio in figure 3. All curves have the export subsidy at its level in March 1989, and different levels of implicit import subsidies assumed in the initial equilibrium. The higher curves are associated with an assumed lower initial level of trade distortions. The subsidies to exports and implicit subsidies to imports (t) represent offsetting distortions to the foreign exchange restrictions. Less than 100 percent retention of foreign exchange discourages exports and imports, but the net effect of the other trade distortions is to encourage exports and imports. Thus foreign exchange liberalization produces greater benefits the lower are other trade distortions in the initial equilibrium. Without reduction of the other trade distortions, increasing foreign exchange retention ratios beyond 65–85 percent will reduce welfare. Other trade distortions must be reduced if retention ratios of less than 85 percent are to produce additional benefits. These are “second-best” experiments that simulate the effects of changing the foreign exchange restrictions, given the presence of other distortions to the trade regime.

First-best policies are then simulated, assuming first the best estimate of the March 1989 level of trade distortions, then simulating their elimination and increases in foreign exchange retention ratios (table 5). Figure 4 shows increased benefits up to 100 percent retention of foreign exchange, which yields benefits equivalent to 7.8 percent of GDP. This is the estimated benefit from more efficient allocation of foreign exchange; reducing other distortions, such as domestic price controls, will produce a more efficient allocation of domestic resources and yield additional benefits that are not estimated by this model.

In the application to Poland, less than full retention of foreign exchange is estimated to be equivalent to either a net export tax of 51.5 percent or an import tariff of 131 percent.
Figure 3. Simulated Welfare Effects of Foreign Exchange Retention Ratios under Differing Trade Policies

Note: $s$ = rate of subsidy as a percentage of export value; $t$ = net policy (dis)incentive to imports as the difference between tariffs and the implicit subsidy equivalent resulting from price controls on domestic substitutes.

Figure 4. Simulated Welfare Effects of Foreign Exchange Retention Ratios Given Liberalization of Trade Policy

Note: $s$ = rate of subsidy as a percentage of export value; $t$ = net policy (dis)incentive to imports as the difference between tariffs and the implicit subsidy equivalent resulting from price controls on domestic substitutes.
APPENDIX. THE DATA, ASSUMPTIONS, AND PARAMETER ESTIMATES

The official exchange rate was slightly less than 550 during early March 1989, and the parallel rate was 2,900 at that time. The retention rate is taken to be 30 percent. Without loss of generality, indexes were chosen so that relative prices between Poland and the rest of the world are initially unity. Thus, the nominal exchange rates are initially identical to the real rates, but as relative prices change over time, the nominal and real exchange rates will differ.

The subsidy rate to exports has two parts: fiscal incentives and the price equalization payments. Fiscal subsidies in 1988 were 7.1 percent of the value of exports. Data on subsidies and tariffs are taken from UNDP / World Bank (1989). Some enterprises were taxed on exports and some were subsidized, but on balance in 1987 the price equalization payments created an 8.2 percent subsidy to exports to hard currency areas. In an efficiency enhancing reform, payments to exporters under the price equalization fund were reduced over time, so that we take 5 percent as the price equalization subsidy in 1989. This yields a 12.1 percent subsidy from fiscal subsidies and price equalization payments.

Net customs duties were 4.1 percent in 1987. In addition, through the operation of the price equalization account, firms paid varying import taxes, but on balance additional import taxes of 5.9 percent were collected in 1987. As above, the import taxes under the price equalization account are assumed to be lower (4 percent) as a result of the reforms, so that in aggregate we take import duties to be 8.1 percent in 1989. There is an opposite bias on imports deriving from the price controls, however, which appears to be at least as strong as the tariff.

The supply of foreign exchange is derived from data on the balance of payments in convertible currencies in 1988. The sources of foreign exchange in the current account were merchandise exports ($7.248 billion), private remittances ($1.433 billion), and sales of services ($0.963 billion), for a total supply of foreign exchange in the initial equilibrium of $9.644 billion. The demand for foreign exchange is based on merchandise imports ($6.307 billion), nonfactor services ($0.544 billion), and debt payments which are derived as the difference between foreign exchange supply and merchandise and service import demand so that foreign exchange demand and supply is equilibrated. There is also a supply and demand for foreign exchange deriving from capital movements and government import programs, respectively. The effects of moving to greater retention of foreign exchange are completely independent of the initial value of foreign exchange supplied or demanded. The additional foreign exchange generated simply shifts the supply and demand curves out to the right, but it does not affect variables otherwise influenced by policy shifts. This is the one parameter in the model that does not affect the results. Thus the supply of foreign exchange deriving from capital movements is ignored.
The final parameters required are the elasticities of supply and demand with respect to the real exchange rate. Two estimates of the supply elasticity are available: an elasticity of 0.2, from annual data for three years ending in 1987, (UNDP / World Bank 1989) and, from monthly export data between December 1985 and December 1987, 1.16 during the first sixteen months and 0.19 during the last nine months (Marczewski 1988). Because the model here is long-run and elasticities are larger in the long run than the short run, and because recent institutional changes allow increased price response of exports, 1.16 is used as the best (high) estimate, but results for a low-elasticity estimate of 0.3 are also calculated.

There is less information available on the elasticity of demand, but the results are estimated for a range of elasticities from 1.0 to 0.3, comparable to the supply elasticities.

I solve for the unknown parameters in equations 1–4 (a, b, c, and d). Given the value of the supply and demand elasticities, I first determine the value of \( b \) in equation 1 and \( d \) in equation 3. Given the values of \( b \) and \( d \), I solve equations 1–3 for the unknown parameters \( a \) and \( c \). Given the values of these parameters, other parameters in the model are then changed to simulate policy experiments.

References


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