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China's Trade Flows: Changing Price Sensitivities and the Reform Process

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Abstract

Over the past 20 years, the Chinese authorities have undertaken wide-ranging reforms of their exchange and trade systems that have steadily reduced the role of planning and increased the importance of market forces. As these reforms have taken root, relative prices and domestic and foreign demand would be expected to have played a bigger role in determining trade flows. Econometric estimates of export and import equations provide evidence that trade flows have indeed become increasingly price sensitive, owing to the gradual liberalization of the trade regime over time, and to the growing shares of foreign-funded enterprises and manufactures in total trade.

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I. INTRODUCTION

Since the start of the reform program in 1978, China's economy has become substantially more open, with the share of merchandise trade in GDP more than tripling from 10 percent to 36 percent in 1997. To a great extent, this has been due to the steady liberalization of the foreign trade system. In 1979, foreign trade was carried out entirely through a central plan implemented through 12 foreign trade corporations (FTCs) using an administratively determined exchange rate, and with relative prices playing little or no role in decision making. By 1994, mandatory planning for exports and imports had been eliminated, and the prices of exports and imports were based on market forces. While the trade system—especially for imports—remains relatively restrictive in nature, the role of market forces has been greatly increased.

The main reforms in the foreign trade system, described in more detail in the next section, took place in three broad stages:

- From **1984–85**, the role of the trade plan was significantly reduced, especially for imports. Local governments—and from 1985, exporting enterprises—were allowed to retain a proportion of foreign exchange receipts, which they could sell or use for imports.

- From **1988**, mandatory export planning was sharply reduced (and eliminated by 1991); the import plan was also scaled down, but to a lesser extent. Retention quotas were increased, and all enterprises eligible to retain foreign exchange were allowed to sell it at Foreign Exchange Adjustment Centers (FEAC) at a more depreciated market determined rate (the "swap" rate).[2]

- In **1994** mandatory planning for imports was eliminated, and licensing requirements and quotas were reduced. The exchange rate was unified at the prevailing swap rate (implying an effective devaluation of about 7 percent (Chart 3)), and the retention quota system was abolished.

- In addition to trade and exchange rate reforms, the opening up of the economy to foreign direct investment (FDI) flows has been an important component of external sector reforms. There was a marked shift in China's foreign investment policies in the second half of the 1980s.[3] Consequently, FDI inflows increased to over $4 billion by 1991. Since 1992 there has been further liberalization and a rapid proliferation of open

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[2]FEACs were set up in late 1986, but originally only for FFEs and a few domestic enterprises.

[3]Special tax incentives were introduced to encourage foreign investment in more technology intensive industries.

economic zones, typically without approval from the central government. By 1997, net FDI inflows rose to over $40 billion.

The initial impact of the reforms was felt primarily on the import side as trade liberalization was accompanied by increased availability of foreign exchange for imports. With the introduction of the reform measures, imports surged by around 60 percent in 1985 (Chart 1); the resulting deterioration in the trade balance then led the government to apply stricter trade controls. Import volumes rebounded in 1988, but with the increase in domestic prices to international levels under the 1988 reforms, import volumes slowed sharply, recovering from 1991 onwards.

Export growth accelerated from the second half of the 1980s, reflecting the impact of the 1988 reforms (Chart 1). The abolition of export subsidies and mandatory export planning in 1991 led to increased competition among FTCs and better prices for export suppliers. In addition to the 1991 reforms, the unification of the exchange rate in 1994 also led to a sharp increase in export volumes. Indeed, export volumes rose by an average of 20 percent in the period 1994–97, compared to an average growth rate of about 8 percent for imports.

The growth in exports can also be linked to the rapid growth of FFEs in the mid–1980s resulting from the opening up of the economy. The share of FFEs in trade increased from less than 2 percent prior to 1984 to around 41 percent of exports and 57 percent of imports in 1997 (Chart 2 and Table 1).

The composition of trade also saw substantial changes over this period. In particular, the share of manufacturing goods in exports rose steadily, from around one half in the mid–1980s to 87 percent in 1997 (Chart 2). This shift is likely to have increased the price elasticity of exports.[4]

In summary, both the liberalization of the trade and exchange system and the rapid growth of the FFEs—which were also subject to much more liberal trade and exchange regulations than domestic enterprises—can be expected to have made exports and imports significantly more sensitive to market signals over the last two decades. This will, of course, have been reinforced by China's domestic reforms, including the liberalization of domestic prices, the steady growth in the role of the collectives and private enterprises, and—particularly in most recent years—growing efforts to reform the SOEs and the banking system.[5]

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[4]Bayoumi (1996) states that manufactured goods have slightly higher price elasticities than primary goods.

[5]See, for example, Tseng and others (1994) for a discussion of China's domestic reform efforts.

The rest of the paper is divided into four sections. Section II describes in more detail the evolution of trade reforms. We then turn to the empirical estimates, to see if the hypothesis of a shift in the price elasticity of trade can be supported by the data. Section III discusses the specification and estimation of the reduced form export and import equations. Section IV provides an overview of the econometric results, and Section V concludes.

II. Foreign Trade Reform in China, 1978–97

At the start of the reforms in 1978, the role of planning in China's foreign trade was to ensure that sufficient foreign exchange was generated through exports to meet the country's import requirements. Almost all trade was carried out through 12 foreign trade corporations (FTCs) which were responsible for implementing the central plan. Exporters supplied targeted quantities to the FTCs for export and all foreign exchange receipts were surrendered to the central bank at the official exchange rate. Under the plan, each province was assigned contractually determined foreign exchange targets which, in turn were disaggregated and allotted as targets to the provincial trading companies. The import plan identified imports of key food, raw materials, and intermediate goods to fill the gap between domestic production and demand.

The FTCs were often not free to determine the goods that were exported or the procurement price. Consequently, export losses occurred when they were required to purchase certain goods such as electronics or machinery a relatively high prices and sell them on the international market at lower prices. Moreover, since imports were largely to fill a demand gap, the FTCs often had to purchase imports at international market prices but sell them at subsidized domestic prices, incurring substantial losses.[6] Therefore, we would expect relative prices to have little, if any, impact on export and import volumes at the start of the reform process.

The 1984–85 reforms

In 1984, the authorities took three major reform measures toward liberalizing the foreign trade regime, but these reforms are likely to have had a greater impact on the responsiveness of import volumes than that of export volumes to changes in relative prices. First, the reduction in the role of the trade plan was greater for imports than for exports. Second, the government began to decentralize administration of foreign exchange, leading to greater availability of foreign exchange for imports. Third, the monopolistic position of most FTCs was abolished, and the foreign trade system was decentralized by allowing branches of the FTCs to become independent operating entities. In addition, FTCs were allowed to operate as agents of the enterprises. This meant that the FTCs would charge a fee for their services, but would not absorb profits or losses on goods traded.

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[6] In 1986, these losses amounted to about 2 percent of China's GNP.

Under the 1984 reforms, about 60 percent of exports fell under a mandatory plan, an additional 20 percent were assigned as value targets to the provinces, and the remainder were nonplan exports.[7] For mandatory exports, the procurement price by the FTCs was fixed and target quantities were assigned to the producing enterprises. For nonmandatory exports, procurement prices by the FTCs depended on how the provinces decided to meet the value targets and on the negotiating position of producing firms vis-à-vis the procuring FTC. The agency system, under which FTCs acted as agents of the enterprises, was much more prevalent for imports than for exports. Given the large share of mandatory exports, most export transactions were routed through designated FTCs so that it is likely that even with these reforms, there was no close systematic relationship between relative prices and export volumes.

The reduction in the role of the import plan was coupled with increased availability of foreign exchange for nonmandatory imports. In early 1984, local governments were granted the right to retain a share of the foreign exchange earned in their region and, by early 1985, this was extended to exporting enterprises. Under this system of retention quotas, local authorities and enterprises had the right to purchase 25 percent of their export earnings at the prevailing exchange rate.[8] In the reforms in 1988 and 1991, the retention quotas were increased significantly.

Another step in the increased availability of foreign exchange came in late 1986 with the establishment of the FEACs. In the FEACs, enterprises were allowed to buy and sell foreign exchange at a depreciated rate known as the swap rate. They could also trade retention quotas which could be used to acquire foreign exchange at the official rate for nonplan imports.

Following the 1984 trade reform, importers could choose any FTC for procuring nonmandatory imports and pay the import price and the FTCs costs. With the decentralization of the foreign trade system, the number of FTCs rose sharply and the agency system became widespread for nonmandatory imports. The increasing share of imports channeled through the agency system meant that changes in international market prices and exchange rates would flow directly to consumers, rather than being absorbed by the FTCs. In addition, the reduction in import goods covered by the mandatory and foreign exchange plan would imply that a greater share of imports would be more sensitive to the price of foreign exchange. By 1991, it is estimated that nonplan, nonpriority imports had increased from about 30 percent in 1986 to about 50 percent of total imports.

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[7]The value targets were often converted into mandatory export plans with fixed quantities and prices in the provinces.

[8]These shares, however, varied between enterprises and provinces.

The reform in 1984 was followed by a sharp increase in the value of imports by over 50 percent in 1985 (on a year-on-year basis), while exports remained stagnant. The surge in imports may have been due, in part, to the increased availability of foreign exchange for imports at the depreciated official rate through the retention quotas. The sharp deterioration in the trade balance led the government to apply stricter trade controls. Credit was tightened and import bans, quotas, and licenses were used to restrict imports. Consequently, import growth declined sharply in 1986 and 1987.

The 1988 and 1991 reforms

The authorities undertook additional wide ranging reforms in 1988. These are likely to have made export volumes more responsive to changes in relative prices. These included an increase in retention quotas, increased access to the FEACs, and a reduction in goods covered by the mandatory export plan by about 30 percent. Under the 1991 reform, the mandatory export plan as well as fiscal subsidies for exports was abolished.

In order to encourage exports, retention quotas were increased for enterprises that exceeded their targets and for priority sectors. The retention rate was also raised for higher domestic value-added products. For instance, it was raised to 100 percent for home electronics and 60 percent for garments. The retained foreign exchange however, did not accrue solely to the producing enterprise, but was distributed between it and the FTC handling the export transaction. As before, the share varied from region to region and depended on the nature of the good.

The increase in retention quotas was coupled with an increase in the number of FEACs as well as liberalization of access to these centers. As a result, all enterprises with retention quotas, including state-owned and collectively owned enterprises, became eligible to access the FEACs at the depreciated swap rate (previously, access to the FEACs had been limited to FFEs). This meant that the effective exchange rate received by the exporter was a weighted average of the official exchange rate and the "swap" rate, with the weights being determined by the size of the foreign exchange retention ratio. Losses on mandatory exports were subsidized by the central government until the abolition of export subsidies in 1991. However, even in 1988, the government took steps to limit the impact of losses of the FTCs on the central government budget. Targets were specified on the amount of foreign exchange earnings, the amount to be remitted to the central government and the level of subsidies that the central government would provide to cover export losses.

The 1988 reforms were a major step in increasing the responsiveness of exports to relative prices and export volume growth did increase to about 13 percent in 1988 from an average of 7 percent in the prior five years. However, the increase in the retention quota may not itself have provided significant export incentives, unless the FTCs passed on these benefits to the enterprises through higher prices. With the abolition of export subsidies in 1991 and the mandatory export plan, there was greater competition among the FTCs in purchasing products

from enterprises and better prices for export suppliers. Export volumes rose by about 16 percent in 1991 relative to 7 ½ percent the previous year.

The scaling-down of the import plan was accompanied by a gradual increase in domestic prices to international levels in order to limit the impact of FTC losses on the central government budget. In 1989 and 1990, domestic prices of steel, nonferrous metals and several other products were raised to international levels. In 1991, there was a further reduction in subsidies for imported food grains and vegetable oils. The increase in prices of imported goods in line with international prices is likely to have increased the responsiveness of import volumes to changes in relative prices.

The 1994 reforms

In January 1994, the exchange rate was unified at the prevailing swap-market rate, which led to a depreciation of the official exchange rate of about 50 percent. The retention quota system was also abolished, and there was a change in the tax system regarding the treatment of exports under the VAT. Zero rating for exports was introduced for domestic firms and newly established FFEs, which meant that exporters could claim a refund of the VAT paid on inputs. The reform of the exchange system and the change in the tax policy led to a strong pickup in exports, particularly for domestic enterprises in 1994. As mentioned before, domestic enterprises had faced an exchange rate which was a weighted average of the official exchange rate and the depreciated swap rate. However, FFEs were not subject to the retention quota and were allowed to retain the full amount of their export earnings. The unification of the exchange rate therefore had a greater effect on export performance of the nonFFEs, contributing to a trade surplus for this sector.

For imports, mandatory import planning was eliminated, and licensing requirements and quotas were reduced. Tariff rates were lowered for a small set of products and nontariff barriers were also reduced.[9] In 1996, there were further cuts in import tariffs, some reduction in nontariff barriers and a planned phasing of import duty restrictions by June 30, 1998.

FDI policies

In addition to changes in the trade and exchange rate regime, China's open door policy toward FDI has been an important component of external sector reform. The first phase of FDI flows was during 1979–85 in which the focus of the policy was to attract foreign investment in natural resource development and the export sector. However, FDI flows remained quite weak during 1979–83 owing to lack of appropriate labor skills and infrastructure. There was a marked shift in China's foreign investment policies in the second half of the 1980s, leading to a pick up in FDI flows (Table 1). Special tax incentives were introduced to encourage foreign investment in more technology intensive industries. Firms

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[9]See SM/96/67, Table 17, page 52 for tariff rates.

operating in the SEZs had fewer restrictions on domestic and external trade, more generous tariff and tax concessions than elsewhere, more flexible labor relations and liberal land use rights, lower income tax rates and tax holidays. In addition, wholly foreign owned firms were allowed outside the SEZs, and FFEs were granted limited access to the domestic market. Moreover, measures were introduced to facilitate FFE operations, including introduction of the foreign exchange swap market. Consequently, FDI inflows increased to over $4 billion by 1991.

Since 1992, there has been further liberalization and a rapid proliferation of open economic zones, typically without approval from the central government, and net FDI inflows rose to over $40 billion in 1997.

III. Methodology and Data

In order to examine how far the hypothesis of increasing price sensitivity can be supported by the data, this section sets out a theoretical framework for China's export and import behavior, and discusses some data issues. The framework forms the basis for the estimations, which are presented in the subsequent section.

Export equation

A reduced form export equation was derived in order to avoid simultaneous equation bias that may result from estimating the export demand or supply function alone.[10] The reduced form equation yields an estimate of the elasticity of trade volumes with respect to changes in the real effective exchange rate (REER).[11] The export demand function posits that the volume of exports depends on the relative price of exports and a measure of a scale variable influencing world demand for China's exports. Equation (1) shows demand for China's exports as a function of its relative price, defined as the ratio of China's export price to the foreign price level, and a scale variable. Although the traditional scale variable is real income or expenditure, quarterly data on these variables for China's trading partners was not available. Therefore, a volume index of imports of China's trading partners weighted by their share in China's exports was used as a proxy for the scale variable, real world income.[12] [13] In

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[10]The detailed discussion of the derivation is provided in Appendix I. See also, Goldstein and Khan (1988).

[11]All variables are in logs and seasonally adjusted.

[12]This proxy may impart a positive bias to the parameter estimate since the dependent variable is a subset of the regressor. However, the bias is considered to be negligible since China's share in imports of its trading partners is very small. China's share of imports to the United States, the largest of China's trading partners, averaged around 5 percent over the 1988–97

(continued...)

addition, this variable may also capture the effect of changes in other factors such as general trade policies of China's trading partners which would affect their import behavior.

$$\ln (X^d_t) = a_0 + a_1 \ln [(P_x(Y)_t / E_t)/(P_{xw}(\$)_t] + a_2 \ln (Y_{wt}) \quad (1)$$

where

X_t : export volume, with super-scripts "d", and "s" (used later) denoting demand and supply, respectively

$P_x(Y)_t$: price of Chinese exports in yuan

E_t : nominal exchange rate, yuans per U.S. dollar (Y/$)

$P_{xw}(\$)_t$: price of alternative goods as measured by the foreign price level

Y_{wt} : world real income, proxied by a volume index of total imports by China's major trading partners weighted by their share in China's imports

An increase in relative prices would be expected to lead to a decrease in export demand; export demand is expected to increase as the world's real income rises.

The supply of exports (equation (2)) is specified as a function of the ratio of export prices to domestic prices for alternative goods (proxied by a retail price index), and a variable related to the capacity of the economy to produce for the export market. An increase in export prices relative to domestic prices is assumed to increase the quantity of exports supplied. Variables, such as industrial production or measures of infrastructure, that gauge the ability of enterprises to supply products to the export market would be expected to have a positive relationship with export supply.

$$\ln (X^s_t) = b_0 + b_1 \ln (P_x(Y)_t / RPI_t) + b_2 \ln (ID_t) \quad (2)$$

where

RPI_t : Yuan-based retail price index for China

ID_t : an index of domestic production capacity

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[12](...continued)
sample period.

[13]The terms "world import index" and "real world income" will be used interchangeably.

Assuming that the actual level of exports represents an equilibrium condition, the reduced form equation that is given in equation (3) posits that export volumes are a function of the REER, the world's real income, and a variable measuring export production capacity.[14] An appreciation of the REER should be associated with a decline in export volumes.[15] The expected signs on the coefficients of the other variables are both positive.

$$\ln (X_t) = c_0 + c_1 \ln (REER_t) + c_2 \ln (Y_{wt}) + c_3 \ln (ID_t) \quad (3)$$

Import equation

China's import demand is specified as a function of the price of China's imports relative to prices of alternative goods (proxied by China's retail price index), and activity variables such as real GDP or industrial output. It has been argued, however, that in many developing countries, foreign exchange reserves or earnings should be used as an explanatory variable to take into account government policy which may influence the level of imports in the presence of foreign exchange constraints.[16] Thus, changes in relative prices and activity have an indirect effect on imports through changes in foreign exchange earnings. In the presence of these policy constraints, import demand can be viewed as an import decision-making rule of the authorities. Therefore, import demand can be written as a function of the relative price, domestic real activity, and the availability of foreign exchange.

$$\ln (M^d_t) = a_0 + a_1 \ln [(E_t (P_m(\$)_t) / RPI_t)] + a_2 \ln (Y_{dt}) + a_3 \ln (r_t) \quad (4)$$

where

M_t : import volume

$P_m(\$)_t$: U.S. dollar-based price index for China's imports (determined in the world market)

Y_{dt} : a measure of domestic real activity

r_t : a measure of the availability of foreign exchange

An increase in the relative price would be expected to lead to a decline in the quantity of imports demanded. Both buoyant domestic activity and a relaxation of foreign exchange constraints would likely increase the quantity of imports demanded.

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[14]Appendix I provides a derivation of the reduced form equation.

[15]An increase in the REER represents an appreciation.

[16] Hemphill (1974), Saracoglu and Zaidi (1986), and Moran (1989).

Import supply depends on the price of Chinese imports relative to prices of alternative products in foreign markets and a variable related to the capacity of the world to supply imports.

$$\ln (M^s_t) = b_0 + b_1 \ln (P_m(\$)_t/P_{mw}(\$)_t) + b_2 \ln (WS_t) \quad (5)$$

where

$P_{mw}(\$)_t$: U.S. dollar-based price index for products competing with Chinese imports in the world market

WS_t : World supply capacity index for China's imports

The quantity of imports supplied would likely increase following a rise in the relative price of Chinese imports and a rise in world production capacity.

Assuming an equilibrium condition, import demand and supply equations can be combined to derive a reduced form equation that expresses import volumes as a function of the REER, domestic real activity, foreign exchange availability, and international supply factors. Equation (6) below says that import volumes are positively related to the REER and the other variables.

$$\ln (M_t) = c_0 + c_1 \ln (REER_t) + c_2 \ln (Y_t) + c_3 \ln (r_t) + c_4 \ln (WS_t) \quad (6)$$

IV. Estimation Results

This section presents results of the estimated export and import equations for 1983–97, the period for which data were available. The sources of data and adjustments made to the REER are discussed in Appendix II. With regard to the export equation, industrial production was found to be insignificant in early estimation attempts and was dropped from the equation. However, the output gap (defined as the difference between actual and potential output)[17] was included in the short-run equation to capture the cyclical influence of productive capacity utilization. The literature also suggests using FDI as an explanatory variable to capture the linkage to export-oriented enterprises, but FDI was insignificant in preliminary regressions and was subsequently dropped.[18] In the import regressions, proxies for

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[17]Potential output was estimated by applying a Hodrick-Prescott filter to the industrial output data.

[18]The insignificance of FDI inflows is probably due to the fact that, although the establishment of the special economic zones (SEZs) and the subsequent inflows boosted exports, the inflows primarily finance imports of capital and intermediate goods, and therefore only indirectly

(continued...)

international supply and domestic real activity were also found to be insignificant or of the wrong sign; these variables were therefore excluded from estimations. As in the export regressions, the output gap was again used in the short-run equation to capture cyclical demand pressures that could lead to higher import demand.

Augmented Dickey-Fuller tests indicated that export and import volumes, as well as most of the explanatory variables used in the regressions—the real effective exchange rate, world imports and FDI inflows were nonstationary (Table 2). Therefore, long-run cointegrating equations for exports and imports were estimated. These results are presented in Tables 4 and 5, and fitted values of the error correction model are shown in Chart 4.

Given the changes in China's trade policy in 1985 and 1988, Chow tests for structural breaks were performed (Table 3) to examine whether these reforms had changed the relationship between trade volumes and the explanatory variables. The evidence strongly indicated structural change; therefore the trade equations were estimated over different sample periods.

In order to shed light on the manufacturing exports and imports, regressions were also run for these subsets of trading activities, which are also shown in Tables 4 and 5.

Exports

Export regression estimates for both the long-run cointegration and short-run relationships over the full sample period (1983–97) give statistically insignificant price elasticities (Table 4). This result could be due to the export behavior of the SOEs, which accounted for virtually all exports during the period 1983–87, and which may have been influenced by nonprice export incentives. Since the majority of exports during this period were either mandatory or converted into mandatory quantity targets by the provincial authorities, there is unlikely to have been a close relationship between relative prices and export volumes.[19]

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[18](...continued)
increase exports.

[19]Brender (1992) estimated export supply equations for China using quarterly data from 1981 to 1990 and found export volumes to be inversely related to the supply price, so that an increase in export unit values would lead to a reduction in the volume of exports. This perverse supply response, which was evident both for total non-oil exports as well as at a more disaggregated commodity level, was attributed to the pervasiveness of export value quotas. A decline in export unit values would imply that SOEs were required to export larger quantities to achieve their value quota.

Since the Chow tests strongly indicate a structural break due to the 1988 reforms, the export equation was estimated over the period 1988–97. Table 4 shows that the relative price elasticity for China's exports was about -0.3 and the income elasticity was about 2, both correctly signed and statistically significant, indicating clear shifts in these parameters. The shifts can be attributed mainly to the greater role allowed to the exchange rate through the foreign exchange adjustment centers in 1988 and the increase in retention quotas.[20] The results also show that manufacturing exports during 1988–97 are more responsive to both changes in the REER (an elasticity of -0.9) and world demand (income elasticity of 2.8).

Separate estimations for exports by the FFEs and domestically owned enterprises (DOEs) using OLS are reported in Table 6. Given the small sample size (annual data from 1983 to 1997), the regression results need to be treated with caution. However, the estimation results suggest differences in export behavior of the FFEs and DOEs. For the FFEs, the price elasticity is quite high (-1.7) and statistically significant, while for the DOEs it has the opposite sign.

The REER elasticities obtained for total and manufacturing exports are broadly comparable to those obtained in other studies. For example, the elasticity with respect to the REER for total exports is close to Reinhart's (1995) estimate of about -0.4 for industrial country demand for developing country exports from Asia. With regard to manufacturing exports, the estimated elasticity with respect to the REER is slightly higher than the estimated long-run coefficient of -0.8 reported by Bayoumi (1996) for a sample of industrial and developing countries.[21]

The results also show that the volume of China's exports during 1988–97 is responsive to world real income. In all the specifications, the income elasticity was statistically significant. For total exports, the estimated income elasticity was about 2, significantly higher than the estimate of about unity obtained by Brender (1992). Again, this discrepancy between our estimate and Brender's could be due to the changing composition of China's exports toward manufactures.[22] For exports of manufactures, the coefficient for world real income is positively significant and higher. The inclusion of world real income in the short-run estimation suggests that, in the short run, exports respond much more to changes in this variable than to changes in the REER. The coefficient on output gap was negative in the regressions (although not significant), suggesting that, when industrial output was above potential, production for exports may have been constrained. Export licensing was in fact

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[20]Brender also finds that an increase in retention quotas in 1988 led to a small but positively significant supply response in 1988–90.

[21]Bayoumi's estimates were based on annual data for 1974–93.

[22]Reinhart (1995) reports income elasticity of industrial country demand for exports from developing countries in Asia of about 2.5.

quite pervasive, with one of its stated objectives to increase the domestic availability of products in short supply.[23]

Imports

As with the export regressions, the results show a shift in import behavior following the policy changes. The price elasticity indicates more market-responsive behavior in the more recent sample period compared with the longer period possibly because of the prevalence of import planning and import restrictions in the earlier years. The change in import behavior between the first two sample periods corresponds to the 1984–85 trade reform, which increased the availability of foreign exchange for nonmandatory imports, and decreased the share of goods covered by the import plan. The estimated REER elasticity for total imports is highest in the latter sample period (1988–97), suggesting that the sensitivity of import volumes to changes in the REER appears to have increased over time with further reforms. Estimation results for manufacturing imports, also shown in Table 5, indicate that the REER elasticity is lower than for total imports.[24]

Separate estimations for the FFEs and the DOEs (Table 6) show that REER coefficients have a perverse sign. For FFEs, the highly significant negative coefficient likely reflects that imports are inputs into export-oriented enterprises. In addition, the impact of the special provisions to the FFEs for foreign exchange transactions may not have been captured adequately by the explanatory variables.

As mentioned earlier, we would expect import demand to be constrained by the availability of foreign exchange reserves. Yuan and Kochhar's (1994) estimates for the period 1980–92 suggest that foreign exchange reserves influence the volume of imports in China with an elasticity of about 0.3. Brender (1992) estimated import functions using quarterly disaggregated data on imports for the period 1981–90 and also found that, for commodity subsamples that excluded advanced technology machinery and electronic goods, imports depended positively on foreign exchange reserves. However, in our estimations, the level of foreign exchange reserves was found to be incorrectly signed or insignificant. As Chart 5 shows, the surge in foreign exchange reserves in the early 1990s has in fact been accompanied by slower or even declining import growth in the DOEs. This suggests that imports may not be influenced by the level of foreign exchange reserves, but by import controls as the trade regime is characterized by numerous nontariff restrictions such as licensing, quotas, and restricted access to foreign exchange. Although tariff barriers have been declining, over

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[23]SM/94/71, page 36.

[24]The estimated coefficient for FDI is higher for manufacturing imports compared with total imports. Reinhart (1995) estimates that the relative price elasticity for import demand in Asia is about -0.4 and the income elasticity is about 1.4.

50 percent of China's imports in 1994 were subject to some form of nontariff barriers in an attempt to control imports.[25]

In contrast to foreign exchange reserves, FDI inflows appear to be more closely linked to imports, particularly of the FFEs . The regression results confirm that these flows are positively related to the volume of imports.[26]

Industrial production was used as a measure of real activity in the cointegrating equation. In the longer sample period, the estimated coefficient on industrial output was about 0.5, which is similar to the result by Yuan and Kochhar (1994). However, over the subsamples, as FDI inflows increase, industrial output becomes insignificant. The use of the FDI variable rather than the level of foreign exchange reserves (which was found to be insignificant) may be capturing both the demand for imports as well as the availability of financing. Since industrial output was insignificant in the shorter sample periods, it was excluded from the estimation results presented here.

The output gap was used as a measure of short-run demand pressures. When actual output is above potential, demand pressures are likely to be associated with higher imports. The results show that demand pressures lead to higher imports, although the shifts in the estimated coefficient over time indicate changes in China's import policy. The results also suggest that actual imports could have been subjected to a tightening of import restrictions. The surge in imports following the trade reform in 1984 and the deterioration in the trade balance did in fact lead to more stringent controls on imports in the subsequent years. The higher coefficients for the output gap for manufacturing imports (compared with total imports) may be due to the increased share of intermediate and capital goods imports in manufacturing imports.

V. Conclusions

Although the econometric estimates should be treated with caution, the results suggest that the responsiveness of exports and imports to the real effective exchange rate has increased over time in response to policy changes. The gradual liberalization of external trade restrictions and exchange controls, which is also reflected in the growing share of FFEs in total exports and imports, appears to have made export and import behavior more responsive to market signals. The increased responsiveness of exports over the period 1988–97 to the REER could be attributed to the establishment of the FEACs, which provided a greater role for the exchange rate. The responsiveness of import volumes to changes in the relative price

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[25]World Bank, 1994.

[26]Goldberg and Klein (1997) also show that FDI flows from Japan and the United States have a significant impact on imports for a sample of Southeast Asian countries.

was affected by policy changes both in 1984–85 and in 1988. However, imports also remain subject to some controls. The differences in the behavior of the FFEs and domestic enterprises also point to differing incentives for these two kinds of enterprises. Although considerable progress has been made toward liberalization of the external sector, the continued transition to a more market-oriented economy is likely to further increase the responsiveness of the domestic enterprises to market signals.

Derivation of the Reduced Form Trade Equations

This appendix derives reduced form equations for China's exports and imports.

Variable definition

X: Volume of Chinese exports; X with superscripts "d" and "s" are demand for exports and supply of exports, respectively.

P_x(Y): Yuan-based price index for Chinese exports

E: Exchange rate, yuans per U.S. dollar (Y/$)

P_x($): U.S. dollar-based price index for Chinese exports

P_{xw}($): U.S. dollar-based price index for products competing with Chinese exports in the world market

Y_w: Real world income (scale variable) proxied by a trade weighted import index

RPI: Yuan-based retail price index for China

ID: Chinese domestic production capacity index

M: Volume of Chinese imports; M with superscripts "d" and "s" as demand for imports and supply of imports, respectively

P_m($): U.S. dollar-based price index for China's imports in U.S. dollars

P_{mw}($): U.S. dollar-based price index for products competing with Chinese imports in the world market

Y_d: Indicator of domestic economic activity

WS: World supply capacity index for China's imports

Export equations

The structural equations for exports consist of export demand (X^d) and export supply (X^s) presented below are identical to equations (1) and (2) in the body of the text after dropping constant terms (for the ease of presentation).

Export demand (X^d)

$$lnX^d = a\ ln\left[\frac{P_x(Y)/E}{P_{xw}(\$)}\right] + c\ lnY_w \qquad \text{where a<o, c>o} \qquad \textbf{(1)}$$

Export supply (X^s)

$$lnX^s = b\ ln\left[\frac{P_x(Y)}{RPI}\right] + d\ lnID \qquad \text{where b>o, d>o} \qquad \textbf{(2)}$$

Using the fact that $P_x(Y) = P_x(\$)E$, equations (1) and (2) can be rewritten as (3) and (4), respectively.

$$lnX^d = a\ ln\ P_x(\$) - a\ ln\ P_{xw}(\$) + c\ ln\ Y_w \qquad \textbf{(3)}$$

$$lnX^s = b\ ln\ P_x(\$) + b\ ln\left[\frac{E}{RPI}\right] + d\ lnID \qquad \textbf{(4)}$$

By assuming an equilibrium condition for X^d and X^s (i.e., $X^d = X^s = X$), solve (3) and (4) simultaneously for $\ln P_x(\$)$

$$(a-b)\ lnP_x(\$) = a\ lnP_{xw}(\$) + b\ ln\left(\frac{E}{RPI}\right) - c\ lnY_w + d\ lnID \qquad \textbf{(5)}$$

$$lnP_x(\$) = \frac{a}{a-b}\ lnP_{xw}(\$) + \frac{b}{a-b}\ ln\left(\frac{E}{RPI}\right) - \frac{c}{a-b}\ lnY_w + \frac{d}{a-b}\ lnID \qquad \textbf{(6)}$$

Substitute equation (6) into equation (3) and solve for lnX.

$$lnX = \frac{a^2}{a-b}\ lnP_{xw}(\$) + \frac{ab}{a-b}\ ln\left(\frac{E}{RPI}\right) - \frac{ac}{a-b}\ lnY_w + \frac{ad}{a-b}\ lnID - a\ lnP_{xw}(\$) + c\ lnY_w \qquad \textbf{(7)}$$

$$= \left(\frac{a^2}{a-b} - a\right) lnP_{xw}(\$) + \frac{ab}{a-b}\ ln\left(\frac{E}{RPI}\right) + \left(c - \frac{ac}{a-b}\right) lnY_w + \frac{ab}{a-b}\ lnID \qquad \textbf{(8)}$$

$$= \frac{ab}{a-b}\ lnP_{xw}(\$) + \frac{ab}{a-b}\ ln\left(\frac{E}{RPI}\right) - \frac{bc}{a-b}\ lnY_w + \frac{ad}{a-b}\ lnID \qquad \textbf{(9)}$$

$$= \frac{ab}{a-b} \ln\left[\frac{P_{xw}(\$)}{RPI} E\right] - \frac{bc}{a-b} \ln Y_w + \frac{ad}{a-b} \ln ID \quad \textbf{(10)}$$

The reduced form equation with expected signs becomes:

$$\ln X = \underset{(-)}{\frac{-ab}{a-b}} \ln\left[\frac{RPI}{P_{xw}(\$)} \frac{1}{E}\right] - \underset{(+)}{\frac{bc}{a-b}} \ln Y_w + \underset{(+)}{\frac{ad}{a-b}} \ln ID \quad \textbf{(11)}$$

Import equations

The structural equations for import supply (M^s) and import demand (M^d) presented below are identical to equations (4) and (5) in body of the text (after dropping from constant terms).

$$\ln M^s = a \ln\left[\frac{P_m(\$)}{P_{mw}(\$)}\right] + c \ln WS \quad \text{where a>o, c>o} \quad \textbf{(12)}$$

$$\ln M^d = b \ln\left[\frac{P_m(\$)}{RPI} E\right] + d \ln Y_d \quad \text{where b<o, d>o} \quad \textbf{(13)}$$

By assuming an equilibrium condition for M^d and M^s (i.e., $M^d = M^s = M$), equations (12) and (13) can be solved simultaneously for lnM and $\ln P_m(\$)$. After some algebra that parallels the export equations above, the reduced form import equation becomes:

$$\ln M = \underset{(+)}{\frac{-ab}{a-b}} \ln\left[\frac{RPI}{P_{mw}(\$)} \frac{1}{E}\right] - \underset{(+)}{\frac{bc}{a-b}} \ln WS + \underset{(+)}{\frac{ad}{a-b}} \ln Y_d \quad \textbf{(14)}$$

Relative price variable:

Each of equation (11) and equation (14) contains a relative price term. By assuming that products competing with Chinese exports and products competing with Chinese imports in the world market are the same and their prices are proxied by an index of consumer prices expressed in U.S. dollars, say $P_w(\$)$, the relative price term in each equation can be expressed as $(RPI/P_w(\$)E)$, which in turn can be proxied by an index of real effective exchange rate (REER).

Data Sources and Issues

Quarterly import and export data were available from 1983 through the end of 1997 from China's Customs Statistics. Real merchandise exports (total and manufacturing) were calculated by deflating the value of exports by the world unit price of manufactures.[1] Real merchandise imports were obtained by deflating import values by a composite index of partner-country export prices.[2] This paper also looks at export and import behavior of domestic enterprises and FFEs. However, data on exports and imports by these two categories were not available on a quarterly basis. Therefore, annual data series were constructed using *China Foreign Economic Statistics* and *China's Customs Statistics.*

The REER was calculated using the retail price index (RPI) for China and consumer price indices for China's trading-partner countries. There have been two concerns with the REER. First, the existence of multiple exchange rates over much of the period of the analysis affects estimates of the REER. Second, entrepôt trade through Hong Kong SAR influences the share of partner countries' trade with China. In addition to taking account of these two factors, the REER was adjusted to include a measure of third-market competition.[3]

The move to a unified exchange rate in January 1994 led to a depreciation of the official exchange rate vis-à-vis the U.S. dollar of some 50 percent. However, it has been estimated that, following the reforms of 1988 (which led to increased access to the FEACs) about 50 percent of the foreign exchange transactions occurred at the swap rate, and this share increased to about 80 percent in the early 1990s. Therefore, the REER has been calculated as a weighted average of the swap and the official exchange rates. The weight for the swap rate varies, based on the estimated share of transactions at that rate. For the period prior to 1988, the REER is based on the official exchange rate.

Entrepôt trade with Hong Kong SAR has been identified as a key factor in the divergent estimates of the U.S.-China bilateral trade deficit as reported by China compared with the United States.[4] The U.S. Department of Commerce records reexports of goods of Chinese origin from Hong Kong SAR as U.S. imports from China. Until 1993, however, China recorded these reexports as Chinese exports to Hong Kong SAR rather than to the United States. Although the accounting of its exports by final destination is still not completely accurate, since 1993 China has attempted to identify its exports by final destination

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[1]The world unit price is assumed to be a reasonable proxy for China's export unit value, a series that China does not publish.

[2]A quarterly deflator was constructed by linear interpolation of annual data from WEO.

[3]Work on revising the REER was done by Marianne Schultze Ghattas.

[4]See Feenstra and others (1997), and Arora and Kochhar (1995).

and improve its trade statistics. If exports to Hong Kong SAR are overestimated, then this provides a greater weight to Hong Kong SAR in the calculation of the REER. Using estimates of U.S. imports of Chinese origin would also overestimate imports from China as it attributes the value added in Hong Kong SAR to China.[5]

To account for the entrepôt trade through Hong Kong SAR, the REER was re-calculated after adjusting for reexports from Hong Kong SAR.[6] Consequently, the weight of Hong Kong SAR in the revised estimates is considerably smaller, with an increase in the weights of other partner countries.

The REER was also adjusted to capture the effects of third-market competition. The weights for countries that compete with China's exports in third markets were adjusted for the degree of correlation between the commodity composition of China's manufacturing exports and manufacturing exports from the competing countries.[7] As a consequence of the adjustment for third market competition, the weights of trading partners in Asia, excluding Japan, are larger in the revised estimates of the REER. Following these changes, Indonesia, Korea, Malaysia, Singapore and Taiwan Province of China have a combined weight of 22 percent compared with around 9 percent in the earlier INS estimates.

The data frequency is quarterly for export and import values (except for the breakdown between foreign and domestic financing which are annual), manufacturing unit values, the REER index, industrial production, and the world import index. Quarterly series were constructed for foreign direct investment and the import price deflator by taking linear interpolations between annual observations. Trade volumes and industrial production were seasonally adjusted before including in the regressions.

XV = export values (in U.S. dollars). Total and manufacturing export values were obtained from China's Customs Statistics. The breakdown of exports and imports between

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[5]The Joint Commission on Commerce and Trade (1996), estimates that the average mark-up on Hong Kong reexports of Chinese goods to the United States was about 29 percent of the reexport value in 1992 and 1993.

[6]For details see China: Staff Report for the 1998 Article IV Consultation (SM/98/170, 7/6/98).

[7]For example, large positive correlations in the commodity composition of manufacturing exports of Chinese and ASEAN countries to the United States (a major destination for Chinese exports) would increase the weights attached to the ASEAN countries in the calculation of the REER. Correspondingly, the weights would be reduced for countries (such as Canada) whose exports to the United States have low correlations with China's exports in terms of commodity composition.

foreign-financed and domestic was obtained from China Foreign Economic Statistics, and China's Customs Statistics (beginning in 1993).

MV = import values (in U.S. dollars), same sources as export values.

P_x ($) = export deflator (in U.S. dollars), export unit value of manufacturers, from World Economic Outlook.

P_m ($) = import deflator (in U.S. dollars), import-weighted average of goods deflators from China's trading partners, from World Economic Outlook.

X = export volumes, XV/ P_x ($).

M = import volumes, MV/ P_m ($).

REER = real effective exchange rate index, using country weights that adjust for entrepôt trade through Hong Kong SAR and the trade composition of third market competitors.

Y_w = world import volume index, as proxy for world real income. This variable was constructed from imports of goods, IFS line 78abd, where the country weights reflect China's export shares. The nominal series was deflated by the U.S. WPI, IFS line 63.

ID = real industrial production, from the State Statistical Bureau's *China Latest Economic Indicators*.

OG = output gap. This variable was derived by first fitting a Hodrick Prescott filter to IP to form potential output; then the output gap was obtained as the difference between actual and potential output.

NFDI = nominal foreign direct investment inflows, from *China Statistical Yearbook*.

FDI = real FDI, NFDI/ P_x ($).

Table 1: China: Foreign Direct Investment and Exports and Imports, 1983-97 1/

	FDI inflows (net)	Exports		Imports	
		Value	FFE share in total	Value	FFE share in total
1983	0.6	22.2	0.3	21.3	1.3
1984	1.3	24.8	0.4	25.9	1.5
1985	1.7	27.3	1.1	42.5	4.9
1986	1.9	31.1	1.9	43.2	5.7
1987	2.3	39.5	3.1	43.4	7.2
1988	3.2	47.5	5.2	55.3	10.4
1989	3.4	52.5	9.4	59.1	14.9
1990	3.5	62.1	12.6	54.0	23.1
1991	4.4	71.6	16.8	63.9	26.5
1992	11.2	85.0	20.4	80.6	32.7
1993	27.5	91.8	27.5	103.9	40.2
1994	33.8	121.0	28.7	115.7	45.8
1995	35.8	148.6	31.5	132.2	47.7
1996	42.4	151.1	40.7	138.9	54.5
1997	41.0	182.7	40.5	142.4	56.6

Sources: China's Customs Statistic; China Foreign Economic Statistics; and IFS.

1/ In billions of US dollars, except shares are in percent.

Table 2: Unit Root Tests

Variable	k 1/	ADF Test Stat.	10% Critical Value
Total Exports	4, T	-2.733	-3.193
Manufacturing Exports	4, T	-2.333	-3.193
Total Imports	0, T	-2.005	-3.193
Manufacturing Imports	4, T	-2.616	-3.193
REER	0, C	-1.894	-2.606
World Imports	5, T	-2.070	-3.193
FDI	1, T	-2.784	-3.193
Output Gap	4	-2.392	-1.620

Source: Staff estimates.

1/ The value of k corresponds to the highest-order lag for which the t-statistic in the regression is significant. "C" denotes a significant intercept, and "T" denotes a significant trend and intercept.

Table 3: Chow Breakpoint Tests 1/

Dependent Variable	Independent Variables	Breakpoint	F-statistic	Probability
Total Exports	REER, World Imports, Outputgap	1988:1	21.0	0.000
Manufacturing Exports	REER, World Imports, Outputgap	1988:1	27.9	0.000
Total Imports	REER, FDI, Outputgap	1988:1	14.6	0.000
		1985:1	34.3	0.000
Manufacturing Imports	REER, FDI, Outputgap	1988:1	12.4	0.000
		1985:1	44.0	0.000

Source: Staff estimates.

1/ Full sample period runs from 1983:1 through 1997:4

Table 4: Error Correction Model Results for Exports

Dependent variable	Total Exports		Manufacturing Exports	
Sample Period	1983 - 1997	1988 - 1997	1983 - 1997	1988 - 1997
Long-run cointegration relationships:				
Real Effective Exchange Rate	3.15 (0.39)	-0.32 (-1.95)	0.37 (0.25)	-0.89 (-4.41)
World Import Volume Index 1/	5.61 (0.50)	1.91 (15.66)	0.52 (0.19)	2.81 (19.80)
Constant	15.96 (0.30)	5.14 (6.46)	2.56 (0.05)	6.67 (6.97)
Short-run relationships:				
Error-Correction Term	0.01 (2.48)	-0.17 (-1.31)	0.01 (0.59)	-0.38 (-2.84)
Output Gap	0.19 (0.59)	-0.66 (-1.73)	-0.15 (-0.36)	-0.59 (-1.23)
Lagged Change of:				
Dependent Variable	-0.38 (-2.99)	0.22 (1.17)	-0.23 (-1.69)	0.26 (1.74)
REER	-0.05 (-0.20)	-0.06 (-0.17)	-0.15 (-0.51)	0.03 (0.09)
World Import Volume Index 1/	0.28 (1.01)	0.93 (2.96)	0.82 (2.26)	0.84 (1.95)
R2 (short-run equation)	0.17	0.28	0.17	0.36
Log Likelihood (short-run equation)	65.63	45.43	52.49	37.80

Source: Staff estimates.
Note: t - ratios in parentheses; data frequency is quarterly.

1/ As proxy for world real income

Table 5: Error Correction Model Results for Imports

Dependent variable	Total Imports			Manufacturing Imports		
Sample Period	1983 - 1997	1985 - 1997	1988 - 1997	1983 - 1997	1985 - 1997	1988 - 1997
Long-run cointegration relationships:						
Real Effective Exchange Rate	0.20	0.42	0.69	0.59	0.41	0.23
	(0.90)	(4.19)	(10.15)	(1.04)	(3.41)	(2.01)
Foreign Direct Investment	0.36	0.36	0.36	0.54	0.44	0.42
	(7.21)	(19.47)	(42.47)	(4.42)	(19.74)	(28.07)
Constant	2.72	1.65	0.48	-0.29	1.05	2.02
	(2.27)	(3.08)	(1.41)	(0.09)	(1.63)	(3.51)
Short-run relationships:						
Error-Correction Term	-0.29	-0.51	-0.42	-0.17	-0.63	-0.70
	(-4.37)	(-4.78)	(-2.19)	(-3.34)	(-6.93)	(-3.86)
Output Gap	1.76	1.01	0.58	1.77	1.05	1.08
	(4.80)	(2.62)	(1.35)	(3.94)	(2.68)	(2.48)
Lagged Change of:						
Dependent Variable	-0.36	-0.11	0.01	-0.17	-0.02	0.18
	(-3.73)	(-0.98)	(0.05)	(-1.45)	(-0.21)	(1.07)
REER	-0.21	-0.05	-0.04	-0.39	-0.14	0.11
	(-1.03)	(-0.25)	(-0.16)	(-1.61)	(-0.76)	(0.46)
Foreign Direct Investment	0.08	0.09	0.16	0.38	0.22	0.14
	(0.60)	(0.80)	(1.30)	(2.74)	(1.84)	(0.95)
R2 (short-run equation)	0.55	0.52	0.22	0.39	0.61	0.46
Log Likelihood (short-run equation)	70.46	68.98	53.51	57.45	65.07	54.12

Source: Staff estimates.
Note: t - ratios in parentheses; data frequency is quarterly.

Table 6: Trade Behavior by Ownership

Dependent variable	Exports		Imports	
	FFE	DOE	FFE	DOE
Sample period	1983 - 1997	1983 - 1997	1983 - 1997	1983 - 1997
Real Effective Exchange Rate	-1.65 (-3.90)	0.32 (1.95)	-2.52 (-4.35)	-0.21 (-1.51)
World Imports Volume Index 1/	4.72 (11.47)	1.25 (7.94)		
Foreign Direct Investment			0.71 (4.55)	0.07 (1.94)
Output Gap	-1.67 (-0.50)	0.99 (0.77)	-3.09 (-0.53)	3.69 (2.60)

Source: Staff estimates.

Note: Estimated by OLS; t - ratios in parentheses; data frequency is annual.

1/ As proxy for world real income

CHART 1
CHINA

TRADE VOLUME GROWTH, 1983-1997

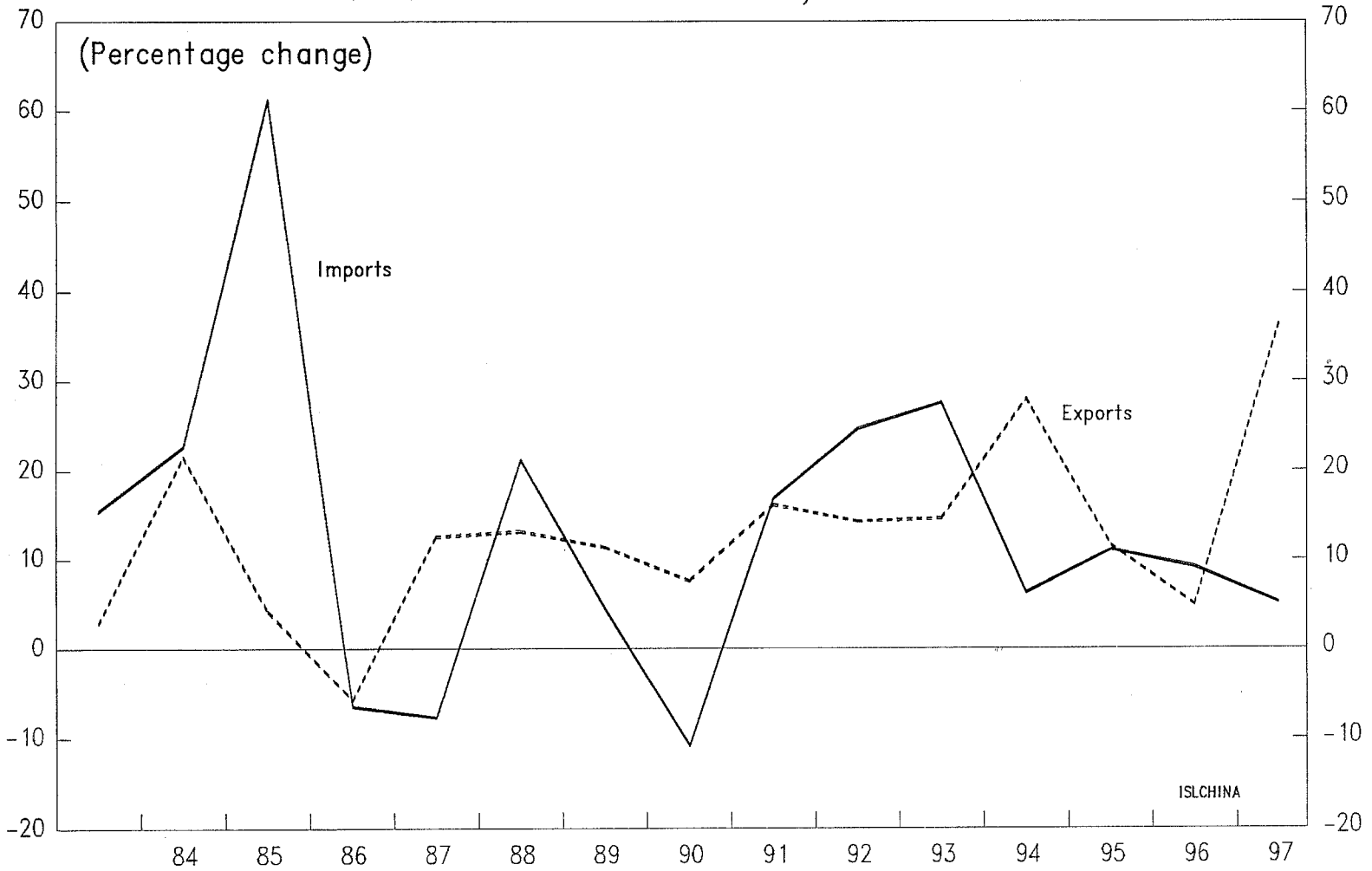
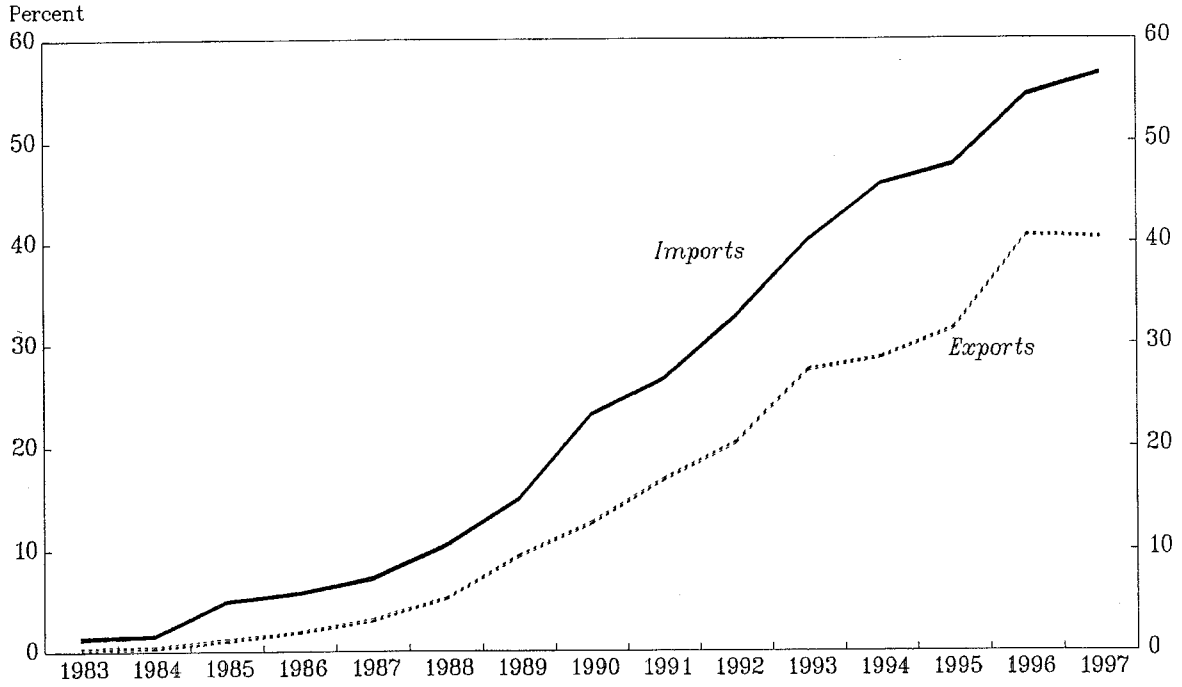


CHART 2

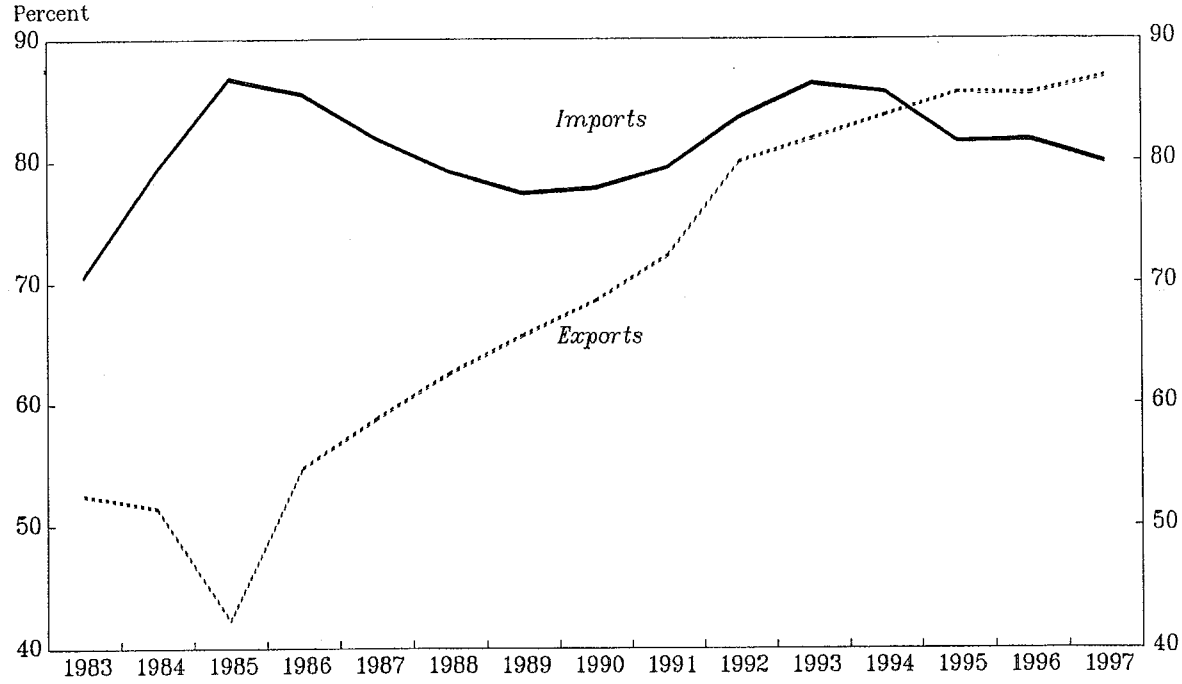
CHINA

COMPOSITION OF TRADE, 1983-97

Foreign Financed Enterprises' Share in Total Trade



Manufacturing Goods' Share in Total Trade



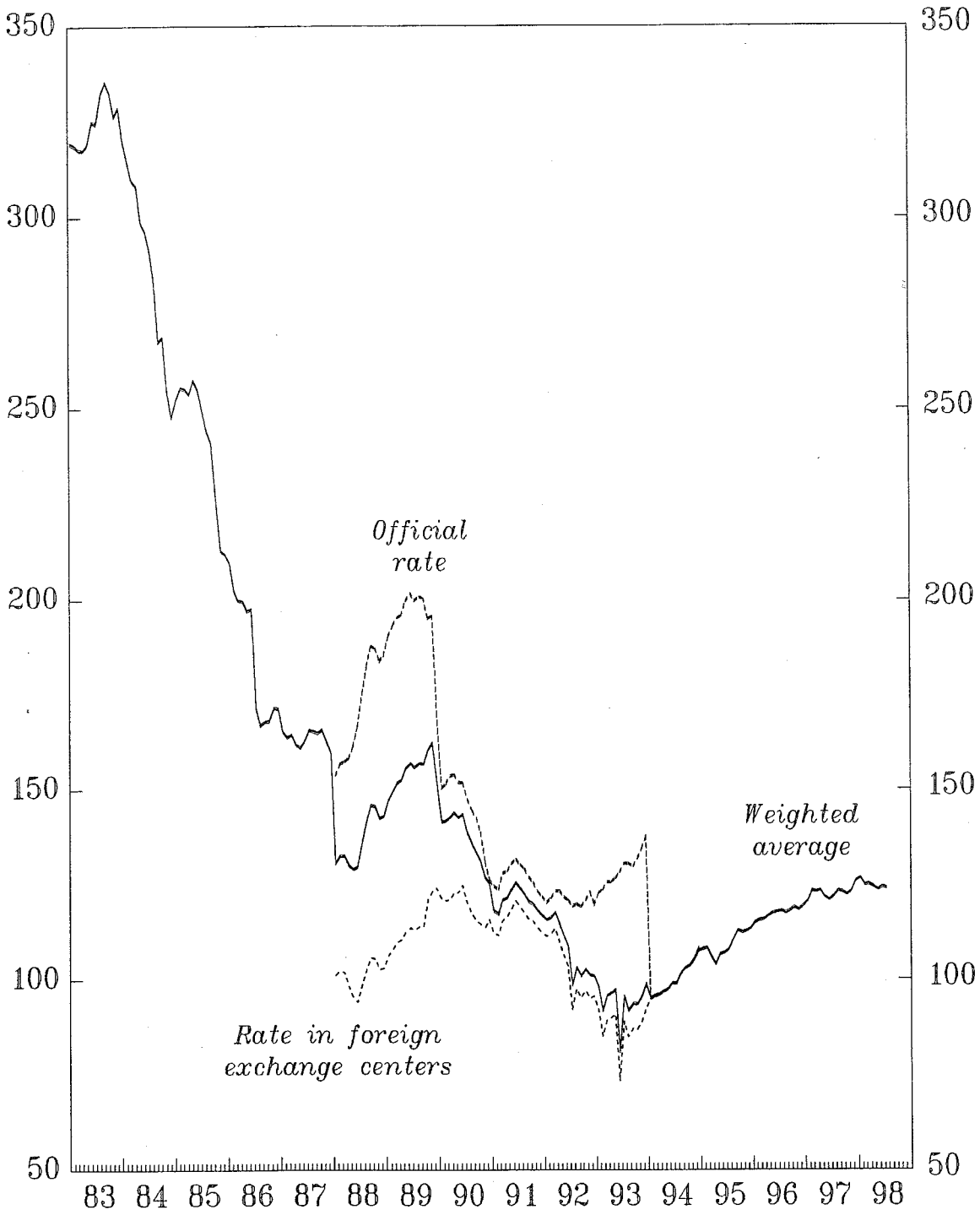
Sources: China's Customs Statistics; China Foreign Economic Statistics; and staff estimates.

CHART 3

CHINA

REAL EFFECTIVE EXCHANGE RATES, 1983-98 1/

(1994=100)



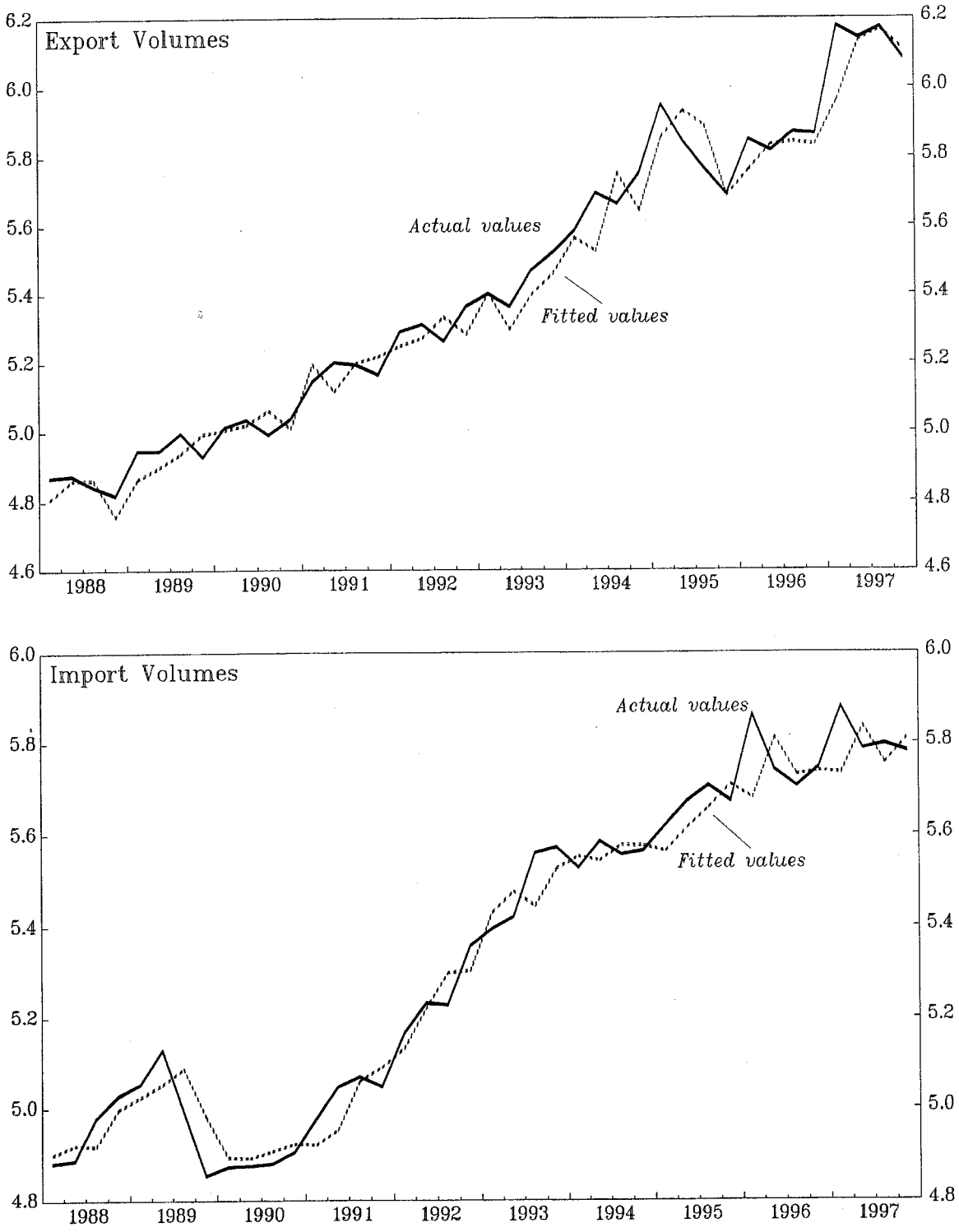
Sources: Chinese authorities; and staff estimates and calculations.

1/ An upward movement indicates an appreciation of the renminbi.

CHART 4

CHINA

FITTED VALUES OF TRADE REGRESSIONS, 1988-97 1/



Sources: China's Customs Statistics; and staff estimates.

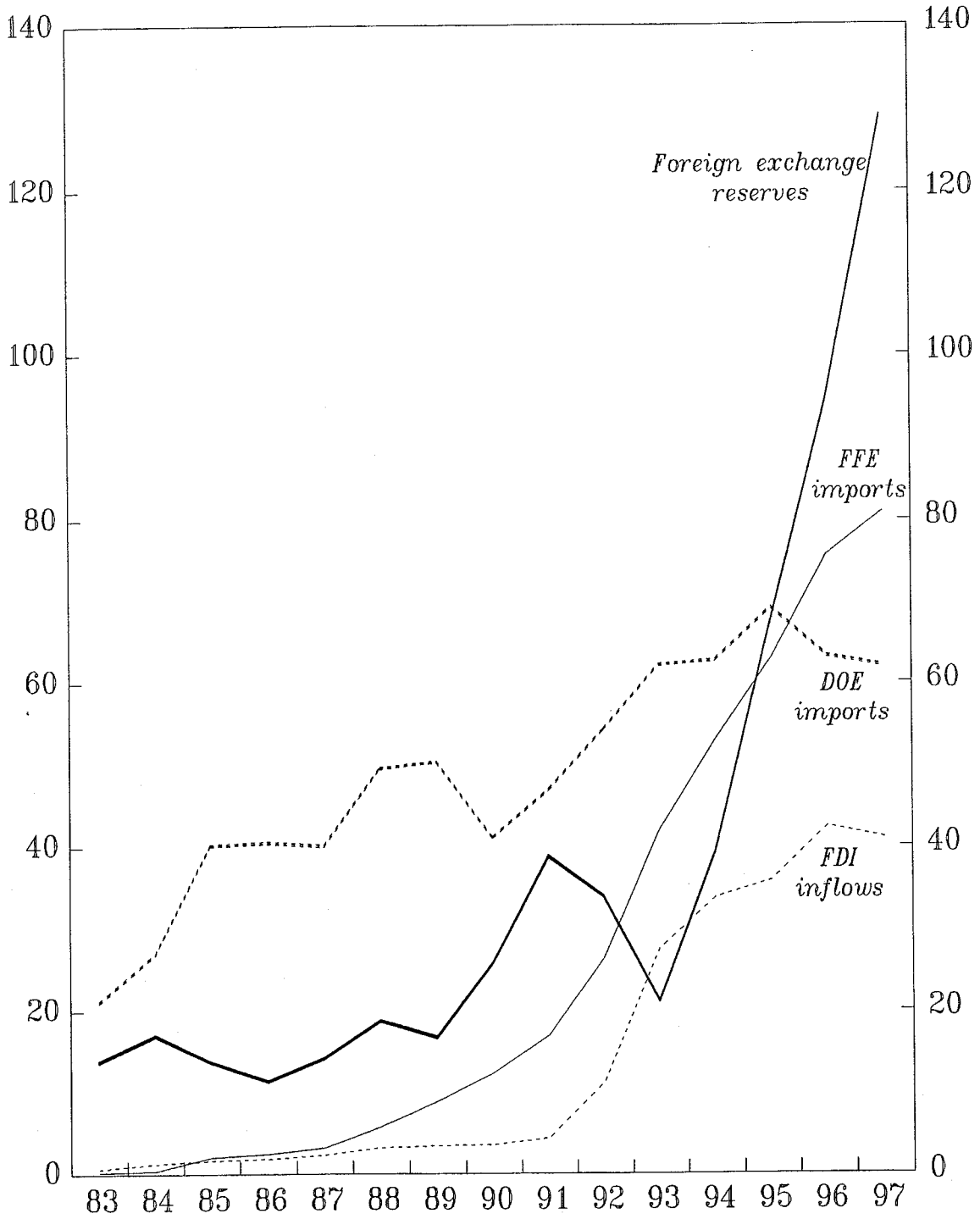
1/ Volumes are in logs and are seasonally adjusted.

CHART 5

CHINA

TRENDS IN RESERVES, FDI, AND IMPORTS BY OWNERSHIP, 1983-97

(In billions of U.S dollars)



Sources: China's Customs Statistics; China Foreign Economic Statistics; China Statistical Yearbook; and IMF: International Financial Statistics.

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