No. 313

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July/August 1986

Paper presented at the Eighth International Conference on Input-Output Techniques, Sapporo, Japan, July 28-August 2, 1986.

THE IMPACT OF ALTERNATIVE DEVELOPMENT STRATEGIES: SIMULATIONS WITH A DYNAMIC INPUT-OUTPUT MODEL

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January 1986

Paper to be presented at the Eighth International Conference on Input-Output Techniques in Sapporo, Japan, July 28-August 2, 1986.

Abstract

This paper analyses the implications of two different development strategies: outward-looking strategy led by manufacturing exports and inwar-looking strategy focused on import substitution strategy. Our approach is to do counterfactual experiments with a dynamic input-output model in order to explore the impact of the different strategy on economic performance. We apply the model to two different countries (Turkey and Korea), which exemplify the two strategies, and explore the impact in each case of a switching strategy. We impose an export-led strategy on Turkey and inward-looking strategy on Korea.

Our results confirm the view that export-led strategy leads to better economic performance. However, we also find that there are risks associated with this choice. An export-led strategy requires high level of foreign capital inflows in the early phase, to be paid back later as export levels rise. The strategy also requires high level of factor productivity growth. If export growth is not maintained, the country will be left with dangerous level of foreign debt. If high productivity growth is not achieved, the growth in factor inputs (particularly investment) required to achieve adequate growth of manufacturing is not sustainable. Finally, our results indicate that the dynamic input-output model provides a good framework for exploring the structural implications of a choice of development strategy.

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1. Introduction

Policymakers have long been concerned with issues of the choice of an appropriate development strategy in pursuit of economic development. In particular, the choice between an inward-looking and an outward-looking development strategy has been a central issue in policy discussions. Studies of a number of semi-industrial countries indicate that countries which achieved a high growth of exports as a result of an outward-looking development strategy performed better in terms of gross output or GNP growth than countries with low export growth rates due to an inward-looking development strategy. A variety of hypotheses have been presented to explain the positive association between export performance and economic growth. For example, expansion of market size through exporting enables producers to reduce the unit-cost of production by exploiting scale economies. It is also argued that competition abroad forces producers to adopt an efficient production technology. Both of these factors are argued to improve productivity, thereby resulting in favorable economic performance.[1/]

This paper examines the structural implications of these two types of development strategies by means of counterfactual experiments with a dynamic input-output (I-O) model applied to two countries: Turkey and Korea. Turkey is an example of a country that followed an inward-looking development strategy, while Korea is an extreme example of a country that pursued an outward-looking development strategy. We proceed by using the model to simulate the growth path for each country had it pursued the polar opposite

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1/ See, for example, B. Balassa, (1981, 1982), W.G. Tyler (1981) and Nishimizu and Robinson (1984) for some evidence and more detailed discussions.

development strategy: that is, an outward-looking strategy for Turkey and an inward-looking strategy for Korea.

Our analysis starts from a dynamic input-output model that links investment to the rate of output growth and so captures dynamic elements that play an important role in the process of economic development. Since output is determined by total final demand, including investment, both output and investment are simultaneously and endogenously determined in the model. In order to capture other features of long-run development, we extend the standard linear dynamic model to include various non-linear relationships so that we may effectively analyze the impact of alternative development strategies.

The paper is organized as follows. We first describe the model used in the analysis, and then discuss important economic features of Turkey and Korea in comparison to other semi-industrial countries. The next two sections analyze the implications of alternative development strategies. The implications of an outward-looking development strategy for Turkey are examined first and then the impact of an inward-looking development strategy for Korea. Some concluding remarks appear in the final section.

2. The Model [1/]

In any dynamic input-output model, the only factor of production that is assumed to limit growth is capital. Each sector has a fixed incremental capital-output ratio, and the sectoral composition of capital goods is given

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1/ See Dervis, de Melo and Robinson (1982), Chaper 3, and Kubo, Robinson and Urata (1983) for a more detailed description of the model. The latter reference also presents the computer program used in the paper.

by fixed shares which vary across sectors. Given the desired consumption growth, these assumptions permit the determination of investment by sector of destination and its translation into demand for investment goods by sector of origin. Investment is treated separately from consumption and is determined endogenously in the dynamic model as a function of the change in output in the period.

The solution of the dynamic input-output model yields a multisector "target equilibrium" function which satisfies the intertemporal equilibrium conditions determining investment and depends on the specified target path for consumption and exports, as well as on the trend values of the various sets of coefficients.[2/] The model is demand driven in that it will find a time path of investment, output, and imports that is consistent with the specified time path of consumption and exports. However, such a path need not be very realistic or sensible. It is mathematically possible to specify target consumption and export paths that yield unrealistic savings rates, trade balances, or gross production structures over time.

Consequently, in order to use the model as a realistic framework for comparing different scenarios, we have imposed three nonlinear system constraints that limit how the structure of the economy can be transformed. The first constraint is that the economy's growth path start from a point reasonably "close" to actual sectoral production in the base year.

2/ This discussion finesses a great deal of mathematics, especially regarding the stability properties of the solution. Suffice it to say that we have successfully dealt with the notorious instability problem of the dynamic input-output model. Mathematically, the "target equilibrium" is termed the "particular solution" or "particular integral." For a complete discussion and justification of our approach, see Dervis, de Melo and Robinson (1982), Chapter 2.

Specifically, we require that aggregate production be the same in the base year, although the sectoral structure of output can be different.[1/] The second constraint is that cumulative investment over the period be equal to an exogenously specified level. Since depreciation is ignored in the present analysis, this restriction is equivalent to requiring that the economy deliver, at the close of the period, a certain pre-specified amount of productive capacity to the next generation. Such a constraint on terminal capital stock is very common in planning models and permits comparisons of different scenarios in which aggregate investment performance is held constant, or is controlled. Third, the cumulative balance of trade over the plan period is set exogenously in real terms. Thus, aggregate net foreign capital inflows, which are an important part of a country's development strategy, can be regulated as an element in different scenarios. The imposition of the constraints discussed above does not really change the essential demand-driven characteristics of the model, although satisfying these constraints requires that additional variables related to aggregate demand be set endogenously. In order to satisfy the constraint that initial-year production in the model be close to actual production, the model varies the level of aggregate consumption in the initial year endogenously. In order to satisfy the constraint that cumulative aggregate investment over time equal an exogenously specified value, the model varies the level of aggregate consumption in the terminal year endogenously. Finally, in order to satisfy the constraint that cumulative foreign capital inflow equal the available

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1/ Mathematically, the initial-year production vector in the model solution is required to have the same Euclidean norm as that of the corresponding actual output vector in the base year.

total inflow, the model varies export levels in the terminal year endogenously. In using the model for counterfactual experiments, one can vary the exogenously imposed aggregate constraints, and let the model determine the time paths of sectoral production, consumption, investment, exports, and imports endogenously.

Solving for the target equilibrium path is, in general, not an easy task. Under some very stringent assumptions about the way consumption and exports grow and about the technology, it is possible to derive an analytic solution. For practical applications, however, these assumptions are much too restrictive and one must rely on numerical solution techniques.1/ In particular, we assume that all the coefficients in the model (input-output coefficients, capital coefficients, import coefficients, consumption shares, and export shares) change over time.2/

In any dynamic input-output model, cumulative investment and capital coefficients (or ICORs) play a crucial role in determining the behavior of the economy because capital is assumed to be the only factor of production that constrains economic growth.3/ Higher output growth may result only from higher cumulative investment, lower ICORs, or a combination of both. In addition, given the multisector framework, the pattern of investment

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1/ For a description of the solution algorithm we used, see Powell (1970).

2/ Contrast this treatment with the model described in Dervis, de Melo and Robinson (1982), Chapter 4, in which all the technical coefficients were assumed to be constant over time. The model here is much more difficult to solve, but is much more realistic.

3/ Capital coefficients (ICORS) represent the increase in a sector's capital stock over a period, divided by the increase in the sector's productive capacity, (expressed as output per year) during the same period.

allocation among sectors and across time periods also affects the growth of the economy. This pattern is determined endogenously, given the demand-driven nature of the model. For example, given the level of cumulative investment and sectoral ICORs, slower growth would result if a change in the structure of exogenous demand shifted the structure of production towards sectors with high ICORs. In addition, although GDP growth mainly depends on output growth, it also depends on the input-output technology. For example, if a change over time in input-output coefficients leads to a reduction in value added relative to intermediate inputs, the growth rate of GDP would be lower. Moreover, the GDP growth rate would be further reduced if the change in technology were accompanied by a shift in the pattern of production away from sectors with high value-added ratios to those with low ratios.

3. Turkey and Korea in International Perspective

We apply the model to Turkey (1958-68) and Korea (1963-73) as examples of countries which pursued different development strategies.[1/] During these periods, Turkey pursued an inward-looking development strategy while Korea followed an outward-looking strategy [2/]. Table 1 compares Turkey

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1/ The periods were chosen to approximate periods characterized by particular development strategies, as well as on the basis of data availability. See Krueger (1974) and Westphal and Kim (1977) for discussion of development policies and patterns for Turkey and Korea, respectively.

2/ The classification of development strategies here is based on the importance of trade in the economy as measured by the shares of exports and imports in GDP. Alternatively, the differences in incentive systems can be used as a criterion. See Balassa (1982).

and Korea with other semi-industrial countries in order to highlight the differences and similarities in development strategies and economic performance.

Turkey and Korea had a very similar economic structures in 1960, although Turkey's per capita GNP was nearly twice as high as that of Korea. During 1960-77, however, the gap narrowed considerably. In 1977, per capita GNP in Korea was almost 90 percent of Turkey's. During 1960-77, the Korean economy rapidly became very open, as indicated by the dramatic increase in the shares of exports and imports in GDP. In Turkey, on the other hand, the relatively low export and import shares in GDP throughout the same period reflected its inward-looking development strategy. The difference in development strategy is also reflected in the share of investment in GDP. Although the share of investment in GDP in Korea was smaller than in Turkey in 1960, Korea passed Turkey by 1970. The rapid increase in Korea's investment share was partly due to a greater foreign capital inflow, largely depended on strong export performance.

Compared with other semi-industrial countries, Korea went through drastic structural changes between 1960 and 1977, especially in trade, while structural changes in Turkey were less notable. These differences are largely attributable to the different development strategies.[1/]

1/ For a more detailed discussion of development strategies and structural dchange in semi-industrial countries, see Chenery, Robinson and Syrquin (1986).

4. Economic Structure and Model Validation

In this section we discuss the patterns of structural change in Turkey and Korea in detail and also examine how closely the model captures these changes. Table 2 presents various macroeconomic indicators for Turkey (1958-68) and Korea (1963-73), and Table 3 shows the structure of production for these countries. The tables present both model estimates and the actual figures. In the initial year, both investment-GDP and export-output ratios were comparable in the two countries; the investment-GDP ratio was about 15 percent and the export-output ratio was about 2.5 percent. Over ten years, however, these ratios diverged drastically. While the ratios increased in both countries, the rate of change in Korea was substantially higher than in Turkey. As a result, investment-GDP and export-output ratios in Korea were 7 and 14 percentage points higher than the respective ratios in Turkey by the end of the period. In contrast, the import-supply ratio was much higher in Korea than in Turkey throughout the period.

Changes in macroeconomic ratios reflect different growth performance of their components, which are shown in the lower part of Table 2. Every component of final demand, as well as GDP and output, increased much more rapidly in Korea than in Turkey. Export growth rates are dramatically different: 35.3 percent in Korea, 7.3 percent in Turkey. The figures in Table 2 also indicate that the Korean development pattern was relatively investment-intensive and outward-looking compared to that in Turkey.

Turning to the production structure shown in Table 3, Turkey in 1958 had a structure remarkably similar to that of Korea in 1963. The only notable differences are found in the shares of consumer goods and social overhead: the share of the consumer goods sector in Korea was 5 percentage points higher

than that in Turkey, whereas the share of social overhead in Turkey was higher by 5 percentage points. The higher production share of social overhead in Turkey may reflect government policy to facilitate import-substitution in capital good industries, which would require establishment of infrastructure.

Over the decade of our data, both countries industrialized rapidly. The magnitude of the shift toward industry and away from agriculture was much greater in Korea than in Turkey. The share of agriculture declined from 30.7 percent to 13.6 percent in Korea, while the percentage decline in Turkey was only half of that in Korea; from 34.6 to 24.6 percent. Also, the gains in the shares of intermediate and capital goods sectors were considerably greater in Korea than in Turkey.

Table 4 shows the foreign trade patterns of the two countries and indicates the very different trade structures that characterize them.[1/] The importance of agricultural imports is greater in Korea than in Turkey, while exports are more concentrated in agriculture in Turkey than in Korea. These structures obviously reflect differences in factor endowments. Turkey is relatively well endowed with land, and so has a comparative advantage in producing agricultural goods. In contrast, Korea has a comparative advantage in producing labor intensive manufacturing goods, especially in consumer goods. Although the import ratio in Korea was significantly higher than that in Turkey in both years, there was a reversal in the ranking in the export ratio between the two countries; the Korean export ratio, which was slightly

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1/ Import structure and export ratios are endogenous in the model, so we can compare the model estimates with actual values. We present only actual values in the table, however, because the model estimates are extremely close to the actual values.

lower in the initial year, greatly surpassed the Turkish ratio in ten years. A large increase in the overall export ratio was attributable to strong export performance in consumer and capital goods, which was in turn due to active export promotion policies.

In spite of these differences, both Turkey and Korea shared a common characteristic of middle income countries; high dependence on foreign supplies of capital goods, indicated not only by the continuing high import share of capital goods, but also by high import ratios measured as the proportion of domestic demand met by foreign supply. The degree of importance of capital goods imports, however, changed differently in these countries over time. In Turkey the import ratio of capital goods declined from 36.1 percent in 1958 to 30.7 percent in 1958, while in Korea it increased from 50.4 percent in 1963 to 58.8 percent in 1973. These differences are attributable to differences in the development policies pursued in these countries. Inward-looking import substitution policies in Turkey resulted in lowering the import ratio, while outward-looking policies in Korea increased the import ratio.

Table 5 presents incremental capital output ratios (ICORs) for Turkey and Korea. As capital is assumed to be the only scarce resource in this model, differences in ICORs determine differences in relative efficiency of the production process.[1/] The ratios reported in Table 5 are obtained from

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1/ In the base runs, the ICORs are assumed to change over time in both countries, with the average rate of change estimated or "tuned" so that output growth rates are close to the actual values. Since we could not obtain reliable ICOR estimates for Turkey, we started with the Korean ICORs and adjusted them to match Turkish economic performance by applying an uniform adjustment factor across sectors. Therefore, relative sectoral rankings in the size of ICORs are identical between Turkey and Korea.

the model base run, which closely tracks actual economic growth in the two countries.

Two observations are in order. First, overall capital effciency was higher in Korea compared with Turkey regardless of the year examined. Second, and more importantly, the productivity of investment increased in Korea, while it declined in Turkey over time. This difference in the direction of productivity change seems to reflect the differences in development strategies in the two countries.[1/]

Changes in the economywide average ICOR are due to a combination of two separate effects: trends in sectoral ICORs and compositional changes in sectoral output. These two effects can be separated by computing a terminal year average ICOR using both initial and terminal year outputs as weights. In Turkey the average ICOR increased from 1.50 in 1958 to 2.05 in 1968, had there been no compositional change in output, while it rose relatively less to 1.97 when the change in output structure is taken into account. This indicates that the composition of output in Turkey shifted toward sectors with lower ICORs between 1958 and 1968. A similar shift in the production structure from the sectors with high ICORs to those with low ICOR was also observed in Korea. However, unlike the Turkish case, the compositional shift was so drastic in Korea that the average ICORs in 1973 (using 1973 weights) actually declined to 0.95 from the 1963 value of 1.02, despite the upward trend in sectoral ICORs, which is shown by the increase from 1.02 in 1963 to 1.14 in

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1/ This is a strongly held view, with some empirical support. For example, Nishimizu and Robinson (1984), in their study of four semi-industrialized countries including Turkey and Korea, found that there was a correlation between the rate of increase in sectoral total factor productivity and outward-orientedness of the development strategies.

1973 when 1963 weights are used.

Comparison of the model estimates with actual values reveals that the model closely replicates the economic structure and its changes in Turkey and Korea. The largest divergence between the estimated and actual values of macroeconomic indicators is one percentage point (export-output ratio for Korea in 1973), while the largest divergence in output shares is slightly higher at 1.6 percentage point (services for Korea in 1963).

5. Alternative Development Strategies

In this section, the dynamic model is used to analyze the implications of alternative development strategies for Turkey and Korea. Three different experiments, each of which highlights certain aspects of an alternative development strategy (outward-looking strategy for Turkey and inward-looking strategy for Korea), are applied sequentially to each country: alternative trade strategies (E-1); alternative values for investment and foreign capital inflow (E-2); alternative level of productivity change (E-3).

The experiments combine different economic features and policies for each of the two countries and are designed to illuminate the effects of the separate elements. The final experiment (E-3) incorporates all the important features of the changes in strategy. In E-1, each country adopts the opposite trade structure. Under E-2, in addition to a different trade structure, the countries have different investment and foreign capital inflow. E-3 adds productivity changes to E-2, i.e., the country has a different trade structure, investment profile, foreign capital inflow, and sectoral productivity growth.

5.1 Turkey

Experiment 1: More Open Trade Strategy

Experiment 1 analyzes the effects of a change in Turkey's trade strategy from inward-looking to outward-looking. In the experiment, the trade structure of Korea in 1973 is imposed on the Turkish economy for the manufacturing, social overhead, and services sectors. The low Turkish import ratios are replaced by the higher Korean ratios in all industrial sectors. For the export side, the Korean export structure is imposed on Turkey within the non-primary sectors.[1/] Higher import ratios in the experiment reflect a more open economic policy, while concentration of exports in consumer goods as observed in Korea is consistent with the comparative advantage at the early stages of development.[2/]

The results of the experiment for various macroeconomic indicators are shown in Table 6. Export-output and import-supply ratios increase drastically, from 3.0 and 4.1 percent in 1968 in the base run to 13.0 and 10.0 percent, respectively, in the experiment. The greater role of international trade in the economy can also be observed in the variations in the growth

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1/ As discussed above, import ratios are exogenous to the model, while export levels are adjusted endogenously to satisfy the cumulative foreign capital inflow constraint. Export levels in the agriculture and mining sectors are assumed to remain the same as in the base run, so the terminal year export levels are adjusted only in the manufacturing, social overhead, and services sectors. This adjustment is made by applying the same multiplication factor to the terminal year export levels in these sectors, keeping their relative shares constant. However, as the weights given to primary and non-primary sectors change, the relative shares among all the sectors are determined endogenously.

2/ For some evidence, see Chenery and Syrquin (1975), Table 5.

rates of various macroeconomic variables. Compared to the base run, exports and imports grow much faster, at annual rates of 23.5 and 21.3 percent, respectively. The higher investment-GDP ratio at the end of the period is necessary to achieve high exports with the same cumulative investment as in the base run. As a consequence of high investment growth, consumption increases more slowly, at 1.9 percent a year, as compared to the 5.3 percent annual growth in the base run. At the end of the period, consumption is 25.2 percent lower than in the base run.

Output and GDP increase at annual rates of 5.5 and 5.1 percent, respectively, which are lower than those in the base run by 0.4 and 0.6 percentage points respectively. The slower growth of output in experiment 1 can be partly explained by a shift in the composition of output from the sectors with low ICORs to those with high ICORs. As shown in Table 7, the average economy-wide ICOR in 1968 (with 1968 output weights) is larger in experiment 1, compared to the corresponding base run figure. This shift can be clearly seen in Tables 5 and 8 where the sectoral ICORs and structure of production are presented. The agriculture and social overhead sectors, with the largest ICORs, increased their shares in total production. The shift in production structure, in turn, is strongly influenced by the changes in export structure. Since it is assumed that primary sector exports grow at the same rate as in the base run, the larger shares of manufacturing exports, especially in consumer goods, indicate a substantial increase in their values. In order to satisfy export demand, the production of capital goods and social overhead have to be increased.

Experiment 2: Increased Resource Availability

Starting from experiment 1, experiment 2 examines the consequences of an increase in foreign capital inflow and investment. Improved export performance, resulting from an outward-looking development strategy (experiment 1), is assumed to attract foreign capital inflow. Export performance is an important factor in determining the amount of foreign capital inflow since it is a major indicator of a country's credit-worthiness. In this experiment cumulative foreign capital inflow is increased so that the ratio between cumulative exports and cumulative foreign capital inflow remains the same as the base run. Although arbitrary, it seems reasonable to maintain the historical ratio.

The increase in foreign capital inflow, in turn, is assumed to be used entirely for investment, without leading to any decrease in domestic savings. There is diagreement regarding the effect of foreign capital inflows on domestic savings and investment.[1/] We adopt the extreme assumption of a one to one correspondence between the changes in foreign capital inflow and investment to provide an upper bound on the effect.

More specifically, in experiment 2 cumulative foreign capital inflow and cumulative investment are increased by multipliers of 1.922 and 1.099 compared to the base run. As expected, increased resource availability increases the growth rate of output and GDP to 6.0 and 5.7 percent from 5.5 and 5.1 percent. Comparison of the results with those from experiment 1 shows that relaxation of the foreign resource constraint lowers the export-output

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1/ Various estimates on this relationship have been presented. See, for example, Chenery, Robinson and Syrquin (1986, Chapter 11) for a discussion on this point.

ratio as well as export growth rate, while improvement in the investment resource availability reduces the investment growth rate. Although the levels of consumption, GDP, and output in 1968 from this experiment compare favorably with those from experiment 1, they are still lower than the base run levels.

Experiment 3: Higher Productivity

Experiment 3 adds higher sectoral productivity growth to the features of experiment 2. As discussed above, although a causal relation between productivity growth and export growth is difficult to establish, a positive empirical association between the two has been noted in the literature. In this experiment, we simply assume that such a link exists.

Since capital is the only factor of production that affects growth in the model, an increase in productivity is captured through a reduction in ICORs. The Turkish terminal year ICORs are replaced by the corresponding Korean ICORs for the manufacturing, social overhead, and services sectors, which are significantly lower than those of Turkey.1/

This experiment yields higher growth rates in both GDP (7.1 percent) and gross output (7.4 percent) compared to the base run or any other experiments. The lower ICORs result in a drastic reduction in the average economywide ICOR, from 2.00 in experiment 2 to 1.45 in experiment 3, as well as in a lower investment-GDP ratio and in lower investment growth rate compared to those obtained in experiment 2. Consequently, consumption grows

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1/ ICORs in the primary sectors are left unchanged because export levels in these sectors are assumed to remain unchanged in the experiment. Some effects on productivity in the primary sector might be expected through channels such as external economies, but such effects are ignored here.

much faster than in experiment 2. Finally, compared with the base run, not only are there higher levels of investments, exports, and imports (which were also subtantially higher in the other experiments than in the base run), but also the levels of consumption, GDP, and output are significantly higher.

Resources and Productivity Growth under an Outward-looking Development Strategy

The results from the experiments indicate that Turkey would have grown faster had it pursued an outward-looking development strategy rather than an inward-looking strategy. An outward-looking development strategy leads to greater export expansion, which, in turn, induces an increase in foreign capital inflow, higher investment, and high productivity growth. As a result of greater resource availability and more efficient technology, the economy grows faster. In this scenario, our experiments indicate the critical importance of productivity growth. Although a greater inflow of foreign resources substantially eases bottlenecks, the open development strategy is not sustainable without a significant increase in productivity. Figures 1 and 2 brings out this point. They give the time profiles of foreign capital inflow and investment for the base run and experiments 2 and 3.

The different levels of resource availability in the form of foreign capital inflow and investment are shown by the differences in the area under the curve in Figures 1 and 2. The area associated with the base run is smaller than that for experiments 2 or 3. Over time, foreign capital inflow showed considerably steeper curves for experiments 1 and 2 relative to the base run in the early years, indicating that large capital inflows were required in the early years in order to achieve a high growth of exports. On

the investment side, there was a marked acceleration in investment rate towards the end of the period in order to satisfy the greater export demand. This phenomenon is particularly strong in experiment 2. In fact, more than 25 percent of GDP in the terminal year was required for investment under these conditions. This high investment ratio may not be feasible because the resources left for consumption may be too small. However, with an improvement in productivity as assumed in experiment 3, the acceleration of investment growth slows and the investment requirement drops to 18.7 percent of GDP in 1968, which is very close to the actual value achieved in Turkey.

5.2 Korea

Experiment 1: Inward-looking Trade Strategy

For Korea, experiment 1 examines the effects of an inward-looking trade strategy by imposing the terminal Turkish import ratios and sectoral export structure on Korea. The import ratios used for the experiment are much lower than Korea's base run values.[1/] The export structure for the experiment is concentrated in the social overhead and services sectors, while the actual Korean structure has large weights for the manufacturing sectors.

In Table 9, the effects of an inward-looking trade structure are shown by a substantially lower export-output ratio in 1973 and also by a significantly lower import-supply ratio, as compared to those in the base run. Drastically reduced import and export growth rates are also evident. Because of lower imports due to lower import ratios imposed for 1973, the

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1/ Except for the service sector, where the Korean ratio is maintained.

export-output ratio and export growth rate are reduced to satisfy the foreign capital inflow constraint, whose level is maintained at the base run level.

GDP and output grow slightly more slowly, at 10.0 and 11.1 percent annually in comparison to 10.6 and 11.9 percent in the base run. This small decline in growth rate is attributable to a shift in production from sectors with low ICORs to high ICORs. More specifically, the shares of production for agriculture, social overhead, and services, which had the highest ICORs in 1973, increase while the share of capital goods, which had the lowest ICORs in 1973, declines (Table 11). These changes in production are, in turn, the result of the shift in the export structure from manufacturing to social overhead and services.

An inward-looking trade strategy, as expected, results in substantial reduction in the export and import levels in 1973; only 39.0 and 48.4 percent of the base run figures. The levels of consumption, investment, GDP, and output remain relatively unchanged from the base run.

Experiment 2: Reduced Resource Availability

Experiment 2 examines the implications of a reduction in resources available for imports and investment. Foreign capital inflow is reduced so that the ratio between cumulative exports and capital inflow remains the same as the base run. The reduction in cumulative capital inflow, in turn, is assumed to result in the reduction in cumulative investment by the same amount. These assumptions on resource availability amount to lowering foreign capital inflow and cumulative investment to 49.7 and 74.1 percent of the base run levels respectively.

The results of this experiment on various macroeconomic indicators are given in Table 9. The lower foreign capital inflow requires exports to increase, resulting in an increase in the aggregate export-output ratio to 13.3 percent from 7.5 percent in experiment 1. To meet the higher export demand late in the period, higher investment is required, leading to an investment-GDP ratio of 30.2 percent in the terminal year, compared to 25.0 percent in experiment 1. Because of the higher investment demand toward the terminal year, consumption is forced to grow at much lower rate (1.5 percent a year). As can be expected from the larger terminal year economywide average ICOR (using terminal year output weights) and the decline in available cumulative resources for investment, GDP and output growth rates decline substantially, from 10.0 and 11.1 percent in experiment 1 to 7.1 and 8.2 percent.

Examination of the final demand and output levels in 1973 shows that consumption in 1973 is only 60.3 percent of the base run level, a drastic reduction from experiment 1. This is due to lower economic growth, which in turn is largely attributable to the lower aggregate investment in this experiment.

Experiment 3: Lower productivity growth

This experiment combines the assumptions of experiments 1 and 2 with lower productivity growth. Here, instead of imposing higher Turkish ICORs in the terminal year, initial year Korean ICORs are maintained throughout the period. If we had used the Turkish ICORs, there would be a decline in productivity over time from the 1963 Korean level. Although a decline in productivity might possibly arise from an inward-looking, import substitution

policy, it is more plausible to assume that the productivity level stays the same.

This experiments yields an increase in the economywide average ICOR in the terminal year, from 1.11 in experiment 2 to 1.22 in experiment 3 (using 1963 output weights, Table 10). The production structure during the period shifts from low to high ICOR sectors, as indicated by a higher 1973 ICOR with 1973 weights than that with 1963 weights. Decline in the efficiency of investment results in an unfavorable outcome; an investment-GDP ratio of 36.6% in 1973, an investment growth rate of 29.3% and a consumption growth rate of -0.3%. This is clearly not a sustainable growth path. The levels of final demand and output in 1973, however, do not differ much from experiment 2, although they are substantially lower than in the base run.

Resources and Productivity Under and Inward-looking Development Strategy

The effects of the reduction in resource availability and decline in productivity growth on the time profiles of foreign capital inflow and investment are shown in Figures 3 and 4. The different levels of resource availibility in the form of foreign capital inflow and investment are shown by the differences in the area under the curves. The area associated with the base run is larger than that associated with experiments 2 or 3. There is a considerable flattening out of the foreign capital inflow profile in these experiments, as compared to the base run. In the base run, the high growth of exports required large foreign capital inflows in the early years, with export earnings catching up only in the last part of the period. When export growth rates are reduced, the economy uses foreign capital more evenly. This again

suggests that an export-led growth strategy crucially depends on large-scale capital inflows concentrated in the early stages.

On the investment side, experiments 2 and 3 indicate an acceleration in the investment growth rate toward the end of the period, compared to the base run. This phenomenon is especially notable in experiment 3, where productivity growth is reduced in addition to assuming lower resource availability. However, the investment profile for experiment 3 does not seem feasible since it implies an excessively large acceleration in investment growth, with the investment rate reaching 36.6 percent of GDP in 1973; more than 10 percentage points higher than the actual value.

6. Conclusions

We have analyzed the implications of two different development strategies: an outward-looking strategy led by manufacturing exports and an inward-looking strategy focused on import substitution. Our approach has been to do counterfactual experiments with a dynamic input-output model in order to explore the impact of the different strategy on economic performance. We extended the standard linear dynamic input-output model to include various non-linearities in the model, and then applied it to two different countries (Turkey and Korea), which exemplify the two strategies, and explored the impact in each case of a switching strategy. We imposed an export-led strategy on Turkey and inward-looking strategy on Korea.

Our results support the view that an export-led strategy leads to better economic performance. However, we also found that there are risks associated with this choice. An export-led strategy requires high levels of foreign capital inflow in the early phase, to be paid back later as export

levels rise. The strategy also requires high levels of factor productivity growth. If export growth is not maintained, the country will be left with a dangerously high level of foreign debt. If high productivity growth is not achieved, the growth in factor inputs (particularly investment) required to achieve adequate growth of manufacturing is not sustainable.

Our results also indicate that the dynamic input-output model provides a good framework for exploring the structural implications of a choice of development strategy. However, it cannot be used to analyze other interesting policy issues such as the effect of price incentive policies (e.g. tariff policy) that work through market mechanisms. These features can be explicitly considered in the framework of a computable general equilibrium (CGE) models.[1/] The input-output model, however, does capture major features of the development process, and is easier to implement than the more ambitious and elaborate CGE models.

1/ See, for example, Dervis, de Melo and Robinson (1982) for a description and discussion of CGE models.

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Table 1

Various Economic Indicators for Turkey, Korea and Other Middle-Income Countries

	Population		Per Capita GNP			Ratio (%) to GDP in Current Prices			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Number (Million)	Average Annual Growth Rate	Level (1977 US$)	Average Annual Growth Rate	Agriculture Value Added	Manufacturing Value Added	Exports	Imports	Gross Domestic Investment
Turkey									
1960	27.5	2.8	613	-	41.4	12.6	4.2	6.5	15.3
1970	35.3	2.5	846	3.3	34.0	15.9	5.8	8.0	17.1
1977	41.9	2.5	1110	4.0	29.0	17.5	5.0	12.3	22.4
Korea									
1960	24.7	2.0	327	-	41.7	11.5	2.8	11.8	11.4
1970	31.4	2.4	572	5.8	34.7	16.9	11.3	21.8	23.2
1977	36.0	2.0	980	8.0	25.8	23.2	29.6	34.3	27.2
Average of Countries 1/									
1960	26.7	-	617	-	28.4	20.9	11.0	12.7	19.2
1970	34.2	2.5	927	4.2	23.5	22.3	13.4	15.5	21.3
1977	40.3	2.4	1214	3.9	20.5	25.4	17.5	20.8	23.8

1/ Individual values for other countries are presented in Appendix III. In addition to Turkey, Mexico and Korea, the sample includes: Egypt, Thailand, the Philippines, Taiwan, Colombia, Peru, Brazil, Yugoslavia, Argentina and Spain.

Source: The World Bank, World Tables, Second Edition (1980).

Table 2

Macroeconomic Indicators (percent)

		Turkey			Korea	
		Actual	Model		Actual	Model
Ratios						
Investment/GDP	1958	13.7	13.8	1963	15.4	15.9
	1968	17.9	18.0	1973	25.2	25.2
Exports/Output	1958	2.6	2.6	1963	2.4	2.7
	1968	3.0	3.0	1973	17.0	18.0
Imports/Supply 1/	1958	3.1	3.1	1963	12.0	12.3
	1968	4.2	4.1	1973	15.8	16.2
Growth Rates		1958-68			1963-73	
Consumption 2/		5.3	5.3		7.2	7.2
Investments		8.4	8.6		15.8	15.8
Exports 2/		7.3	7.3		35.3	35.3
Imports		9.3	8.9		15.0	15.6
GDP		5.5	5.7		10.2	10.6
Output		5.9	5.9		11.4	11.9

1/ Supply = output + imports-exports

2/ Exogenous

Source: Actual data come from the World Bank Research Project ("A Comparative Study of the Sources of Industrial Growth and Structural Changes," [RPO 671-32]) data bank.

Table 3

Production Structure (percent)

	Turkey				Korea			
	1958		1968		1963		1963	
	Actual	Model	Actual	Model	Actual	Model	Actual	Model
Agriculture	34.6	35.5	24.6	24.8	30.7	31.1	13.6	13.3
Mining	1.7	1.3	1.5	1.4	1.9	1.9	1.0	1.0
Food	10.6	10.4	9.5	9.3	9.4	9.9	10.1	10.5
Consumer Goods	6.9	6.8	8.5	8.4	16.0	16.2	21.1	21.9
Intermediate Goods	7.2	7.3	12.0	11.7	7.9	7.9	14.6	14.7
Capital Goods	2.4	2.5	3.8	3.8	3.0	3.0	7.4	7.9
Social Overhead	15.1	14.0	16.4	16.3	10.2	10.7	13.6	13.2
Services	21.5	22.2	23.7	24.4	20.9	19.3	18.6	17.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Same as Table 2.

Table 4

Foreign Trade Patterns (percent)

	Turkey				Korea			
	Structure		Ratio 1/		Structure		Ratio 1/	
	1958	1968	1958	1968	1963	1973	1963	1973
Imports								
Agriculture	9.7	2.6	0.9	0.5	27.9	15.5	11.1	18.2
Mining	0.1	5.3	0.2	14.2	0.9	1.5	8.0	24.2
Food	3.3	0.7	1.0	0.3	3.5	2.9	5.0	5.3
Consumer Goods	4.2	4.3	1.9	2.2	9.8	15.1	8.2	18.5
Intermediate Goods	37.5	35.2	14.3	11.6	34.3	29.9	38.7	31.1
Capital Goods	43.3	39.1	36.1	30.7	21.4	32.6	50.4	58.8
Social Overhead	1.9	4.2	0.4	1.1	0.6	1.2	0.8	1.9
Services	0.0	7.6	0.0	1.4	1.6	0.3	1.1	0.3
Total	100.0	100.0	3.1	4.2	100.0	100.0	12.0	15.8
Exports								
Agriculture	72.8	42.5	5.3	5.1	8.1	2.9	0.7	3.9
Mining	5.4	3.2	10.8	6.7	12.0	0.9	16.6	16.2
Food	2.6	17.9	0.7	5.8	8.1	2.9	2.2	5.1
Consumer Goods	0.4	1.7	0.1	0.6	26.0	45.6	4.3	37.5
Intermediate Goods	4.2	3.1	1.5	0.8	12.0	12.7	4.1	15.6
Capital Goods	0.04	0.04	0.04	0.03	2.4	18.2	2.2	41.3
Social Overhead	8.6	14.5	1.6	2.7	18.9	9.2	4.7	12.6
Services	6.1	17.1	0.7	2.1	12.4	7.6	1.7	7.8
Total	100.0	100.0	2.6	3.0	100.0	100.0	2.4	17.0

1/ Import ratio is defined as (imports/(output + imports - exports) whereas export ratio is defined as (exports/outputs)

Sources: Same as Table 2.

Table 5

Incremental Capital Output Ratios (ICORs)

	Turkey		Korea	
	1958	1968	1963	1973
Agriculture	1.07	2.50	0.81	1.60
Mining	0.70	0.62	0.53	0.39
Food	0.20	0.27	0.15	0.17
Consumer Goods	0.65	0.31	0.49	0.20
Intermediate Goods	0.92	0.75	0.70	0.48
Capital Goods	0.45	0.22	0.34	0.14
Social Overhead	3.72	4.30	2.71	2.76
Services	2.00	2.02	1.52	1.29
Total	1.50	1.97 (2.05)	1.02	0.95 (1.14)

Note: Weighted by current year outputs and figures in parenthesis are weighted by initial year outpus.

Source: Same as Table 2.

Table 6

Key Macroeconomic Indicators from Experiments - Turkey

	Base Run	E-1	E-2	E-3
Ratios (percent)				
Investment/GDP				
1958	13.8	7.1	10.8	14.2
1968	18.0	28.3	25.5	18.7
Exports/Output				
1958	2.6	2.7	2.6	2.6
1968	3.0	13.0	10.0	10.2
Imports/Supply[1]/				
1958	3.1	2.7	2.9	3.1
1968	4.1	10.0	9.8	9.1
Growth Rates, (percent) 1958-1968				
Consumption	5.3	1.9	3.9	6.4
Investment	8.6	20.6	15.1	10.1
Exports	7.3	23.5	21.1	23.2
Imports	8.9	21.3	20.5	20.5
GDP	5.7	5.1	5.7	7.1
Gross Output	5.9	5.5	6.0	7.4
Rates to Base Run, 1968 (percent)				
Consumption		74.8	88.9	110.1
Investment		143.5	139.3	118.8
Exports		406.1	334.8	396.1
Imports		243.2	252.9	272.8
GDP		91.4	98.5	114.2
Gross Output		93.1	99.6	115.6

Table 7

Economy-Wide ICORs for Turkey

	Base Run	E-1	E-3	E-4
1958	1.50	1.43	1.47	1.51
1968 (1958 sectoral weights)	2.05	2.01	2.03	1.65
(1968 sectoral weights)	1.97	1.99	2.00	1.45

Table 8

Production Structure - Turkey
(Percentage of Total)

	Base Run		E-1	E-2	E-3
	Initial	Terminal	Terminal Year		
Agriculture	35.5	24.8	25.6	24.7	22.7
Mining	1.3	1.4	1.3	1.3	1.3
Food	10.4	9.3	7.0	8.1	9.1
Consumer Goods	6.8	8.4	11.9	10.9	11.8
Intermediate Goods	7.3	11.7	9.9	9.8	10.0
Capital Goods	2.5	3.8	5.6	4.6	4.0
Social Overhead	14.0	16.3	18.2	18.1	16.6
Services	22.2	24.4	20.6	22.6	24.5
TOTAL	100.0	100.0	100.0	100.0	100.0

Table 9

Key Macroeconomic Indicators from Experiments - Korea

	Base Run	E-1	E-2	E-3
Ratios				
Investment/GDP				
1963	15.9	17.4	8.2	5.2
1973	25.2	25.0	30.2	36.6
Exports/Output				
1963	2.7	2.7	2.8	2.7
1973	18.0	7.5	13.3	13.3
Imports/Supply				
1963	12.3	12.4	11.7	11.5
1973	16.2	9.0	9.6	10.2
Growth Rates, 1963-1973				
Consumption	7.2	7.3	1.5	-0.3
Investment	15.8	14.1	22.1	29.3
Exports	35.3	23.2	26.6	25.5
Imports	15.6	7.3	6.0	6.2
GDP	10.6	10.0	7.1	6.3
Gross Output	11.9	11.1	8.2	7.5
Ratios to Base Run, 1973 (Percent)				
Consumption		100.1	60.3	51.0
Investment		94.5	85.2	94.8
Exports		39.0	51.4	47.3
Imports		48.4	38.7	38.4
GDP		95.3	71.1	65.2
Gross Output		93.9	69.3	63.8

Table 10

Economy-Wide Average ICOR for Korea

	Base Run	E-1	E-2	E-3
1963	1.02	1.02	0.97	0.95
1973 (1963 sectoral weights)	1.14	1.15	1.11	1.22
(1973 sectoral weights)	0.95	1.03	1.11	1.27

Table 11

Production Structure - Korea
(Percentage of Total)

	Base Run		E-1	E-2	E-3
	Initial	Terminal	Terminal Year		
Agriculture	31.1	13.3	13.7	16.2	17.0
Mining	1.9	1.0	1.1	1.2	1.2
Food	9.9	10.5	10.8	8.0	7.0
Consumer Goods	16.2	21.0	15.7	13.4	12.5
Intermediate Goods	7.9	14.7	16.8	16.9	16.9
Capital Goods	3.0	7.9	7.7	8.9	10.4
Social Overhead	10.7	13.2	14.8	17.1	17.9
Services	19.2	17.5	19.6	18.4	17.1
TOTAL	100.0	100.0	100.0	100.0	100.0

FIGURE 1: TURKEY

FOREIGN CAPITAL INFLOW PROFILE

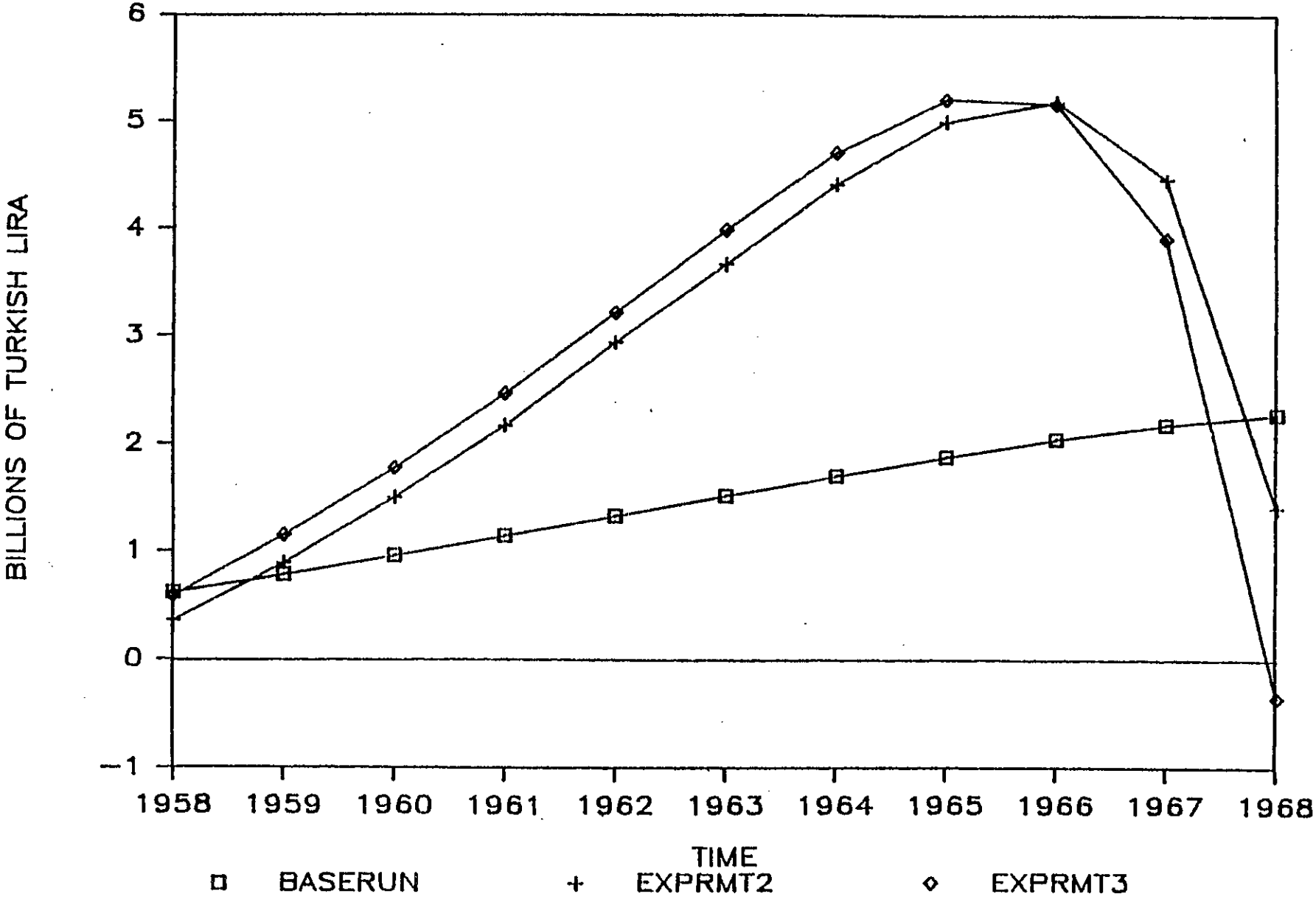


FIGURE 2: TURKEY

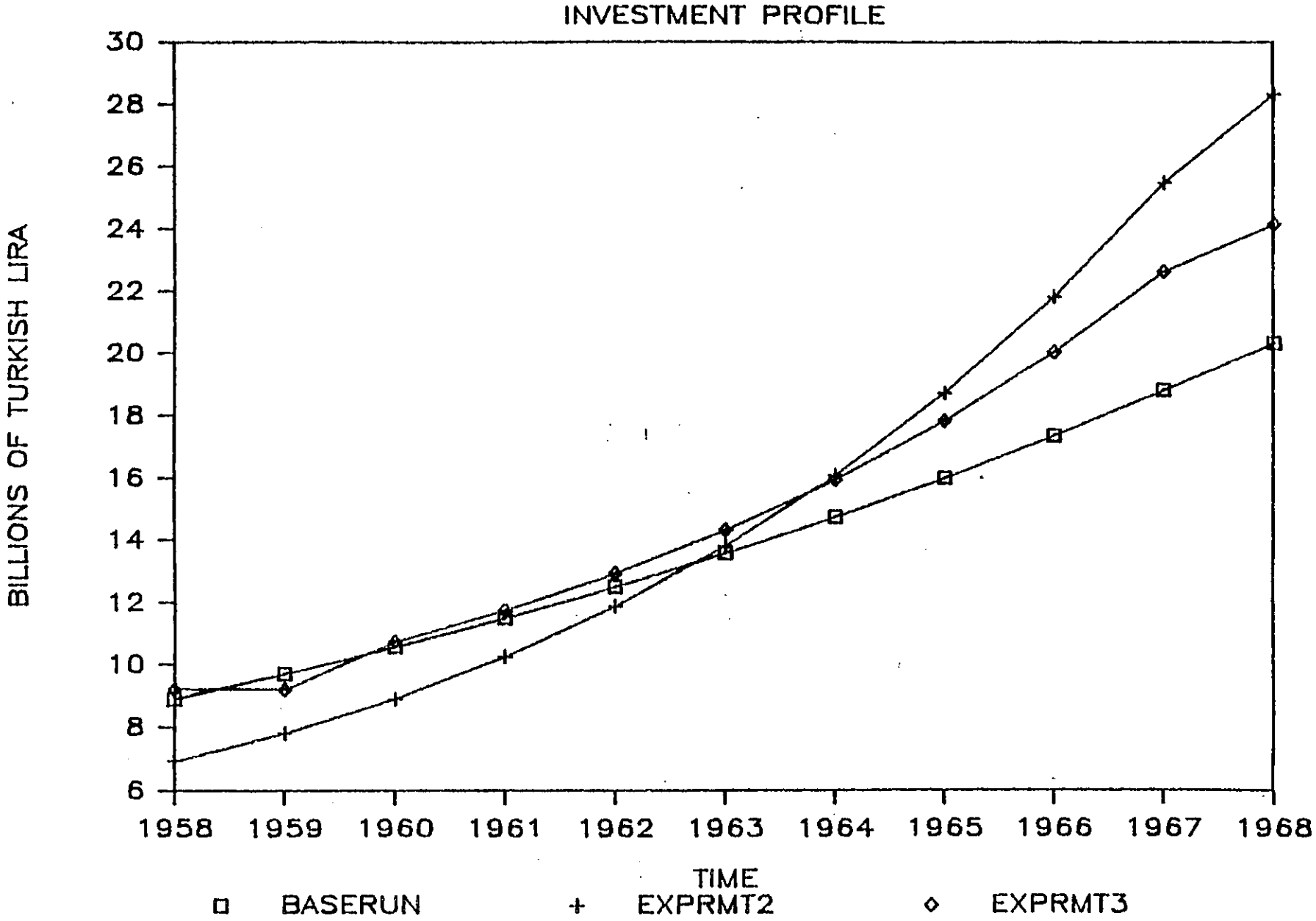
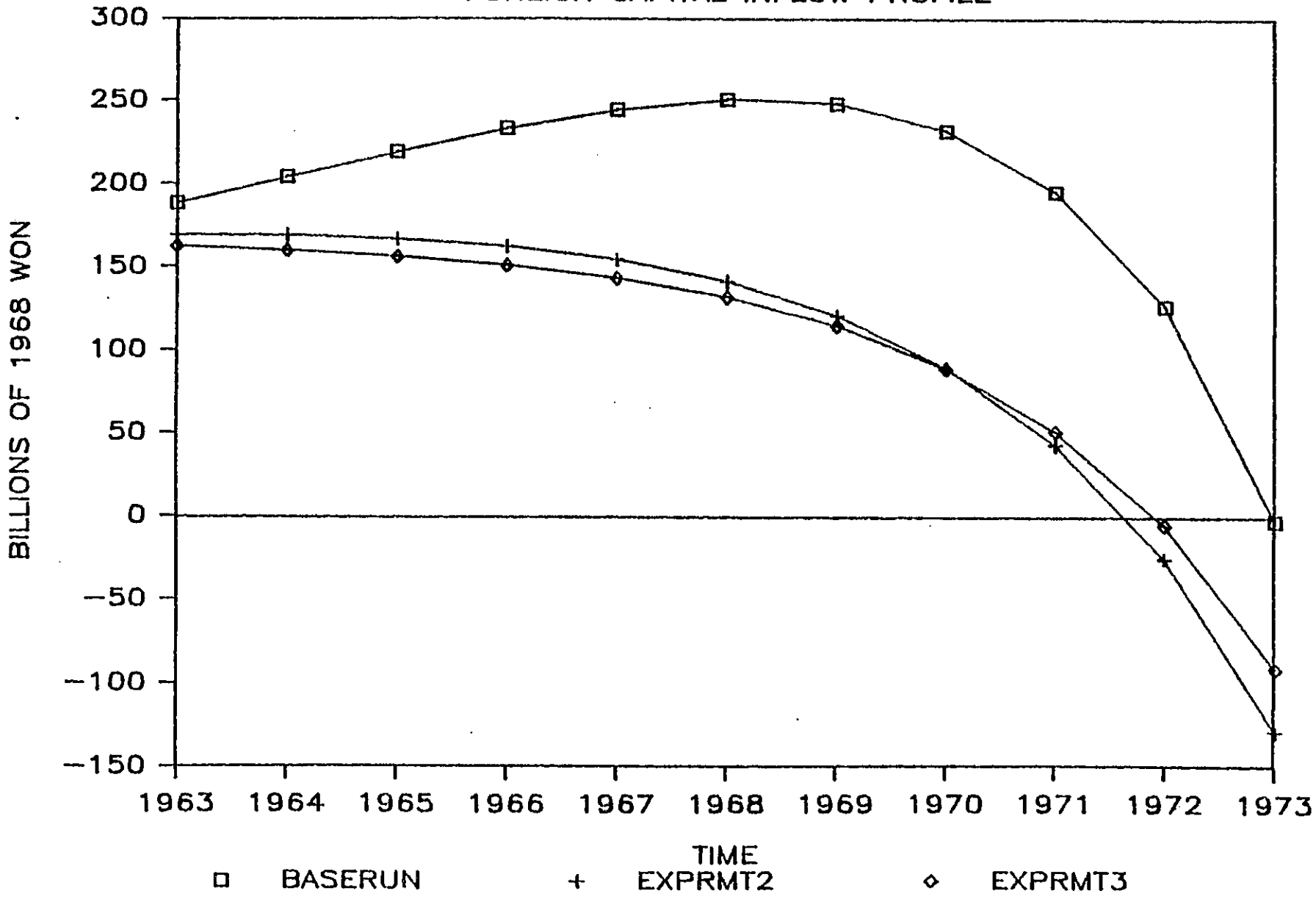
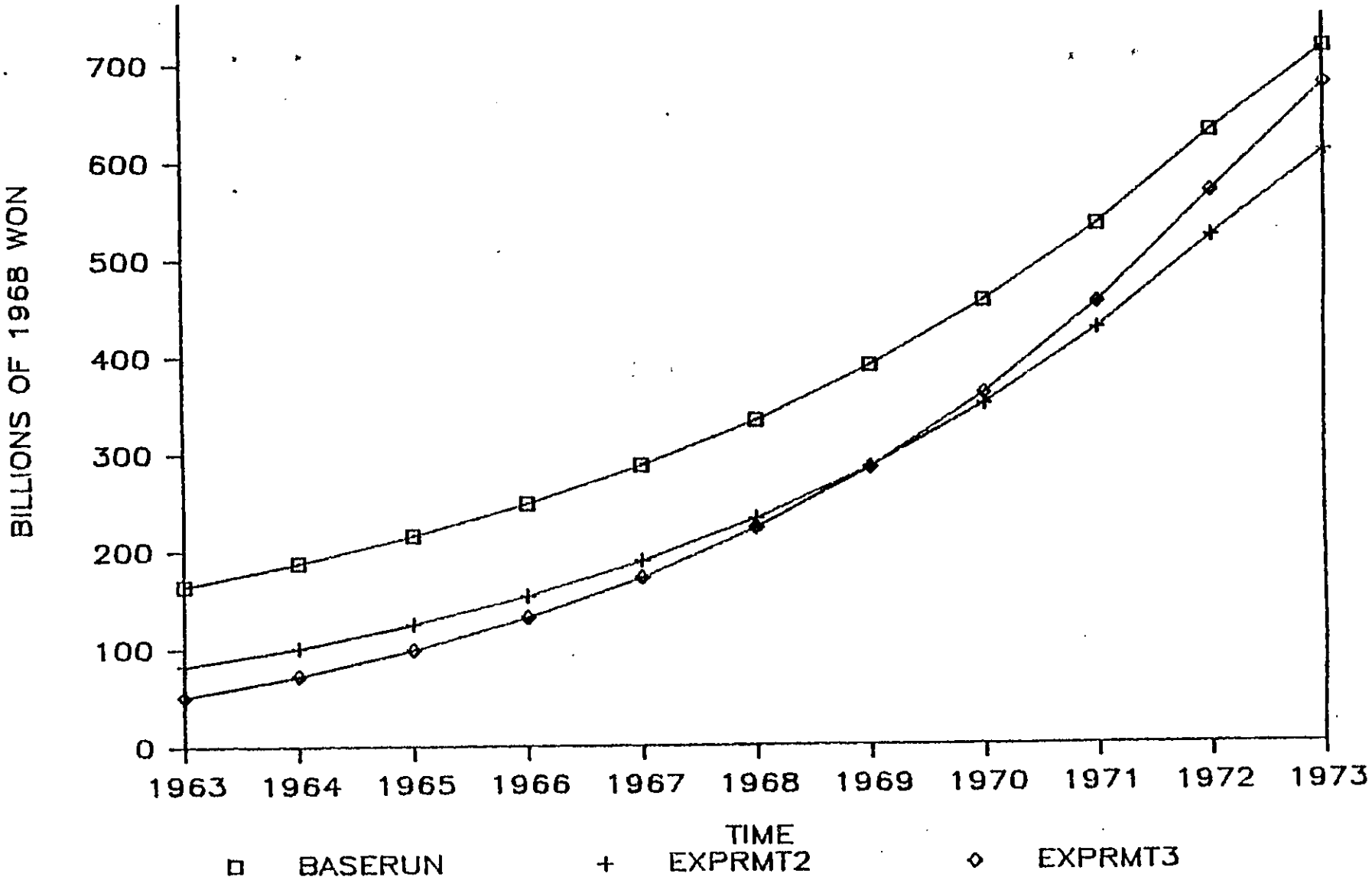


FIGURE 3: KOREA

FOREIGN CAPITAL INFLOW PROFILE




BILLIONS OF 1968 WON
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TIME
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EXPRMT2
EXPRMT3