Openness to trade and structural changes in the sources of economic growth and labour demand in Turkey[1]

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■ **Abstract:** Unlike neoclassical expectation behind the structural adjustment programme, some studies for Turkey have showed that the policy change in 1980 caused a decline in employment. Results show that the Turkish industrialisation strategy cannot be regarded as export-led industrialisation strategy. Extra output created by exports has been very limited during the post-liberalisation period. However domestic final demand has continued to be the most dominant determinant of output growth. A surprising result of the paper appears for the period of 1985-1990 when import substitution in final demand created output growth particularly in technology-intensive manufacturing and other manufacturing sectors. However import penetration in final and intermediate goods are important factors creating de-industrialisation in the period of 1990-1996. Despite neoclassical expectations, the reform period after 1982 witnessed large factor substitution against labour, even in the tradable goods sector. Additionally, labour demand also appears to response to output growth less in the post-liberalisation period than before.

■ **Resumen:** A diferencia de las expectativas bajo el enfoque neoclásicas detrás del programa de ajuste estructural, algunos estudios de Turquía han demostrado que el cambio de política en 1980 causó una disminución en el empleo. Los resultados muestran que la estrategia de industrialización de Turquía no puede ser considerada como estrategia de industrialización impulsada por las exportaciones. La producción adicional creada por las exportaciones ha sido muy limitada durante el período posterior a la liberalización. Sin embargo, la demanda interna final ha seguido siendo el factor más dominante de crecimiento de la producción. Un resultado sorprendente de este documento aparece en el período de 1985-1990, en la sustitución de importaciones en la demanda final de crecimiento del producto creado especialmente en la tecnología de manufactura intensiva y otros sectores manufactureros. Sin embargo, la penetración de importaciones de bienes finales e intermedios son factores importantes para la creación de la desindustrialización

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en el período de 1990-1996. A pesar de las expectativas de estilo neoclásico, el período de reforma a partir de 1982 fue testigo de la sustitución de factores de gran lucha contra el trabajo, incluso en el sector de bienes comercializables. Además, la demanda de trabajo también parece respuesta al crecimiento de la producción menor en el período posterior a la liberalización que antes.

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■ *Introduction*

The relationship between opennes to trade and economic growth has been the one of the key issues of debate in development economics, and this debate has paved way of a large number of theoretical and empirical researches, most of which predominantly indicated the presence of a positive and significant relationship between trade opennes and economic growth (see Krueger, 1998; Greenaway *et al*., 2002; Yanıkkaya, 2003; Lewer and den Berg, 2003). However, another group of empirical researches has drawn our attention to other factors, rather than trade, in determining economic growth. Rodriguez and Rodrik (1999) and Frankel and Romer (1999), for example, put particular emphasis upon the role of geography which may be endogenous with a trade variable and overstates the estimated coefficient of the trade variable in a single OLS regression. Recent growth theory has also provided an important insight into understanding the determinants of economics growth and the role of international trade as its determinant. Likewise climate, instutional quality, R&D activities, the rule of law and property right have been considered as crucial determinants of economic growth, and it has been seen that the inclusion of these factors into an OLS estimation based on a large cross section data diminished the size of the coefficient of the trade variable, and puzzeled economists and policy makers regarding the importance of trade in designing right economic policies to promote economic growth. Despite all these competing empirical results, there is still enough room for further research, particularly based on a single country and using a different empirical methodology.

Although there has been a large amount of literature trying to resolve this debate, regression analysis appears to have been a standart tool used in the literature. However, the presence of this debate in empirical researches justifies the use of new empirical tools to investigate this relationship between trade opennes and economic growth. The *Input-Output* methodology in this regards is employed in this paper as a consequence of such need.

Unlike other researches in the literature, our investigation in this paper is based on the data from a single country, rather than cross section of countries. Among others, one important reason for this is that it is extremely difficult to control each country specific factor in a pooled data set, and accordingly it is difficult to interpret the empirical results for a single country in the same data set. However, the experience of a single country, which has liberalized her trade regime succefully, may provide better insight into understanding trade-growth relationship. Turkey in this respect was among those countries implementing trade reform policies which were promoted by IMF and World Bank in the early 1980s. It gradually opened up its trade regime starting in 1980, and after almost 30 years today it can be seen as one of the success story in the world.

Turkey has undergone drastic structural changes in its economy since the beginning of the 1980s. In the inhospitable international setting of the pre-1980 period, Turkey had pursued an inward-oriented industrialisation strategy, which was supported by a high degree of protection, exchange rate controls, negative real interest rates *etc*. However, this strategy was followed by severe balance of payment crises in 1979, which arose basically from the low level of exports and heavy dependence on imported capital and intermediate goods. International organisations, such as the International Monetary Funds (IMF) and World Bank, then urged Turkey to adopt a more outward-oriented development strategy emphasising greater reliance on market mechanism, reductions in barriers to imports and removal of all distortions that cause internal relative prices to deviate from the relative world prices. The Turkish structural changes in economic policies were far reaching, and can be attributed *to some extent* to trade reforms. The expectation from the liberalisation of the foreign trade was that increasing foreign trade would improve the allocation of economic resources and would encourage the domestic production. With various incentive measures and competitive foreign exchange rate, exports additionally were expected to take over a greater share in the international markets in favour of the Turkish tradeable goods.

In the post-reform period, the Turkish economy has been exposed to fluctuations in the world economy for nearly 20 years with liberal trade policies, and arises some concerns about whether international trade has helped the Turkish economy for (de) industrialisation. This paper accordingly attempts to examine changes in compositional structural change of the economy as a consequence of trade reform, and measures the extent of which trade-related factors were accounted for these changes. Compositional structural changes particularly allow us to analyse the changes in the relative importance of different demand factors in creating output and employment in the pre- and post-liberalisation periods.

The effects of structural adjustment programme in Turkey have been examined by various studies (see Arıcanlı and Rodrik, 1990, Günçavdı, Bleaney and McKay, 1999), but a few have put particular emphasis on the employment effects of structural adjustment programme (*e.g.* Günçavdı and Küçükçifçi, 2001, Günçavdı, Küçükçifçi and McKay, 2003, Günlük-Şenesen, 1998 and Yentürk, 1997). The Turkish structural adjustment programme aimed to increase the production of tradeable goods, while reducing their domestic consumption, so bringing about external balance. The measures

of the programme included both of them, which are likely to have adverse employment effects, such as fiscal contraction, import competition, *etc*., and others which are likely have favourable impacts on employment, such as increases in production of exportation and the production of tradeable goods (Rodrik, 1999). The net effect is, however, a matter of empirical investigation. The theory behind Structural Adjustment Programmes is provided by the conventional Heckscher-Ohlin (*H-O*) Theorem. This theorem predicts that countries will tend to be net exporters of their abundant factors and net importers of their scare factors. Previous studies for Turkey have consistently showed that the structural adjustment programme and trade reform as an integral part of it were ineffective creating additional employment in this expected direction for the labour abundant Turkish economy and, in fact, caused an economy-wide decline in employment in the pro-adjustment period (Günçavdı and Küçükçifçi, 2001, Günlük-Şenesen, 1998 and Yentürk, 1997). However, none of them has explicitly investigated the sources behind this decline in employment in the adjustment period. In this study, we investigate the role of various trade-related factors in the losses (or gains) in output and employment, and introduce a methodology to measure the changing role of these factors in sectoral and total output growth.

The remainder of the paper is organised as follows. The following section highlights the main aspects of economic development in the Turkish economy. In the second section the methodology is introduced to identify the sources of the changes in economic growth and employment. In the third section presents the sources of data and the results derived for at the total and sectoral levels. The final section gives concluding comments.

■ *Economic background and trade reform in turkey*

After two decades of experience with the import-substituting industrialisation strategy, the Turkish economy has undergone radical economic reforms towards relatively more open, outward-oriented strategy with increasing reliance on the guidance of the market mechanism (see Celasun and Rodrik, 1989; Arıcanlı and Rodrik, 1990). In the pre-reform period, Turkish development strategies had been based upon the premise that industrialisation was essential and could be encouraged only through policies that protected the domestic firms from foreign competition. Accordingly, in the sectors where the domestic production flourished, imports had been restricted through various quantity restrictions (see Baysan and Blitzer, 1990).[3][1] The Turkish economy, however, enjoyed this strategy with very high growth rates until 1976, which was 7.2 percent on average for the period of 1973-1976 (see Table 1). The public sector was the deriving force behind this economic growth, relying largely upon expansion of public demand and investment boom (see Celasun, 1990). Import demand required for ambitious growth rates, as a consequence, it was growing much more rapidly than exports, and it was thus worsening balance of payment of the country and leading the economy

[3] Krueger and Aktan (1992) demonstrate the shift in the restrictiveness of import licensing over the 1979-1988 period. They report that the number of commodities subject to any form of licensing fell sharply from 1600 in 1979 to 33 in 1988.

to being increasingly dependent on foreign borrowing. When the country's balance of payment position worsened, the widely-used means of external adjustment in the pre-reform period were the use of international reserve (if available), restricting imports through highly protective trade regime, and when imbalances reached unsustainable levels, sizeable devaluations of the Turkish lira (see Metin-Özcan *et al.,* 2001).[4] In the 1977-1980 period, the economy growth virtually collapsed to 1.3 percent on average (see Table 1), mainly because of supply-side bottlenecks imposed by unfavourable international setting of the time (see Bilginsoy, 1993).

Table 1
Main Macroeconomic Indicators

	1973-76	1977-80	1981-83	1984-88	1989-93	1994-96
			(Period Average in %)			
Real GDP growth rate	7.2	1.3	4.0	5.9	5.2	3.1
Savings/GDP	20.8	17.3	17.3	21.7	21.9	21.4
Investment/GDP	21.4	22.5	18.5	22.3	23.7	23.9
Exports/GDP	3.7	3.3	7.8	11.5	9.1	13.3
Imports/GDP	9.2	8.6	13.7	16.4	14.7	21.1
Total PSBR/GDP*	---	6.9	4.1	4.7	9.1	7.6
Main prices						
Inflation (average in %)	19.2	61.9	56.6	48.5	65.1	93.4
Real exchange rate** (% average)	-3.9	7.4	12.0	-0.69	-6.45	5.72
Real interest rate (average in %)	-10.7	-43.4	-13.2	2.96	4.66	24.4

* *CAB* and *PSBR* respectively stand for current account balance and public sector borrowing requirement.
** Calculated as $e(P^*/P)$, where e is the nominal exchange rate, P^* and P are the consumer price indices of the *USA* and Turkey respectively. Negative numbers indicate the overvaluation of currency, and *viceversa*.
Sources: Economic and social Indicators (1950-1998), Ankara: State Planning Organiation, 1997, and F. Özatay (2000), "A Quarterly Macroeconomics Model for a Highly Inflationary and Indebted Country: Turkey", *Economic Modelling,* 17: 1-11.

Under the trade regime prior to 1980, imports were subject to discretionary import licensing, along with restrictions, which governed the utilisation and allocation of foreign exchange. Protection was further intensified by extremely high levels of tariffs across the border. In this macroeconomic setting, there was little incentive for exports, given the high profitability of producing for the domestic market. Furthermore, this protection system, which became increasingly complex over time, led to the elimination of the possibility of competition in the domestic markets, and hence

4 As a consequence of restrictive trade regime and the fixed exchange rate policy, the Turkish lira appreciated in real term against the *US* dollar by 23 percent between 1975 and 1979 (Krueger and Aktan, 1992). In 1980, however, devaluation of *TL* reached to 144 percent in nominal, giving rise to a 30 percent real devaluation with 100 percent inflation in the same year (see Baysan and Blitzer, 1990).

contributed to high levels of inefficiency in the economy (see Krueger and Aktan, 1992 for detail).

Monetary policies in the same period were very much designed for complementing the trade regime and the industrialisation. Until 1982, the Turkish financial markets had been considered as financially repressed with intensive government involvements into financial markets in the forms of fixing interest rate and exchange rates, heavy tax burden on financial earnings, high liquidity and reserve requirement ratios, limiting the entry to the financial markets. Control was also exercised on the allocation of credit by public ownership of financial institutions providing long-run loan to the privileged private sector (see *e.g*. Akyüz, 1990; Atiyas and Ersel, 1995).

Starting in 1980, Turkey embarked on a series of policy reforms under the auspices of international institutions such as the IMF and the World Bank. Between 1980 and 1984, the World Bank granted Turkey five one-year structural adjustment loans (*SAL*s), amounting to $1.6 billion, which were all used in supporting policy reforms (Kirkpatrick and Öniş, 1991). The great extent of reforms took place in the period of 1980-1986, and involved trade and foreign exchange regimes and price reform aiming at reducing public involvement in commodity and financial markets. On the finance side, financial liberalisation became an integral part of overall reform programme. Financial reforms initially aimed at eliminating exogenous constraints, which had been created by intensive public involvement and administratively controlled interest rates. First interest rates were freed, allowing real interest to become positive in the pro-reform period. New financial institutions were introduced with a premise that they improve the efficiency of financial markets and the allocation of financial resources among alternative uses. The restrictions on the entry into the Turkish banking sector were removed.

As another integral part of the reform, the government implemented a rather gradual trade liberalisation because of the worry that a rapid import liberalisation would deteriorate the balance of payments condition of the country. The trade reform between 1980 and 1985 aimed at eliminating quantitative controls on imports (such as quota and licensing system), and included the reduction of stamp duty from 25 percent to 1 percent, gradual shifting of goods from most restrictive List II to liberalised List I (see Baysan and Blitzer, 1990 and Olgun and Togan, 1990). In January 1995, Turkey finally joined the custom union and eased foreign trade with European Union. The export promotion strategy was implemented by introducing a number of export incentives including tax rebates, subsidised credit and foreign exchange allocation that allowed for the duty-free import of raw materials.[5] An improvement in the balance of payments was of great importance to the government, first to gain international creditworthiness, then to compensate for the depressed domestic demand due to the austerity programme.

The economy responded to these changes in economic policies in the beginning very well. Exports grew very rapidly, at an annual rate of 24 percent, in the early reform period of 1980-1985 (see *SOP*, 2002). The economy-wide export-GNP ratio rose from 4.2 percent in 1980 to nearly 12 percent in 1985. The composition of exports also drastically

[5] The total value of direct incentives given to exporters reached, on average, 23.4 percent of total exports in 1983 (Baysan and Blitzer, 1990).

changed. The share of industrial good exports rose from 36 percent of total exports in 1980 to 75 percent in 1985, while that of agricultural exports, which had been the traditional export sector in Turkey for many years before the reforms, declined from 57.5 percent in 1980 to 21.6 percent in 1985. Following the import liberalisation, imports increased substantially at an annual growth rate of 56 percent from 1979 to 1980. The most striking feature of imports figures is the observation of a rapid increase in the share of the importation of consumption goods from 2.1 percent in 1980 to 8.6 percent in 1986. In the second phase of the reform in the period 1987-1990, the ratio of exports to imports increased to 71 percent from almost 64 percent in the initial period 1980-1985.

Table 2
The Share of Sectoral Production Levels in GDP (%)

			(average)		
	1968-73	1974-80	1981-85	1986-90	1991-96
Agriculture	36.1	30.5	21.7	17.7	15.6
Manufacturing	17.7	18.7	21.9	26.2	25.6
Services	35.9	39.6	48.2	46.5	45.6

Source: SPO (2000). *Economic And Social Indicators* (Ankara: SPO).

This drastic structural change in the economy is shown in Table 2, which reports the shares of sectoral production levels in GDP over the period of 1963-1996. The most drastic feature of the change was the enormous decline in the share of agricultural output from 36 percent in the period of 1968-1973 to nearly 16 percent in the period of 1991-1996. The share of service output, on the other hand, showed a substantial rise from 36 percent in 1968-1973 to 46 percent in the period of 1991-1996.

It is clear, from the discussion above, that the Turkish economy underwent a series of radical institutional and structural changes in the 1980s and 1990s. It is also obvious that changes in the trade regime of the country were crucial element of these radical changes. However, after nearly 20 years of experiences with liberal trade policies, the Turkish trade regime still raises some concerns about its contribution to economic problems that the country has recently encountered. In what follows we introduce the methodology to measure the extent of which changes in trade regime influence (de) industrialisation through output growth and employment generation.

■ *Methodology*

In this section, we introduce the accounting approach to the analysis of patterns of economic growth pioneered by Chenery *et al*. (1962) using input-output framework (also see Gregory *et al.,* 2001; Albala-Bertrand, 1999; and Feldman *et al*., 1987). We then apply this framework to the Turkish input-output tables in order to investigate the sources of economic growth in the Turkish economy.

Input-output models are based on some restrictive assumptions of fixed input-output coefficients with constant returns to scale, fixed factor shares in production and perfectly elastic supplies of factors of production (see Bulmer-Thomas, 1982). The Leontief production function is often criticised for its assumption of fixed coefficients in input use. Since we utilise input-output tables observed at two separate dates, we obtain direct measures of the change in input use over time. Therefore, the only necessary assumption on the production function is constant returns to scale across all inputs at each point in time. The model and its derivation are introduced in the following section.

(a) *The source of Changes in Gross Output*
In a standard input-output framework, the flows of all goods in an economy with n industries can be written as follows:

$$\mathbf{x} = \left(\mathbf{I} - \mathbf{A}\right)^{-1}\left(\mathbf{f} + \mathbf{e}\right) \tag{1}$$

where $\boldsymbol{I}$ and $\boldsymbol{A}$ respectively are the unit matrix and the matrix of input-output coefficients, whose element a_{ij} represents the unit-input requirement of the i^{th} industry for the output of the j^{th} industry, all with $(n \times n)$ dimension. $\boldsymbol{x}$ is the column vector of sectoral production, with $(n \times 1)$ dimension. $\boldsymbol{f}$ and $\boldsymbol{e}$, respectively, are the vectors of total final demand and exports, both with $(n \times 1)$ dimension.

The balance equation for the flow of domestic output can be written as follows:

$$\mathbf{x} = \mathbf{w}^{\mathbf{d}} + \mathbf{f}^{d} + \mathbf{e} \tag{2}$$

where $\boldsymbol{f}^{d}$: the vector of flows of domestic final use; $\boldsymbol{w}^{d}$: the vector of flows to domestic intermediate use, which is given by:

$$\mathbf{w}^{\mathbf{d}} = \mathbf{A}^{\mathbf{d}}\mathbf{x} \tag{3}$$

Upon substituting (3) into (2),

$$\mathbf{x} = \mathbf{A}^{\mathbf{d}}\mathbf{x} + \mathbf{f}^{d} + \mathbf{e} \tag{4}$$

Imports are included in this framework by assuming that imported goods for intermediate and final uses are in fixed proportion of total. In other words,

$$\mathbf{A}^{d} = \mathbf{hA} \text{ and } \mathbf{f}^{d} = \mathbf{sf} \tag{5}$$

where $\boldsymbol{A}^{d}$: the matrix of domestic input-output coefficients, $\boldsymbol{h}$: domestic supply ratio in intermediate uses, $\boldsymbol{s}$: domestic supply ratio in final uses. Substituting (4) into (3) renders the following:

$$\mathbf{x} = \mathbf{hAx} + \mathbf{sf} + \mathbf{e} \tag{6}$$

Solving (6) with respect to *x* gives

$$\mathbf{x} = \left(\mathbf{I} - \mathbf{hA}\right)^{-1}\left(\mathbf{sf} + \mathbf{e}\right) \tag{7}$$

This relationship holds for any point in time, and differencing it with respect to time and rearranging the resulting expression gives us the change in gross output between any two periods. This final expression allows us explicitly to see the sources of these changes in gross output as follows:

$$\Delta\mathbf{x} = \mathbf{R}\Delta\mathbf{sf} + \mathbf{Rs}\Delta\mathbf{f} + \mathbf{R}\Delta\mathbf{e} + \mathbf{R}\Delta\mathbf{h}\,\mathbf{A}\mathbf{x} + \mathbf{Rh}\Delta\mathbf{A}\,\mathbf{x} \tag{8}$$

where Δ denotes the change over time; $\mathbf{R} = \left(\mathbf{I} - \mathbf{hA}\right)^{-1}$ is the Leontief inverse matrix. The level terms in equation (8) can be evaluated as beginning and end values, which are similar to *Paasche* and *Laspeyres* index weighting. The derivation of the formula for either use is analogous and yields the following two results for *Paasche* and *Laspeyres* index weighting respectively: [4]

$$\Delta\mathbf{x} = \mathbf{R}_1\Delta\mathbf{sf}_0 + \mathbf{R}_1\mathbf{s}_1\Delta\mathbf{f} + \mathbf{R}_1\Delta\mathbf{e} + \mathbf{R}_1\Delta\mathbf{h}\mathbf{A}_0\mathbf{x}_0 + \mathbf{R}_1\mathbf{h}_0\Delta\mathbf{A}\mathbf{x}_0 \tag{9a}$$

$$\Delta\mathbf{x} = \mathbf{R}_0\Delta\mathbf{sf}_1 + \mathbf{R}_0\mathbf{s}_0\Delta\mathbf{f} + \mathbf{R}_0\Delta\mathbf{e} + \mathbf{R}_0\Delta\,\mathbf{h}\mathbf{A}_1\mathbf{x}_1 + \mathbf{R}_0\mathbf{h}_0\Delta\mathbf{A}\mathbf{x}_1 \tag{9b}$$

where the subscript *0* and *1* represent the initial and terminal years respectively. Equation (9) allocates the change in gross output among changes in the various components of its use: the changes in domestic final demand (Δ*f*); the changes in exports (Δ*e*); the changes in the home shares in final consumption (*import substitution* in final demand) (Δ*s*); and the changes in the home shares in intermediate goods (*import substitution* in intermediate goods) (Δ*h*). The term Δ*A* explicitly allows the input-use coefficients to vary over time in a way that will be determined by the data. These changes in Leontief coefficients are interpreted as technical changes in the production. In what follows, equation (9) is then applied to the data of the Turkish economy.

Output Growth and Employment

Our interest is in assessing the sources of changes in employment in the Turkish economy over a period. In doing so, we extend the derivations in the previous section towards decomposing the sources of sectoral employment demand. We implicitly assume that changes in employment are due to output growth and factor substitution in production. Therefore, the factors that cause to change gross output can also be considered as the sources of changes in employment. Total labour requirements of producing *x* are given by:

$$L = lx \tag{10}$$

where **L** is the vector of sectoral employment levels, **l** is the vector of employment coefficients required in the production of unit output (expressed as a diagonal matrix). Similarly, we difference (10) with respect to time to measure the sources of changes in employment as follows:

(11) $$\Delta \mathbf{L} = \mathbf{L}_1 - \mathbf{L}_0$$

where *0* and *1* represent the initial and terminal points in time. To be comparability with the earlier derivation we use the Laspeyres weighting, and derive the following:

(12) $$\Delta \mathbf{L} = \mathbf{l}_0 \Delta \mathbf{X} + \Delta \mathbf{l} \mathbf{X}_1$$

In equation (12), changes in demand for employment can be attributed to two different sources; namely changes in sectoral gross output at constant labour use (the first term on the right-hand side), and changes in the use of labour per unit output (the second term on the right-hand side). Substituting (9) into (12) allows us to see the allocation of changes in demand for employment across the various sources of output on the one hand, and labour requirements per unit of output on the other.

(13) $$\Delta \mathbf{L} = \left(\mathbf{l}_0 \mathbf{R}_0 \Delta \mathbf{sf}_1 + \mathbf{l}_0 \mathbf{R}_0 \mathbf{s}_0 \Delta \mathbf{f} + \mathbf{l}_0 \mathbf{R}_0 \Delta \mathbf{e} + \mathbf{l}_0 \mathbf{R}_0 \Delta \mathbf{h} \mathbf{A}_1 \mathbf{x}_1 + \mathbf{l}_0 \mathbf{R}_0 \mathbf{h}_0 \Delta \mathbf{A} \mathbf{x}_1\right) + \Delta \mathbf{l} \mathbf{x}_1$$

Equation (13) is the expression, showing that changes in employment are associated with the evaluation of the various constituents of demand and technology. The results of this analysis are presented in the next section.

■ *Empirical results*

a) *Data*

Our analysis is based on the input-output tables for the years 1973, 1985, 1990 and 1996. Our focus on these four years was primarily dictated by the availability and reliability of detailed data on input-output tables. Although another table is available for 1979, the analysis based on this table lacks credibility because this year was a year of foreign exchange shortage, which caused various constraints on the supply side of the economy (see Bilginsoy, 1993). These three papers, however, are candidates of reflecting the different phases of the Turkish economy. The first table, for example, compromises structural information regarding the inward-oriented strategy before 1980. In order to see the structural changes after the reform, other tables can be used. The table for 1985 represents the economic structure just after the initial reforms, whereas information on the economy after the capital account liberalisation can be extracted from the table for 1990. The distortions created by the effects of increased public involvement in capital markets and large capital flows could be captured in the recently published 1996 table (see State Institute of Statistics, 2002).

The first three input-output tables for Turkey contain 64 industries while the last one for 1996 possesses only 97 sectors. However, the number of sectors must be reduced to 24 because price indices and employment data used in this study are available only for 24 sectors. Sectoral employment data in Turkey are collected from different sources, and typically cover formal employment figures which are recorded

by the *Social Insurance Agency* and the *Civil Servants' Pension Funds* (see Celasun, 1990 for detail). However, the use of informal labour is widespread in the Turkish economy (see Özar, 1995; Köse and Yeldan, 1996; Yeldan, 2000 for further discussion). For example, Günlük-Şenesen (1998) estimated that the use of informal labour in 1990 is 98 percent of total employment in agriculture, 44 percent in manufacturing and 48 percent in services. The estimated figures on the use of labour (including formal and informal) in all 24 industries are borrowed from Günlük-Şenesen (1998) for the year 1973 and 1990, and these figures show consistency with the estimates of similar figures in Köse and Yeldan (1996). Employment data for 1985 and 1996 have been compiled from *Household Labour Force Survey Results* April 1998 by the authors and adjusted according to Günlük-Şenesen (1998) for the inclusion of the informal labour force (see *SIS*, 1998).

Our analysis is based on aggregated tables by commodity groups, rather than *industry by industry* input-output tables. All sectors are classified to seven aggregate sectors; namely *primary and extractive sectors, primary manufacturing, technology-intensive manufacturing, other manufacturing, less tradeable services, more tradeable services and financial services*. The intertemporal comparison of input-output tables for different years necessitates handling changes in price levels, particularly in any study involving a highly inflationary country such as Turkey. All data used in our analysis have therefore been deflated to 1973 prices (see *Appendix B*). It must be noted that the price indices for services are implicit *GNP* deflator computed from State Institute of Statistics. Further details about data and aggregation are given in *Appendix C*.

b) Results

The losses (or gains) of output and employment in the Turkish economy as a result of foreign trade can be attributed to some trade-related factors such as *import penetration* and *substitution effects* and *exports* along with changes in technology and final demand. After the trade liberalisation foreign trade became easier, and an increase in import competition could cause the domestic production to loose market share with a likely decline in output and employment. Import substitution, on the other hand, encourages domestic production of formally imported goods, and positively contributed to the sectoral as well as total output levels. Exports, in this regard, are expected to contribute to output positively and may increase employment level dependent on the production technology of the domestic economy. Understanding which of these effects has contributed most directly to changes in output and employment is crucial to assessing the nature of (de) industrialisation in Turkey. In this section we examine the role of each of these factors in output growth and changes in employment using the methodology introduced in the third section.

The first group of our results is shown in Table 3, which reports the shares and growth rates of sectoral output aggregated by commodity groups. Over the entire period between 1973 and 1996, the economy seems to have grown on average by 6.5 percent per annum. The striking feature of the growth rates over the entire period is that the economy

grew more rapid in the period of 1985-1990 than others, with 8.7 percent growth rate on average. This can be attributed to expansionary macroeconomic policies, which became feasible after the capital account liberalisation in 1989. However, the growth performance of the economy dropped drastically in the last period of 1990-1996, particularly with the influence of Gulf War in 1991 and the economic crises in 1994.

After the implementation of the structural adjustment programme, it was expected that new incentive structure encouraged the production of mostly tradeable goods. In the first sub-period in the table, corresponding to the initial stage of the programme, the growth performances of the sectors like primary & extractive and the finance sectors appear not to have been particularly impressive due to the growth rates lower than the entire economy. However, the sector that can be considered as relatively technology intensive performed better than the entire economy in the period of 1973-1985, with the only exception of the growth of more tradeable service sector. This performance caused a substantial rise in output share of the technology manufacturer in 1985. In the following period of 1985-1990, the less tradeable service sectors grew relatively more rapid than the entire economy with 10 percent growth rate per annum on average, and led the share of this sector in total output to a slight increase from 1985 to 1990. With the 26 percent share, the less tradeable service output became the largest sectoral production in the Turkish economy in 1996.

Table 3
The Shares & Growth Rates of Sectoral Output (%)

	Output Growth		Shares of Sectoral Output	
	Overall Period	Annual*	Initial Year	Terminal Year
1973-1996				
Primary and extractive sectors	235.0	5.4	22.6	17.8
Primary manufacturing	282.9	6.0	27.3	24.7
High technology manufacturing	429.6	7.5	9.6	12.0
Other manufacturing	424.2	7.5	7.0	8.7
Less tradeable services	377.8	7.0	23.1	26.1
More tradeable services	399.8	7.3	8.2	9.7
Financial services	130.0	3.7	2.2	1.2
TOTAL	324.2	6.5	100	100
1973-1985				
Primary and extractive sectors	52.5	3.6	22.6	16.8
Primary manufacturing	117.7	6.7	27.3	29.0
High technology manufacturing	138.4	7.5	9.6	11.2
Other manufacturing	123.7	6.9	7.0	7.7
Less tradeable services	102.7	6.1	23.1	22.9
More tradeable services	163.9	8.4	8.2	10.6

	Output Growth		Shares of Sectoral Output	
	Overall Period	Annual*	Initial Year	Terminal Year
Financial services	75.1	4.8	2.2	1.9
	104.8	6.2	100	100
1985-1990				
Primary and extractive sectors	71.0	11.3	16.8	18.9
Primary manufacturing	44.2	7.6	29.0	27.6
High technology manufacturing	29.4	5.3	11.2	9.5
Other manufacturing	47.0	8.0	7.7	7.4
Less tradeable services	61.3	10.0	22.9	24.4
More tradeable services	54.2	9.0	10.6	10.7
Financial services	12.5	2.4	1.9	1.4
TOTAL	51.7	8.7	100	100
1990-1996				
Primary and extractive sectors	28.5	4.3	18.9	17.8
Primary manufacturing	22.0	3.4	27.6	24.7
High technology manufacturing	71.6	9.4	9.5	12.0
Other manufacturing	59.5	8.1	7.4	8.7
Less tradeable services	46.1	6.5	24.4	26.1
More tradeable services	22.9	3.5	10.7	9ç7
Financial services	16.8	2.6	1.4	1.2
TOTAL	36.6	5.3	100	100

*Annual growth rates are calculated as geometric average of each period.

Source: Authors' computations.

Somewhat surprisingly, the performance of the financial sector was disappointing especially in the second sub-period of 1985-1990. Although various incentive measures were undertaken along with deregulation in the financial sector in the early 1980s, its growth rate appeared to be 5 percent, second lowest in the economy after the primary and extractive sectors, and then sharply declined by almost 50 percent in the period of 1985-1990. The share of financial output also continuously declined in the post-liberalisation period. The high technology manufacturing sector grew in the same period more slowly than total output. The other manufacturing sector first slumped in the early stage of reform and then revived in the last sub-period.

Output growth exhibits a great fluctuation, in the entire economy. After a 6.2 percent rate in the first sub-period, growth revived substantially and then slumped to 5 percent. To examine the causes of this fluctuation we decomposed the output growth rates into five different sources as defined in the previous section, and report them in Table (4a) and (4b).The results in the tables are based on two different weighting, namely *Laspeyres* and *Paasche*. Each table consists of four different panels corresponding to three sub-periods and the entire period. The sources of growth are shown in the columns of the tables. Figures in the tables are the percentage shares of each source in the total output growth.

Table 4a
The Sources of Changes in Gross Output: Laspeyres Weighting (%)

Sectors	Final demand	Exports demand	Import substitution in final demand	Import substitution in intermediate goods	Changes in Technology
1973-1996					
Primary and extractive sectors	99.5	17.3	12.4	-12.2	-17.1
Primary manufacturing	74.8	21.7	4.4	-4.0	3.2
High technology manufacturing	71.0	27.3	8.0	-5.7	-0.5
Other manufacturing	50.8	25.1	20.2	-6.8	10.8
Less tradeable services	79.1	12.5	1.1	-0.7	8.1
More tradeable services	58.2	27.7	1.7	-1.1	13.5
Financial services	211.9	52.0	16.7	-12.0	-168.7
TOTAL	76.8	20.4	6.6	-4.7	0.9
1973-1985					
Primary and extractive sectors	95.6	27.8	42.0	-19.2	-46.2
Primary manufacturing	77.0	22.8	3.4	-2.7	-0.6
High technology manufacturing	65.0	22.7	-5.9	17.1	1.1
Other manufacturing	28.2	50.9	25.3	-2.8	-1.7
Less tradeable services	89.2	14.5	1.1	0.1	-5.0
More tradeable services	56.9	30.1	1.4	-0.1	11.8
Financial services	109.4	37.8	11.1	-1.5	-56.7
TOTAL	74.3	25.0	7.7	-1.1	-5.9
1985-1990					
Primary and extractive sectors	111.7	2.5	-22.1	-4.0	11.9
Primary manufacturing	79.9	2.6	2.1	-0.6	16.1
High technology manufacturing	57.5	10.7	59.9	-37.6	9.5
Other manufacturing	18.5	-9.1	49.1	-4.5	46.1
Less tradeable services	76.7	3.5	1.1	-0.6	19.3
More tradeable services	73.1	7.8	1.6	-1.4	18.9
Financial services	375.9	-10.6	18.2	-19.2	-264.3
TOTAL	81.2	3.1	3.2	-4.2	16.7
1990-1996					
Primary and extractive sectors	93.3	23.7	0.7	-14.3	-3.3
Primary manufacturing	72.2	48.0	1.3	-6.9	-14.6
High technology manufacturing	122.6	37.7	-27.6	-19.3	-13.3
Other manufacturing	163.5	29.5	-75.0	-13.5	-4.5
Less tradeable services	79.5	19.7	-2.9	-1.6	5.2
More tradeable services	80.4	62.0	-10.5	-5.2	-26.7
Financial services	211.0	74.8	-19.3	-15.1	-151.5
TOTAL	99.0	32.7	-15.6	-9.4	-7.1

Source: Authors' computations.

Table 4b
The Sources of Changes in Gross Output: Paasche Weighting (%)

Sectors	Final demand	Exports demand	Import substitution in final demand	Import substitution in intermediate goods	Changes in Technology
1973-1996					
Primary and extractive sectors	92.0	12.0	3.1	-3.8	-3.2
Primary manufacturing	77.4	21.5	1.3	-0.9	0.8
High technology manufacturing	74.9	24.7	1.8	-1.5	0.1
Other manufacturing	67.8	24.8	5.9	-1.5	2.9
Less tradeable services	84.4	13.6	0.3	-0.2	1.9
More tradeable services	67.4	29.4	0.5	-0.3	3.0
Financial services	117.7	22.4	1.6	-1.4	-40.3
TOTAL	79.8	19.3	1.7	-1.3	0.4
1973-1985					
Primary and extractive sectors	80.8	19.9	30.2	-6.5	-24.4
Primary manufacturing	76.9	22.5	2.0	-1.3	-0.1
High technology manufacturing	67.8	23.6	-1.6	6.7	3.5
Other manufacturing	29.4	49.8	22.6	-2.1	0.3
Less tradeable services	88.0	13.8	0.5	0.1	-2.4
More tradeable services	61.7	31.4	1.3	0.0	5.6
Financial services	90.1	29.8	6.8	-0.1	-26.6
TOTAL	73.0	23.9	6.1	-0.4	-2.6
1985-1990					
Primary and extractive sectors	103.2	2.6	-10.5	-3.3	7.9
Primary manufacturing	84.1	2.7	2.1	-0.3	11.5
High technology manufacturing	37.3	9.9	70.4	-23.8	6.2
Other manufacturing	25.7	-8.2	52.6	-4.9	34.9
Less tradeable services	81.3	3.7	1.9	-0.5	13.5
More tradeable services	76.2	7.7	3.3	-0.9	13.7
Financial services	308.0	-14.3	9.7	-6.8	-196.6
TOTAL	80.9	3.2	7.2	-3.0	11.8
1990-1996					
Primary and extractive sectors	89.8	21.6	1.6	-11.5	-1.5
Primary manufacturing	65.7	45.8	3.5	-4.5	-10.5
High technology manufacturing	94.1	33.4	-8.9	-13.0	-5.6
Other manufacturing	106.2	27.1	-24.6	-5.5	-3.2
Less tradeable services	77.5	19.8	-0.8	-0.9	4.3
More tradeable services	64.2	59.1	-2.4	-2.6	-18.3
Financial services	159.8	60.5	-3.3	-8.2	-108.9
TOTAL	83.6	30.7	-4.2	-6.0	-4.0

Source: Authors' computations.

Decomposition of the changes (Table 4a)[6] reveals that over the whole period, final demand, exports, home share in final demand (*i.e*. import substitution) and the changes in Leontief coefficients were positive influences for output growth, and falling home share in intermediate goods was a negative influence. The growth of domestic final demand made the largest contribution to total output growth with the nearly 77 percent share. The extra unit of exports generated the second largest impact on total output, and this was followed by import substitutions in intermediate goods. Also the production technology in the entire period appears to have changed in a way of demanding more domestic production, and caused to increase total output in the economy.

There were also differences between sub-periods. Somewhat surprisingly, the impact of import penetration due to trade liberalisation was not as much as expected in the 1973-1985 period. On the contrary, import substitution in final demand had almost 8 percent share in changes in total output while import penetration in intermediate goods was responsible only 1 percent decline in output. This finding is particularly important because an easy import with trade reform was expected to increase import penetration. We must also note that the period of 1973-1985 includes the period of import-substitution strategy until 1980 and exposed to the output generation effects of this strategy. However, import penetration did not appear to be a discouraging factor in output growth even in the post-liberalisation period of 1985-1990. Exports, on the other hand, in the same period accounted for only 25 percent of total changes in output. It can be considered as the contribution of the Turkish trade reform and export promotion policies to this output growth.

Table 5 reports better presentation of the evidence regarding the role of the trade-related sources of output growth. The formation of Table 5 is based on the numerical results shown in Table 4. As presented earlier, foreign trade may influence output growth through three distinctive channels, which can be regarded as the trade-related sources of output growth; namely exports (foreign demand for Turkish goods), import substitution and import penetration (or competition). Increases in first two sources encourage the domestic production while a rise in the import competition is expected to decrease it. Any sources of growth written bold in each cell represent the most dominant factors that influence the domestic production. In the period of 1973-1996, for example, exports and import substitution in final goods appear to be the most dominant two factors on the sectoral output growth for the primary and extractive sector. Although import penetration seems to have discouraged domestic production substantially (by 12 percent in Table 4a), this effect cancelled out by the sum of the positive contributions created by exports and import substitution in final demand. In the entire period between 1973 and 1996, the foreign trade (through exports, import substitution in final goods and import penetration in intermediate goods) can be

[6] Table 4 includes the results calculated by using two different weighting. Since the qualitative results for both weighting appear to render the similar interpretation, our analysis is only based on the results of Laspeyres weighting.

Table 5
The Trade-related sources of output growth by sector

Sectors	1973-1996	1973-1985	1985-1990	1990-1996
Primary and extractive sectors	**exports**	**exports**	---	**exports**
	import substitution in final goods	**import substitution in final goods**	**import penetration in final goods**	---
	import penetration in inputs	--	**import penetration in inputs**	---
Primary manufacturing	**exports**	**exports**	exports	**exports**
	import substitution in final goods	**import substitution in final goods**	import substitution in final goods	---
	import penetration in inputs	---	---	import penetration in inputs
High technology manufacturing	**exports**	**exports**	**exports**	exports
	import substitution in final goods	import penetration in final goods	**import substitution in final goods**	**import penetration in final goods**
	import penetration in inputs	**import substitution in inputs**	import penetration in inputs	**import penetration in inputs**
Other manufacturing	**exports**	**exports**	(exports)	exports
	import substitution in final goods	**import substitution in final goods**	**import substitution in final goods**	**import penetration in final goods**
	import penetration in inputs	---	import penetration in inputs	**import penetration in inputs**
Less tradeable services	**exports**	**exports**	exports	**exports**
	---	---	---	---
	---	---	---	---
More tradeable sectors	**exports**	**exports**	exports	**exports**
	---	---	---	import penetration in final goods
	---	---	---	import penetration in inputs
Finance sectors	**exports**	**exports**	**(exports)**	**exports**
	import substitution in final goods	**import substitution in final goods**	import substitution in final goods	import penetration in final goods
	import penetration in inputs	---	**import penetration in inputs**	import penetration in inputs
Total	**exports**	**exports**	exports	**exports**
	Import substitution in final goods	**import substitution in final goods**	import substitution in final goods	import penetration in final goods
	Import penetration in inputs	---	**Import penetration in inputs**	import penetration in inputs

Notes: An expression in each cell of the table shows only the trade-related sources of sectoral output growth. Expressions written in bold indicate the dominant positive and negative effect on output growth. Exports in brackets represent the substantial negative effects.

accounted for the 22.3 percent[7] of overall output growth in the Turkish economy. Foreign trade seems to explain 32 percent of output growth in the first-sub-period of 1973-1985, while only 2 percent in the period of 1985-1990. Despite a small increase in this share, it is still very difficult to express with nearly 8 percent share that the Turkish output growth was trade-driven growth. It seems from our results that the Turkish domestic production has been competing with foreign goods which penetrated the Turkish market substantially and discouraged 25 percent of domestic production in the period of 1990-1996.

c) Structural changes and demand for labour

Table 6 contains the decomposition of the employment change as noted in equation (12), which reveals the impacts of changing technology and business organisation on the demand for labour. As seen in the table employment, generation effects of gross output are largely counterbalanced by decreasing labour-input requirement per unit of gross output. Labour-saving technology and factor substitution in favour of capital play a major role in these negative effects of change in employment-output ratio.

Table 6a
Decomposition of change in employment: Laspeyres Weighting (%)

	Change in gross output	Change in employment income ratio	Total change in employment
1973-1996			
Primary & Extractive sector	234.96	-225.22	9.74
Primary manufacturing	282.90	-193.09	89.82
Technology-intensive manufacturing	429.58	-324.68	104.90
Other manufacturing	424.15	-383.66	40.48
Less tradeable	377.82	-245.45	132.38
More tradeable	399.77	-324.07	75.70
Finance	130.01	246.79	376.80
Total	324.24	-276.74	47.50
1973-1985			
Primary & Extractive sector	52.45	-53.31	-0.86
Primary manufacturing	117.67	-73.96	43.70
Technology-intensive manufacturing	138.43	-86.11	52.32
Other manufacturing	123.70	-93.75	29.95
Less tradeable	102.74	-40.44	62.30
More tradeable	163.89	-121.66	42.23
Finance	75.08	174.99	250.08
Total	104.77	-84.60	20.17

[7] The numerical value of the share of the trade was calculated from the values in Table 4a. Particularly 22.3 percent was derived from the sum of the share of exports, 20.4 percent, the share of import substitution, 6.6 and the share of import penetration, -4.7 percent.

Table 6a (continuation)
Decomposition of change in employment: Laspeyres Weighting (%)

	Change in gross output	Change in employment income ratio	Total change in employment
1985-1990			
Primary & Extractive sector	70.99	-66.41	4.58
Primary manufacturing	44.23	-39.43	4.81
Technology-intensive manufacturing	29.44	-23.24	6.20
Other manufacturing	46.94	-29.70	17.24
Less tradeable	61.33	-40.08	21.25
More tradeable	54.16	-42.58	11.58
Finance	12.50	-1.92	10.59
Total	51.65	-42.53	9.11
1990-1996			
Primary & Extractive sector	28.50	-22.65	5.85
Primary manufacturing	21.96	4.07	26.03
Technology-intensive manufacturing	71.59	-44.93	26.66
Other manufacturing	59.46	-67.25	-7.79
Less tradeable	46.09	-28.01	18.08
More tradeable	22.85	-12.14	10.72
Finance	16.77	6.39	23.16
Total	36.62	-24.13	12.49

Source: Authors' computations.

Table 6b
Decomposition of change in employment: Paasche Weighting (%)

	Change in gross output	Change in employment income ratio	Total change in employment
1973-1996			
Primary & Extractive sector	70.15	-61.27	8.88
Primary manufacturing	73.88	-26.57	47.32
Technology-intensive manufacturing	81.12	-29.92	51.20
Other manufacturing	80.92	-52.11	28.82
Less tradeable	79.07	-22.11	56.97
More tradeable	79.99	-36.90	13.09
Finance	56.52	22.50	79.03
Total	76.43	-44.22	32.21
1973-1985			
Primary & Extractive sector	34.41	-35.27	-0.87
Primary manufacturing	54.06	-23.65	30.41
Technology-intensive manufacturing	58.06	-23.71	34.35

Table 6b (continuation)
Decomposition of change in employment: Paasche Weighting (%)

	Change in gross output	Change in employment income ratio	Total change in employment
Other manufacturing	55.30	-32.25	23.05
Less tradeable	50.68	-12.29	38.39
More tradeable	62.10	-32.41	29.69
Finance	42.88	28.55	71.43
Total	51.16	-34.38	16.79
1985-1990			
Primary & Extractive sector	41.52	-37.14	4.38
Primary manufacturing	30.67	-26.08	4.59
Technology-intensive manufacturing	22.75	-16.90	5.84
Other manufacturing	31.95	-17.24	14.71
Less tradeable	38.02	-20.49	17.53
More tradeable	35.13	-24.76	10.38
Finance	11.11	-1.54	9.57
Total	34.06	-25.71	8.35
1990-1996			
Primary & Extractive sector	22.1	-16.65	5.52
Primary manufacturing	18.01	2.65	20.65
Technology-intensive manufacturing	41.72	-20.67	21.05
Other manufacturing	37.29	-45.74	-8.45
Less tradeable	31.55	-16.24	15.31
More tradeable	18.60	-8.92	9.68
Finance	14.36	4.44	18.80
Total	26.80	-15.70	11.11

Source: Authors' computations.

Closer examinations of the sub-periods of 1973-1996 give rise to the fact that the employment-generation ability of the economy drastically declined over time. While employment grew 20 percent in the period of 1973-1985, this growth rate dramatically felt to 9 percent in the period of 1985-1990, and then rose to 12 percent in the last period (yet it did not reach to its initial level). It is clear from this evidence that the Turkish economy, overall, lost its employment generation ability in the post-liberalisation period.

This undistinguished performance of the economy appears to have resulted from two separated factors, namely employment generation effects of output growth and changes in employment-income ratio. Considering the former effect, demand for labour seems to response to output growth eventually less than the pre-liberalisation period. It is also evident from Table 6a, that factor substitution appears to have taken place in favour of capital, rather than labour.

In a sectoral investigation, the finance sector comes forward with its 250 percent total change in employment in the period of 1973-1985. This is particularly crucial because factor substitution was the primary source of employment generated with its 175 percent. The output growth in this sector led only 75 percent of labour demand in this period. This distinguished record of the finance sector went along with liberalisation efforts of the sector after 1982. However, this trend dramatically changed in the period of 1985-1990. The positive and substantial effect of factor substitution reversed and led to almost 2 percent decline in labour demand in the sector.

The less tradeable goods sector became the second leading sources of employment in the economy in the first port-liberalisation period with the growth rates 62 percent in the 1973-1985 period and 21 percent in the period of 1985-1990. Interestingly, this leading role took place in the period where the incentive structure of the economy changed in favour of tradeable and production of the non-tradeable was expected to have declined.

Another interesting result of Table 6a is that factor substitution took place, to a great extent, against labour in the post-liberalisation period. Among other sectors, this is especially important for the tradeable sector. This is because the export-promotion policy adopted in the early 1980 was expected to encouraged labour intensive export goods. However, the results in Table 6a indicate that the factor component of the tradeable goods sector changed against labour in the period of 1985-1990. This particular result is consistent with Günçavdı and Küçükçifçi (2001) and Günçavdı *et al.* (2001).

■ *Conclusion*

The effect of foreign trade has been substantially high and positive on the domestic production in the periods covering the periods of both import substitution and trade reform between 1973 and 1985. Despite this effect was still positive, its magnitude seems to have dropped drastically in the period of 1985-1990 where the Turkish economy was open to international markets. This undistinguished growth performance of foreign trade was because of increased import competition in final demand and intermediate goods. Our findings implicitly show that output gains created by trade in the Turkish economy appear to have been temporary, possible only in the early years of reforms. However, this does not mean that trade reform itself was unsuccessful. This undistinguished performance of trade in terms of creating extra domestic production might be related to macroeconomic environment. Fiscal expansion, overvaluation of *TL* in some periods and macroeconomic uncertainty that discourage domestic production may also be taken responsible for unimpressive growth performance of trade. Empirical results also show that the employment generation capacity of the Turkish economy drastically declined in the post-liberalisation period. Despite neoclassical expectations, the reform period after 1982 witnessed large factor substitution against labour, even in the tradeable goods sector. Additionally, labour demand also appears to response to output growth less in the post-liberalisation period than before.

■ Appendix A: *Derivation of Equation (9) in Detail*

We start the formal derivation from equation (7)

(A-1) $$\mathbf{x} = \left(\mathbf{I} - \mathbf{hA}\right)^{-1}\left(\mathbf{sf} + \mathbf{e}\right)$$

For simplicity and tractability, let $\mathbf{D} = \left(\mathbf{I} - \mathbf{hA}\right)$ and $\mathbf{g} = \left(\mathbf{sf} + \mathbf{e}\right)$, and write equation (A-1) as follows:

(A-2) $$\mathbf{x} = \mathbf{D}^{-1}\mathbf{g}$$

Equation (A-2) holds for any point in time with *x, A, f, e, h* and *s*. Then differencing (A-2) yields

(A-3) $$\Delta\mathbf{x} = \mathbf{x}_1 - \mathbf{x}_0 = \Delta\left(\mathbf{D}^{-1}\mathbf{g}\right) = \left(\mathbf{D}_1^{-1}\mathbf{g}_1\right) - \left(\mathbf{D}_0^{-1}\mathbf{g}_0\right)$$

Equation (A-3) can be expressed in a way that each term on the right-hand side of the equation increases by the amounts of ΔD^{-1} and Δg respectively between time 0 to time 1. We then obtain

(A-4) $$\Delta\mathbf{x} = \left(\mathbf{D}_0^{-1} + \Delta\mathbf{D}^{-1}\right)\left(\mathbf{g}_0 + \Delta\mathbf{g}\right) - \mathbf{D}_0^{-1}\mathbf{g}_0$$

Upon expanding (B-4), we get

(A-5) $$\Delta\mathbf{x} = \mathbf{D}_0^{-1}\mathbf{g}_0 + \mathbf{D}_0^{-1}\Delta\mathbf{g} + \Delta\mathbf{D}^{-1}\mathbf{g}_0 + \Delta\mathbf{D}^{-1}\Delta\mathbf{g} - \mathbf{D}_0^{-1}\mathbf{g}_0$$

Cancelling out the similar terms, we finally derive the following expression:

(A-6) $$\Delta\mathbf{x} = \mathbf{D}_0^{-1}\Delta\mathbf{g} + \Delta\mathbf{D}^{-1}\mathbf{g}_0 + \Delta\mathbf{D}^{-1}\Delta\mathbf{g}$$

In calculating equation (A-6), it is quite important the way we handle the last interactive term (see Martin and Evans, 1981). Some similar studies in the literature recognise the presence of the last term, but none explicitly calculate it, preferring instead to calculate it as a residual. However, we here follow a different way. In the present context, we assume that either the first or the second term on the right hand side of (A-6) can compromise this last term. If the first term includes the last term, then equation (A-6) become weighted by the terminal year of the structural D^{-1} and the base year of the volume *g*, and vice versa if the this term is absorbed by the second one. This is rather similar to *Paasche* and *Laspeyres* index weightings respectively. Given this explanation, equation (A-6) respectively can be re-written as follows:

(A-7) $$\Delta\mathbf{x} = \mathbf{D}_1^{-1}\Delta\mathbf{g} + \Delta\mathbf{D}^{-1}\mathbf{g}_0$$

(A-8) $$\Delta\mathbf{x} = \mathbf{D}_0^{-1}\Delta\mathbf{g} + \Delta\mathbf{D}^{-1}\mathbf{g}_1$$

Despite the fact that the calculations using both weighting yield the analogous, we use the Laspeyres weighting for presentation. However, the same derivation can be repeated for the Paasche weighting. For our present purpose, the first term on the right-hand side of (A-8) can be decomposed as follows:

(A-9) $$\mathbf{D}_0^{-1}\Delta\,\mathbf{g} = \mathbf{D}_0^{-1}\left[\left(\mathbf{s}_1\,\mathbf{f}_1 + \mathbf{e}_1\right) - \left(\mathbf{s}_0\,\mathbf{f}_0 + \mathbf{e}_0\right)\right]$$

Adding and subtracting the term $\mathbf{s}_0\,\mathbf{f}_1$ from the right-hand side of (A-9) yields:

(A-10) $$\mathbf{D}_0^{-1}\Delta\mathbf{g} = \mathbf{D}_0^{-1}\left(\Delta\mathbf{s}\mathbf{f}_1 + \mathbf{s}_0\Delta\,\mathbf{f} + \Delta\mathbf{e}\right)$$

The second-term on the right-hand side of (A-8), on the other hand, can be decomposed as:

(A-11) $$\Delta\mathbf{D}^{-1}\mathbf{g}_1 = \left(\mathbf{D}_1^{-1} - \mathbf{D}_0^{-1}\right)\mathbf{g}_1$$

Since multiplying the first and the second term in the bracket on the right-hand side of (A-11) by ($D_0^{-1}D_0$) and ($D_1D_1^{-1}$) does not change equation (A-11), the following can also be written:

(A-12) $$\Delta\,\mathbf{D}^{-1}\mathbf{g}_1 = \left(\mathbf{D}_0^{-1}\mathbf{D}_0\mathbf{D}_1^{-1} - \mathbf{D}_0^{-1}\mathbf{D}_1\mathbf{D}_1^{-1}\right)\mathbf{g}_1$$

Upon re-written (A-12),

(A-13) $$\Delta\,\mathbf{D}^{-1}\mathbf{g}_1 = \mathbf{D}_0^{-1}\left(\mathbf{D}_0\mathbf{D}_1^{-1} - \mathbf{D}_1\mathbf{D}_1^{-1}\right)\mathbf{g}_1$$

From (A-13), the following can also be derived:

(A-14) $$\Delta\,\mathbf{D}^{-1}\mathbf{g}_1 = \mathbf{D}_0^{-1}\left(\mathbf{D}_0 - \mathbf{D}_1\right)\mathbf{D}_1^{-1}\mathbf{g}_1$$

From equation (A-2), let $D_1^{-1}g_1 = x_1$ and write (A-14) as follows:

(A-15) $$\Delta\mathbf{D}^{-1}\mathbf{g}_1 = \mathbf{D}_0^{-1}\left(\mathbf{D}_0 - \mathbf{D}_1\right)\mathbf{x}_1$$

Substituting the definition of D_0 and D_1 in the (A-15) yields

(A-16) $$\Delta\mathbf{D}^{-1}\mathbf{g}_1 = \mathbf{D}_0^{-1}\left[\left(\mathbf{I} - \mathbf{h}_0\mathbf{A}_0\right) - \left(\mathbf{I} - \mathbf{h}\;\mathbf{A}_1\right)\right]\mathbf{x}_1$$

Re-arranging (A-16) gives us equation (A-17) below

$$\Delta\mathbf{D}^{-1}\mathbf{g}_1 = \mathbf{D}_0^{-1}\;\left(\mathbf{I} - \mathbf{h}_0\mathbf{A}_0 - \mathbf{I} + \mathbf{h}_1\mathbf{A}_1\right)\mathbf{x}_1$$

(A-17) $$\Delta \mathbf{D}^{-1}\mathbf{g}_1 = \mathbf{D}_0^{-1}\left(\mathbf{h}_1\mathbf{A}_1 - \mathbf{h}_0\mathbf{A}_0\right)\mathbf{x}_1$$

Adding and subtracting the same term h_0A_1 from (A-17),

(A-18) $$\Delta \mathbf{D}^{-1}\mathbf{g}_1 = \mathbf{D}_0^{-1}\left(\mathbf{h}_1\mathbf{A}_1 - \mathbf{h}_0\mathbf{A}_0 + \mathbf{h}_0\mathbf{A}_1 - \mathbf{h}_0\mathbf{A}_1\right)\mathbf{x}_1$$

Re-arranging the resulting equation (A-18) gives,

(A-19) $$\Delta \mathbf{D}^{-1}\mathbf{g}_1 = \mathbf{D}_0^{-1}\left(\Delta \mathbf{h}\mathbf{A}_1\mathbf{x}_1 + \mathbf{h}_0\Delta\mathbf{A}\mathbf{x}_1\right)$$

Finally substituting (A-10) and (A-19) into (A-8) yields the following:

(A-20) $$\Delta \mathbf{x} = \mathbf{D}_0^{-1}\left(\Delta \mathbf{s}\mathbf{f}_1 + \mathbf{s}_0\Delta\mathbf{f} + \Delta\,\mathbf{e}\right) + \mathbf{D}_0^{-1}\left(\Delta\,\mathbf{h}\mathbf{A}_1\mathbf{x}_1 + \mathbf{h}_0\Delta\mathbf{A}\mathbf{x}_1\right)$$

Letting $D_0^{-1} = R_0$ we can derive equation (9b) in the text:

(A-21) $$\Delta x = \mathbf{R}_0\Delta\mathbf{s}\mathbf{f}_1 + \mathbf{R}_0\mathbf{s}_0\Delta\mathbf{f} + \mathbf{R}_0\Delta\mathbf{e} + \mathbf{R}_0\Delta\mathbf{h}\,\mathbf{A}_1\mathbf{x}_1 + \mathbf{R}_0\mathbf{h}_0\Delta\mathbf{A}\mathbf{x}_1$$

Using *Paasche* weighting the derivation of equation (9a) is also analogous to (A-21).

- Appendix B: *Price Adjustment Procedure*

The examination of the effects of structural changes in the economy requires an inter-temporal comparison by handling changes in price levels. Using two input-output matrices for different years in current prices, we attempt to adjust coefficient matrices for *s* based matrices to the base year *t* (*s*>*t*) (e.g. see Günlük-Senesen and Küçükçifçi, 1994). The deflating procedure involves expressing A_s, the matrix of technical coefficients, in the price of the year *t*. We define A_s^t as A_s deflated with year *s* prices, so that

(B-1) $$A_s^t = P_s^{-1}A_sP_s$$

where P_s is the diagonal matrix of industrial price indices capturing changes in price levels from year *t* to *s*. From A-1, the typical element of A_s^t is

(B-2) $$a_{s,ij}^t = \frac{x_{s,ij}}{x_{s,j}}\frac{P_{s,j}}{P_{s,i}}$$

where $P_{s,i}$ and $P_{s,j}$ are changes in industrial price indices of sector i and sector j from year t to year s respectively, and the $(P_{s,j}/P_{s,i})$ term on the right-hand side captures the relative prices from year t to year s.

■ Appendix C: *The Seven-Sector Aggregation*

The Turkish input-output tables before 1996 comprised sixty-four sectors. The available latest table, on the other hand, possesses 97 sectors. Due to lack of the data on the price indices at this aggregation level, we aggregated sectors to the 24 sectors. However, it has been necessary to aggregate them further to 7 sectors to examine some hypothesis advanced in the text. In what follows, we first present the aggregation of the 64 x 64 input-output table to the 24 x 24 one, then introduce the smaller table with further aggregation to 7 sectors.

The sectors in the 24 x 24 tables

Sectors	Sector numbers in the 64 x 64 input-output table	Sector numbers in the 97 x 97 input-output table
1- Agriculture	1-4	1-7
2- Mining	5-10	8-12
3- Food-Beverage	11-19	13-25
4- Textiles	20-24	26-32
5- Wood-Furniture	25-26	33-34 and 67
6- Paper-Printing	27-28	35-37
7- Chemicals	29-31	39-43
8- Oil-Refining	32-33	38
9- Rubber-Plastics	34-35	44-45
10- Glass-Cement	36-38	46-49
11- Iron-Steel	39-40	50-52
12- Metal Product	41	53-54
13- Machinery	42-43	55-58
14- Electrical-Machinery	44	59-60
15- Transportation-Vehicles	45-48	62-66
16- Other manufacturing	49	61 and 68
17- Utilities	50-51	69-71
18- Construction	52-53	72
19- Trade	54-55	73-77
20- Transportation Service	56-60	78-83
21- Banking and Insurance	61	84-85
22- Personal Services	62	86-95
23- Public Services	63	96
24- Housing	64	97

The sectors in the 7 x 7 tables

Sectors	Sector numbers in the 24 x 24 table
I- Primary and extractive sectors	1-2
II- Primary manufacturing	3-4-5-6-10-17-18
III- High technology manufacturing	7-8-9-14-15
IV- Other manufacturing	11-12-13-16
V- Less tradeable services	19-22-23-24
VI- More tradeable services	20
VII- Finance	21

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