Cost-push Inflation in Turkey: An Input-Output Analysis

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Abstract

Turkish economy was plagued by high inflation rates from the early 1970s to the mid-2000s. High inflation in Turkey was generally attributed to macroeconomic factors such as public deficit and monetary policies and demand-pull factors. Cost-push inflation is also important. This paper examines cost-push inflation in Turkey from 1973 to 2002 and its sources using input-output tables and a decomposition analysis. Sectoral contributions of cost-push inflation are also examined. The findings are interpreted in conjunction with the relevant development policies of the government.

Keywords: Turkey; inflation; input-output analysis; cost-push inflation

JEL Classification: C67, E31, N15

1 Introduction

Turkish economy has suffered from continuous high inflation starting from the early 1970s until the mid 2000s. Inflation rates were especially high during the 1980s and the 1990s. Even when it hit 90-100 percent levels, high inflation rates in Turkey were not considered hyperinflation. It was rather

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viewed as manageable high inflation and macroeconomic phenomenon arising from various structural problems in the economy such as public deficit and monetary policies.

The sources of inflation can be analyzed through demand-pull and cost-push factors. The former is used more widely as the required data are available at a high frequency from the national income accounts. Macroeconomic policies of successive governments in Turkey during the high-inflation period are generally held responsible for persistent inflation. For instance, Lim and Papi (1997) and Us (2004) emphasized expansionary monetary policy and large public sector deficits as major causes of high inflation in Turkey.

Studies in the past examining cost-push inflation analyzed structural factors that affect inflation such as the exchange rate transmission mechanism, the impact of the market structures which affect pricing behavior of firms, and the impact of wages and wage determination process. Lim and Papi (1997) and Kibritçioğlu (2002) reviewed the literature about the causes of inflation in Turkey from the 1970s until the end of the 1990s. We are specifically interested in those studied examining cost-push inflation and structural factors. One group of studies including Togan (1987), Öniş and Özmucur (1990), Rittenberg (1993), and Metin (1995) examined the link between the exchange rate and inflation, i.e. the transmission effect of increase in the exchange rate on inflation through its effect on import prices. These papers do not reach a consensus about the causal relationship between the exchange rate and inflation and the findings are mixed. Inflationary inertia, which largely reflects the continuous expectations of high inflation due mainly to the lack of trust on economic administration, has also been raised as an important cause of inflation in the long-run (e.g. Akçay et al. 1997, Lim and Papi 1997, Cizre-Sakallıoğlu and Yeldan 1999, Erlat 2002, Metin-Özcan et al. 2004).

Another group of studies including Uygur (1990) and Da Cunha et al. (1990) has examined the impact of pricing behavior of oligopolistic firms on inflation. Uygur (1990) showed that markups play only a limited role but inflationary inertia and the effect of the increasing prices in publicly provided goods are more important. An interesting finding of these studies is no significant impact of wages on inflation during the 1980s (Lim and Papi, 1997: 9). Yeldan (1993) showed using an applied general equilibrium model that price of capital (rent) affected inflation more than wages due to the markups as a result of oligopolistic market structure during the 1980s.

The story is not full without a thorough analysis of cost structure in the economy by taking into account the intersectoral relations in the economy. An alternative approach to examine the structural sources of inflation, cost-push inflation in particular, is to work with intersectoral transactions data

from the input-output tables. Input-output analysis provides useful tools to analyze cost-push factors of inflation. Accordingly, this paper examines the sources of cost-push high inflation since 1973 using data from the input-output tables. While the analysis in this paper lays out the cost structure of the economy, the results also shed light on the evolution of cost competitiveness as well.

The paper is organized as follows. The second section reviews the trends in inflation performance in Turkey. The third section describes the method of analysis in detail and the fourth section presents and discusses the findings. Finally, the fifth section concludes the paper.

2 High Inflation in Turkey

Two-digit inflation rates have persisted for a long time in Turkey after the early 1970s until 2012. Consumer price index (CPI) based inflation rates are presented in Figure 1. The figure uses multiple base years throughout the period 1970-2012 because the statistical office has occasionally changed the base year over time. The CPI-based inflation rate averaged 18 percent during 1970-1977 and 73 percent during the crisis years of 1978-1980. Following a brief slowdown (34 percent) during 1981-1987 CPI-based inflation rate increased again to 52 percent during stagflation in 1988-1989. During the 1990s (1990-2000) which is characterized by macroeconomic instability, inflation rate averaged 56 percent, and it averaged 40 percent during the economic crisis in 2001-2002 following a failed disinflation program. Subsequent fiscal discipline and government commitment in inflation-targeting and structural reforms in this regard brought inflation down to single digits after 2004 and the inflation rate averaged 8.2 percent during 2005-2012.

Producer price index (PPI) based inflation rates are presented in Figure 1. PPI is measured by the wholesale price index (WPI). PPI-based inflation rates have followed a pattern similar to the CPI-based inflation. During the early 1970s (1971-1977) PPI-based inflation rate averaged 19 percent before rising to 75 percent during the economic crisis in 1978-1980, peaking at 107 percent in 1980. After a sharp decrease to 35 percent during 1981-1987, it again increased to 66 percent during 1988-1989. The 1990s first saw a large increase to 72 percent average during 1990-1994 and PPI-based inflation hit the all-time high 121 percent in the economic crisis in 1994. Following the crisis, it gradually declined until 2000 and averaged 67 percent during 1996-2000. After reaching 56 percent on average in the economic crisis in 2001-2002, it started falling again and averaged 14 percent during 2003-2006, and 8 percent during 2007-2012.

GDP deflator also reflects the rising trend in inflation in Turkey (see Figure 1). The long-run trend, as shown by the five-year moving average, exhibits a secular increasing trend during the 1970s. The brief decline in the early 1980s was followed by ups and downs but with an increasing trend after 1983, rising above 100 percent in 1994. The decline in the CPI-based and PPI-based inflation rates following the 2000-2001 crisis is also observable from the GDP deflator as well.

3 Method of Analysis

The method of analysis builds on Fujikawa et al. (1995), Ezaki et al. (1996), and Wang et al. (2002). At the outset, we assume that output price and input costs are equal, i.e., output price equals the sum of the costs of intermediate inputs, capital, and labor as follows:

$$p_j = \sum_j p_i a_{ij} + w_j b_j^L + r_j b_j^K \tag{1}$$

where the subscripts i and j denote sectors, p is price, w is the wage rate, r is the return to capital, a_{ij} are the usual intermediate input coefficients defined as percentage of the value of output, b^K is the share of capital in output, and b^L is the share of labor in output. The matrix A is defined by its member a_{ij} such that $a_{ij} = X_{ij}/X_j$, where X_{ij} is the amount of intermediate inputs from sector i used in the production of output of activity j (X_j). The output shares of capital and labor in the matrix B can be shown as $b_{mj} = Z_{mj}/X_j$, where m refers to capital (K) and labor (L) (i.e. $m = K, L$), Z_{mj} is the amount of production factors used to produce the output of activity j, and b_m is the share of production factors in the value of output.

Our aim is to find an expression for the change in activity prices, $\Delta p_j/p_j$. Equation (1) can be rewritten in matrix notation as follows:

$$p = pA + qB \tag{2}$$

where p is the vector of prices, A is the matrix of intermediate input coefficients (obtained from the input-output table), B is the matrix consisting of the shares of capital and labor in output value, q is the vector of factor prices (i.e. wage and payment to capital). If there are n sectors, p is a $1 \times n$ vector, A is an $n \times n$ matrix, q is a 1×2 matrix, and B is a $2 \times n$ matrix.

p, q, A, and B are all time-variant. Therefore, it is possible to take time derivative of equation (2) as follows:

$$\Delta p = (p\Delta A + \Delta q B + q\Delta B) \cdot (I - A)^{-1} \tag{3}$$

Equation (3) implies that the change in the activity price is affected by the changes in the wage rate and return to capital, change in the intermediate input coefficients of all other activities, and the Leontief inverse matrix, $(I - A)^{-1}$, which is a multiplier.

In the next stage, total factor productivity (TFP) growth is defined. TFP growth for an economic activity j is defined in the conventional manner as the residual after the growth of intermediate inputs, capital, and labor are deducted from output growth as follows:

$$\frac{\Delta TFP_j}{TFP_j} = \frac{\Delta X_j}{X_j} - \left[\sum_i \left(\frac{p_i a_{ij}}{p_j X_j} \cdot \frac{\Delta X_{ij}}{X_{ij}} \right) + \sum_m \left(\frac{q_{mj} Z_{mj}}{p_j X_j} \cdot \frac{\Delta Z_{mj}}{Z_{mj}} \right) \right] \tag{4}$$

Using the definitions of a_{ij} and b_{mj}, equation (4) can be rewritten as follows:

$$\frac{\Delta TFP_j}{TFP_j} = - \left[\sum_i \left(\frac{p_i X_{ij}}{p_j X_j} \cdot \frac{\Delta a_{ij}}{a_{ij}} \right) + \sum_m \left(\frac{q_{mj} Z_{mj}}{p_j X_j} \cdot \frac{\Delta b_{mj}}{b_{mj}} \right) \right] \tag{5}$$

Denoting the elements of the Leontief inverse matrix $(I - A)^{-1}$ as c_{ij}, equation (3) can be rewritten as follows:

$$\begin{aligned}
\Delta p_j &= \left(\sum_m \Delta q_m b_{mj} + \sum_i p_i \Delta a_{ij} + \sum_m q_m \Delta b_{mj} \right) \cdot (c_{ij}) \\
&= p_j \left[\sum_m \left(\frac{q_m Z_{mj}}{p_j X_j} \cdot \frac{\Delta q_m}{q_m} \right) + \sum_i \left(\frac{p_i X_{ij}}{p_j X_j} \cdot \frac{\Delta a_{ij}}{a_{ij}} \right) + \sum_m \left(\frac{q_m Z_{mj}}{p_j X_j} \cdot \frac{\Delta b_{mj}}{b_{mj}} \right) \right] \cdot (c_{ij}) \\
&= \left[p_j \left(\frac{w L_j}{p_j X_j} \cdot \frac{\Delta w}{w} + \frac{r K_j}{p_j X_j} \cdot \frac{\Delta r}{r} - \frac{\Delta TFP_j}{TFP_j} \right) \right] \cdot (c_{ij}) \\
&= \left[\sum_h p_h \left(S_{Lh} \frac{\Delta w}{w} + S_{Kh} \frac{\Delta r}{r} - \frac{\Delta TFP_h}{TFP_h} \right) \right] \cdot (c_{hj})
\end{aligned} \tag{6}$$

where $S_{Lh} = \frac{w L_h}{p_h X_h}$ and $S_{Kh} = \frac{r K_h}{p_h X_h}$ are, respectively, the share of the sector h in total labor and total capital endowment in the economy. It follows that $S_{Lh} + S_{Kh} = 1 - \sum_i \frac{p_i X_{ih}}{p_h X_h}$, which is smaller than 1. The growth rate of the jth element in equation (6) is written as follows:

$$\begin{aligned}
\frac{\Delta p_j}{p_j} &= \left[S_{Lj} \frac{\Delta w}{w} + S_{Kj} \frac{\Delta r}{r} - \frac{\Delta TFP_j}{TFP_j} \right] \cdot c_{jj} \\
&+ \sum_{h \neq j} \frac{p_h}{p_j} \left(S_{Lh} \frac{\Delta w}{w} + S_{Kh} \frac{\Delta r}{r} - \frac{\Delta TFP_h}{TFP_h} \right) \cdot c_{hj}
\end{aligned} \tag{7}$$

where c_{jj} is greater than 1. Equation (7) implies that the growth rate of the price of sector j's output is affected by the growth rate of the sector's wage rate and return to capital, the negative of TFP growth rate, and the Leontief inverse, i.e., the multiplier effect. The multiplier effect adds the effects of other sectors' effects on the price level.

Since our data come from input-output tables belonging to specific years, there is a need to transform equation (2). It follows for two consecutive years 1 and 2 that $\Delta(pA) = \Delta p \frac{A_0+A_1}{2} + \frac{p_0+p_1}{2}\Delta A$, where $\Delta p = p_1 - p_0$ and $\Delta A = A_1 - A_0$. Then, denoting the arithmetic average for two consecutive years 1 and 2 for any variable x as $\overline{x}$, the discrete form of equation (3) is written as follows:

$$\Delta p = \left(\overline{p}\Delta A + \overline{q}\Delta B + \overline{B}\Delta q\right) \cdot (I - A)^{-1} \tag{8}$$

Then, the discrete form of equation (7) is calculated using the average values for two consecutive years as follows:

$$\begin{aligned} \frac{\Delta p_j}{\overline{p_j}} &= \left[\left(\overline{w}\frac{\overline{b_j^L}}{\overline{p_j}} \cdot \frac{\Delta w}{\overline{w}}\right) + \left(\overline{r}\frac{\overline{b_j^K}}{\overline{p_j}} \cdot \frac{\Delta r}{\overline{r}}\right) - \frac{\Delta TFP_j}{\overline{TFP_j}}\right] \cdot \overline{c_{jj}} \\ &+ \sum_{h \neq j} \frac{\overline{p_h}}{\overline{p_j}} \left[\left(\overline{w}\frac{\overline{b_{Lh}}}{\overline{p_j}} \cdot \frac{\Delta w}{\overline{w}}\right) + \left(\overline{r}\frac{\overline{b_{Kh}}}{\overline{p_j}} \cdot \frac{\Delta r}{\overline{r}}\right) - \frac{\Delta TFP_h}{\overline{TFP_h}}\right] \cdot \overline{c_{hj}} \end{aligned} \tag{9}$$

TFP growth rate in equation (9) is computed as the reduction in costs arising from the reduction in the costs of intermediate inputs, capital, and labor, as follows:

$$\frac{\Delta TFP_j}{\overline{TFP_j}} = -\left[\sum_h \left(\overline{p_h}\frac{\overline{a_{hj}}}{\overline{p_j}} \cdot \frac{\Delta a_{hj}}{\overline{a_{hj}}}\right) + \overline{w}\frac{\overline{b_j^L}}{\overline{p_j}} \cdot \frac{\Delta b_j^L}{\overline{b_j^L}} + \overline{r}\frac{\overline{b_j^K}}{\overline{p_j}} \cdot \frac{\Delta b_j^K}{\overline{b_j^K}}\right] \tag{10}$$

Equation (9) can be rewritten by using a simple arithmetic manipulation for the first line of the equation as follows:

$$\begin{aligned} \frac{\Delta p_j}{\overline{p_j}} &= \left[\left(\overline{w_j}\frac{\overline{b_j^L}}{\overline{p_j}} \cdot \frac{\Delta w_j}{\overline{w_j}}\right) + \left(\overline{r_j}\frac{\overline{b_j^K}}{\overline{p_j}} \cdot \frac{\Delta r_j}{\overline{r_j}}\right) - \frac{\Delta TFP_j}{\overline{TFP_j}}\right] \\ &+ \left[\left(\overline{w_j}\frac{\overline{b_j^L}}{\overline{p_j}} \cdot \frac{\Delta w_j}{\overline{w_j}}\right) + \left(\overline{r_j}\frac{\overline{b_j^K}}{\overline{p_j}} \cdot \frac{\Delta r_j}{\overline{r_j}}\right) - \frac{\Delta TFP_j}{\overline{TFP_j}}\right] \cdot (\overline{c_{jj}} - 1) \\ &+ \sum_{h \neq j} \frac{\overline{p_h}}{\overline{p_j}} \left[\left(\overline{w_j}\frac{\overline{b_{Lh}}}{\overline{p_j}} \cdot \frac{\Delta w_j}{\overline{w_j}}\right) + \left(\overline{r_j}\frac{\overline{b_{Kh}}}{\overline{p_j}} \cdot \frac{\Delta r_j}{\overline{r_j}}\right) - \frac{\Delta TFP_h}{\overline{TFP_h}}\right] \cdot \overline{c_{hj}} \end{aligned} \tag{11}$$

The first line of equation (11) represents the direct effect of the sector j on itself. The second line shows the indirect effect of the sector on itself. Finally, the third line shows the indirect effects of the remaining industries on the sector j. These effects work through the growth rates of wage, rental rate of capital, and TFP growth and the intersectoral input relations. The indirect affects work through the Leontief inverse matrix (c_{ij}).

4 Data

Most data used in the analysis are obtained from the input-output (I–O) tables. We use I–O tables published by the Turkish Statistical Institute (Turkstat) for the years 1973, 1979, 1985, 1990, 1996, and 2002. The number of sectors is 64 in 1973, 1979, 1985, and 1990 I–O Tables, 98 in 1996 I–O tables, and 59 in 2002 I–O tables. We aggregated these sectors into 15 broad activities, of which 10 are manufacturing industries, as shown in Table 1. The disaggregation into 15 sectors is based on the availability of price indices. The I–O tables for 1973, 1979, 1985, and 1990 are all reported only in consumer prices and are not available in producer prices. Therefore, they are inclusive of trade and transport margins. I–O tables are available in producer prices only for 1996 and 2002. For consistency, for all years we used I–O tables in consumer prices.

The officially published I–O tables are competitive I–O tables. For the purpose of the empirical analysis, we construct non-competitive I–O tables to disentangle the effect of competitive imports. For this purpose, we disaggregate the intermediate input demand in the I–O tables into domestic and imported intermediate inputs. For details about how to construct non-competitive I–O tables, see METI (2012: 741-744).

For the input-output analysis, it is necessary to transform the I–O tables in current prices input tables in constant prices. For this purpose, we normalized I–O tables using the price indices with the base year 1987, using the method introduced in Celasun(1983). To calculate the constant-price figures, we used the deflators in the national income accounts to deflate the final demand columns in the I–O tables and the producer price indices to deflate output and intermediate input values. The deflators and the producer price indices are obtained from the State Planning Office (currently, the Ministry of Development) and the Central Bank of the Republic of Turkey (CBRT) Electronic Data Dissemination Service.

4.1 Prices

Wholesale price indices (WPI) are obtained from CBRT Electronic Data Dissemination Service. These statistics are organized into different categories with different base years. One series takes 1981 as the base year and spans the period 1982-2004. Another series takes 1987 as the base year and spans the same period. Both series are disaggregated into sectors but these sectors cover only agriculture, mining, manufacturing, and energy sectors. Services sector prices are not available. We used the series with 1987 as the base year. Therefore, the data for the years 1985, 1990, 1996, and 2002 are obtained from these series. The data for 1979 on the other hand are not available from these series. We used the Istanbul Chamber of Commerce (ICC) Wholesale Price Index (1968 to present) which is reported at the disaggregated level for only food, mining, unprocessed products, textiles, construction, energy, and chemicals. We used these indices for the corresponding sectors and re-based them from 1968 to 1987.

In the case of the price indices for the services sectors, they are available only for the construction sector in the ICC Wholesale Price Index. However, the national accounts statistics report GDP deflators for a variety of services sectors. Therefore, we use the GDP deflators for the three services sectors, including the construction sector.

4.2 Output

Output data are available from the I–O tables. The value of output includes payments made by producers to all material inputs, capital (gross operating surplus), and labor (remuneration of employees) as well as production taxes minus subsidies. In addition, when calculating the annual TFP growth rates we use value-added data for the manufacturing industries which are available from the annual issues of Statistical Yearbook of Turkey and Annual Survey of Manufacturing Industries, both of which are published by Turkstat. Nominal value-added figures are deflated by WPI for each industry to compute real value-added. All real figures are calculated with 1987 as the base year.

4.3 Labor

Labor input used in calculating TFP growth is measured as total number of workers engaged in production. Data on labor are obtained from ILO's Laborsta Database for the main production sectors. Labor data for the manufacturing industries are obtained from annual manufacturing surveys and the official statistical yearbook. The data exclude owners of the establish-

ments and take into account only those actively engaging in production. Data on payments to labor are obtained from the input-output tables. These data include all kinds of payments made to labor, i.e. wages and salaries and payments by the workers for social security and pension funds. Average wage level is found by dividing total payments to labor by the number of workers.

4.4 Capital Stock

Capital stock series are needed to calculate TFP growth and the rental rate of capital. There are no officially published capital stock series. Therefore, they need to be estimated. Nominal capital stock series at the sectoral level in domestic prices are available the World Input Output Database (WIOD) for the period 1995-2009.[2] Capital stock data of Turkey are provided in the Socioeconomic Accounts Database of WIOD. These capitals stocks are constructed with 1970 as the benchmark year and the subsequent years' capitals stocks are calculated using the sectoral investment data from Turkstat. The benchmark year's capital stock is calculated using Harberger's method as follows:

$$K_{1970} = \frac{I/Y}{g+d} \cdot Q_{1970} \tag{12}$$

where K refers to capital stock, Q refers to gross output, I is investment, Y is output, g is the average output growth rate for 10 years, and d is the deprecation rate. Harberger's approach calculates the the steady-state capital-output ratio using investment data for 10 years and uses this ratio to calculate the capital stock in the benchmark year. WIOD capital stock data are calculate using the annual business surveys and official investment statistics but they are available only for the period 1995-2009. Other data in the WIOD database are based on the Turkish I–O tables and hence they are compatible with our I–O data. Therefore, for the years 1996 and 2002, we use these capital stocks. We take these series and recalculate the real figures by changing the base year to 1987.

To compute the capitals stocks for the years 1973, 1979, 1985 and 1990, we use an indirect approach. We take the 1996 figure from the WIOD database and calculate the capital stocks backwards for previous years using the perpetual inventory method as follows:

$$K_{t+1} = (1-d)\, K_t + I_t \tag{13}$$

[2] See Erumban et al. (2002 :31) for sources and details about the computation of capital stock series for Turkey. For details about the WIOD database, see Timmer et al. (2015).

the subscript t refers to time. We use the sector-specific depreciation rates from WIOD[3] and investments from Saygılı et al. (2005), which report investment series for nine major economic sectors obtained from the official statistical yearbook for the period 1972-2003. Saygılı et al. (2003) do not estimate the capital stock series for manufacturing industries. Therefore, they need to be estimated separately. Yıldırım (1989) has previously estimated capital stock series for 19 manufacturing industries for the period 1963-83. We take the percentage shares of the manufacturing industries' capital stocks in total manufacturing capital stock by rearranging the industry disaggregation to comply with this study. We use this composition for the years 1973, 1979, and 1985. For 1990, due to lack of estimates, we assume that the same composition in 1985 holds also for 1990. Investment data and price deflators for investment goods are available from the official statistical yearbook and Saygılı et al. (2005).

5 Findings

The results of the decomposition based on equation (11) is presented in Table 2. The change in prices is decomposed into direct and indirect effects. The direct effects, the first line in equation (11) are composed of the effects arising from wages, rental rate, and TFP. The indirect effects are divided into own indirect effects and indirect effects of other industries which correspond respectively to the second and third lines in equation (11). Table 2 presents the results for each of the six periods 1973-1979, 1979-1985, 1985-1990, 1990-1996, and 1996-2002. Below, we interpret the results for each sub-period in conjunction with the government's policies.

5.1 1973-1979

The period 1973-1979 coincides with the second half of the import-substitution era (1962-1977) characterized by large investments in capital-intensive industries such as machinery, chemicals, oil refining, and metals. These industries were protected with high tariff rates and an overvalued exchange rate enabled cheap imports of intermediate inputs. Public enterprises provided intermediate inputs at low cost to the private sector, which was protected from foreign

[3] The sector-specific depreciation rates are as follows: AGR: 4.7%, MIN: 5.3%, Food: 5.9%, TexClo: 5.9%, Wood: 6.1%, Paper: 6.6%, ChemOil: 6.4%, PlasMin: 6.6%, Met: 5.7%, FabMet: 5.7%, Mach: 7.6%, ENER: 4.9%, CONST: 5.4%, TRAN: 6.0%, OTHSER: 7.7%. See Erumban et al. (2012 :35) for details.

competition. Import-substitution policy came to an end with the 1977-1980 balance of payments crisis.

The findings in Table 2 show that direct effects and indirect effects account are both large virtually for almost all sectors. Direct effects arising from capital costs (rent) are especially large in most manufacturing industries as well as agriculture, transport services, and other domestic services sectors. Wage costs account for a large portion of price increases in certain manufacturing industries (metals, machinery, plastics), energy, and construction sectors. Overall, rental rate of capital seems to explain a large part of the producer price inflation in the Turkish economy during this period as shown in Figure 2. It is important to note that the price-reducing effect of TFP is observed only in some manufacturing industries which are at the lower end of the manufacturing technology scale, including food, textile-clothing, wood, and paper industries. The direct effect of rent is positive in all manufacturing industries except metals, meaning that the change in the price of capital led to higher PPI-based inflation. Those industries which were promoted under the import-substitution strategy, namely, metals, machinery, and energy, exhibit an unfavorable TFP effect that works to increase producer prices. This implies rent-seeking which is typical in import-substitution policy.

Indirect effects are largely negative for all sectors except for domestic services (See Table 2). However, part of the indirect effects are own effects. If we deduct this from total indirect effects, we get the indirect effects of other sectors, which is an indication of the effects of backwards linkages. In most sectors, this component is fairly large and reduces the combined price-increasing impact of the direct effects and own indirect effects. In other words, backward linkages were strong enough to reduce inflation in producer prices in most industries during this period.

5.2 1979-1985

The period 1979-1985 coincides with transition from an inward-looking strategy to an outward-looking strategy. Turkey adopted structural adjustment and trade liberalization policy in 1980. The long-run aim of this strategy was to liberalize trade and a policy shift from import substitution to export promotion through various incentives and economic liberalization.

Direct effects, especially of wages, contribute largely to the changes in producer prices as shown in Table 2. The contribution of the rental rate of capital is also large. The combined impact of capital cost and labor cost arising from both direct and indirect effects dominate the total effect as seen in Figure 3. TFP effects work to reduce producer prices in most sectors most likely due to the competition brought about the liberalization policy,

but they increase prices in textiles-clothing, wood, and machinery industries and transport services sector. The contribution of capital cost to PPI-based inflation in the textiles-clothing sector is also negative. This is interesting because textiles-clothing sector has emerged as the main export industry in this period. The unfavorable impact of efficiency change (TFP) in this industry may be partly due to failure by the government in effective allocation of direct price subsidies to capital-owners in this sector. The contribution of direct effects of the rental rate of capital to producer price inflation is fairly large in all other manufacturing industries. It is worth noting that the change in the rental rate of capital worked to increase PPI-based inflation in the upper-end manufacturing industries (chemicals-oil, plastic, metal, machinery) to a lower degree than the previous period. A similar change is also observed in the lower-end manufactures (textiles-clothing, wood, paper) as well. Considering the importance of the textiles-clothing industry for exports, it can be asserted that the export promotion policy seems to have reduced PPI-based inflation in some export industries. On the other hand, we do not see the same effect at work in the food industry which was another emerging major export industry in the 1980s.

Indirect effects are largely negative in all sectors except agriculture as in the previous period. Therefore, it can be argued that backward linkages continued to play an important role in reducing PPI-based inflation during this period.

5.3 1985-1990

The period 1985-1990 coincides with substantial liberalization and export boom. Trade liberalization was largely accomplished by 1990. The mechanism for the creation of exportable surplus during the 1980s is discussed in Senses and Yamada (1990) and Boratav et al. (2000). They argue that declining real wages and the weakening of labor movements played a major role in enhancing cost competitiveness of export industries by reducing production costs and creating an exportable surplus for producers via reduced purchasing power of domestic consumers.

PPI-based inflation was on a rising trend during the period 1985-1990 (see Figure 1). Figure 4 presents the overall decomposition of price changes into wage, rental rate, and TFP components which combines all direct and indirect effects. It is observed that a large part of the rise in producer prices in manufacturing industries except metals was accounted for by the direct effect of capital cost. In 10 sectors the direct effect of wages is larger than the direct effect of the rental rate of capital (see Table 2). Interestingly, the direct contribution of TFP to inflation was favorable in all sectors. In other

words, the growth strategy of the government emphasizing export promotion and trade liberalization succeeded in producing an efficiency-enhancing effect that would lead to a reduction in producer price inflation although its impact on prices was limited. Macroeconomic policy failures have also exacerbated the situation. It can be argued that the government's growth strategy which aimed to enhance competition and efficiency did not yield expected declines in producer prices. One reason might be the continued rent creation for the capital owners as exemplified by the large share of rental rate in the changes in producer prices. Boratav et al. (2000) emphasize the large markups in manufacturing industries during the 1980s, which is unexpected from a liberalizing economy. Therefore, the distribution of income between wage and capital and the role of the government during this period seems to have produced unexpected results, hence the political economy at the background becomes important.

Indirect effects are fairly large and negative in all sectors but their magnitudes are lower in eight sectors. Overall, it is observed that backward linkages continued reduce PPI-based inflation during this period but his effect became slightly weaker.

5.4 1990-1996

Due to stagflationary pressure in the economy in 1988-1989 and rising inflation rates, the government gave up on its policy of allocating resources towards export industries via wage suppression and direct price subsidies after 1989 (Boratav et al., 2000). Along with increasing demands for democratization, real wages were allowed to rise and restrictions on labor movements were eased. In addition, liberalization of the capital account in 1989 led to substantial inflows of short-term foreign capital. This inflow led to the appreciation of the real exchange rate which gave rise to cheapening of imports and expanding trade and current account deficits, which eventually resulted in a foreign exchange crisis in 1994. After the 1994 crisis, the government switched back to export promotion through wage suppression as in the 1980s (Boratav et al., 2000). Real wages in manufacturing declined substantially after 1994. High real interest rates and real appreciation of the exchange rate led to persistent fragility of the economy.

Table 2 and Figure 5 demonstrate the impact of the return to wage suppression after 1994. During the period 1990-1996, the direct effects of wages to inflation are lower than that of capital cost in all but four sectors. The contribution of capital cost to PPI-based inflation was especially high in some major sectors such as food, machinery, energy, construction, and transport services. Compared with the previous period, the contribution of the

direct effect of wages to PPI-based inflation increased in only five sectors. TFP growth reduced PPI-based inflation in all sectors except construction, transport services, and agriculture. All these imply that while the change in efficiency in all sectors led to reduction in inflation, resource reallocation towards capital led to increase in producer price inflation along with the macroeconomic uncertainties that plagued the economy. The return to wage suppression is evident from the relatively smaller share of wage costs in the increases in producer prices.

Indirect effects are largely negative as usual for all sectors except agriculture and chemicals sectors. Therefore, despite the macroeconomic uncertainties in the economy, the industrial structure of the Turkish economy continued to support a pattern where the backward linkages offset part of the increases in producer prices.

5.5 1996-2002

High inflation rate, large trade deficits, and increasing indebtedness of the government were the main characteristics of the second half of the 1990s. The government commenced a stabilization and disinflation program with the IMF support in 2000, which ended in two financial crises in late 2000 and early 2001. A new reform program was started in 2001 with ambitious structural reforms to reform the public sector balances and to strengthen the financial sector. At the same time, important reforms such as the independence of the Central Bank and empowering the independent regulatory authorities to enable the transition towards liberalization of the respective markets (energy, telecom, banking, etc.) were undertaken.

Table 2 presents the decomposition results for the period 1996-2002. Figure 6 reports the decomposition of the results into major costs items, wage, rent, and TFP. This period is different than the previous periods because PPI-based inflation declined from over 80 percent in 1996 to about 50 percent in 2002 and 24 percent in 2003. This period also coincides with increasing integration with the global markets with the signing of the customs union agreement with the European Union in 1996.

The direct effect of wages seem to be the most important contributor to producer price inflation in most sectors. The contribution of the direct effect of wages vary across sectors. The direct effect of the change in capital cost, on the other hand, exhibits larger variation across sectors. Compared with the previous period, the contribution of the direct effect of capital cost on inflation decreased in all sectors. The direct effect of TFP is much smaller and favorable in only half of the sectors. All these imply that when producer price inflation was reduced under a more liberal and more competitive

environment, the macroeconomic uncertainties and the failed disinflation attempt which ended in crisis led to a reduction in the ability of capital cost in creating further produce price inflation in most sectors. This resulted in substantial reduction in PPI-based inflation.

There is also a stark difference in 1996-2002 in indirect effects. Unlike previous periods, indirect effects are positive in six sectors (agriculture, wood, paper, fabricated metal products, machinery, and construction). This means that the backward linkages for these sectors worked in the opposite direction compared to the previous periods and increased producer prices. The contribution of capital cost to PPI-based inflation is also negative for these sectors.

6 Conclusion

In this paper we analyzed the sources of cost-push inflation in Turkey using data from the input-output tables and a decomposition analysis for the period 1973-2002. The results show that the changes in the costs of labor and capital account for the dominantly large part of the changes in producer prices. The effect of TFP growth on the changes in producer prices are minimal. The most interesting finding is that the changes in the cost of capital, i.e. rental price, explain a fairly large part of the increases in producer prices until 2002. This finding implies that capital has played a major role in cost-push inflation. Therefore, it can be argued that capital-owners must have reaped substantial benefits over the three decade period due to imperfectly competitive market structures which yield sizable markups and rent-seeking activities through their relations with the government. Özen and Akkemik (2012) showed that the specific conditions pertaining to the political economy in Turkey facilitates large gains for firms complying with successive governments' political and economic aims. Therefore, the findings of this paper imply that political economy is also important in understanding the inflation dynamics in Turkey.

The empirical analysis in this paper is bound by the availability of data. While most of the required data are available, the capital stock series are not available. The estimates of capital stock are based on official statistics of investment but it is obvious that a direct measurement of capital stocks through a national census of capital assets is necessary. Such a large census will act as a benchmark for capital stock series. The level of the rental rate of capital and the growth rate of capital stock are important in our decomposition and in the estimation of TFP growth in the growth accounting exercise. On the other hand, the growth rate of capital stock is generally

invariant to the benchmark stocks if there is a sufficiently long period of time between the beginning of the series used in the analysis and the benchmark year.

Future line of research in this field should focus on further decomposition by taking into account the import content of intermediate products. By doing so, it will be possible to disaggregate the sources of cost-push inflation further into domestic and import sources. Such an analysis is especially important for a highly open economy like Turkey and may help understand the various pass-through effects as well. In addition, when the more recent I–O tables are published, it may be possible to evaluate the impact of the post-reform policies on producer prices.

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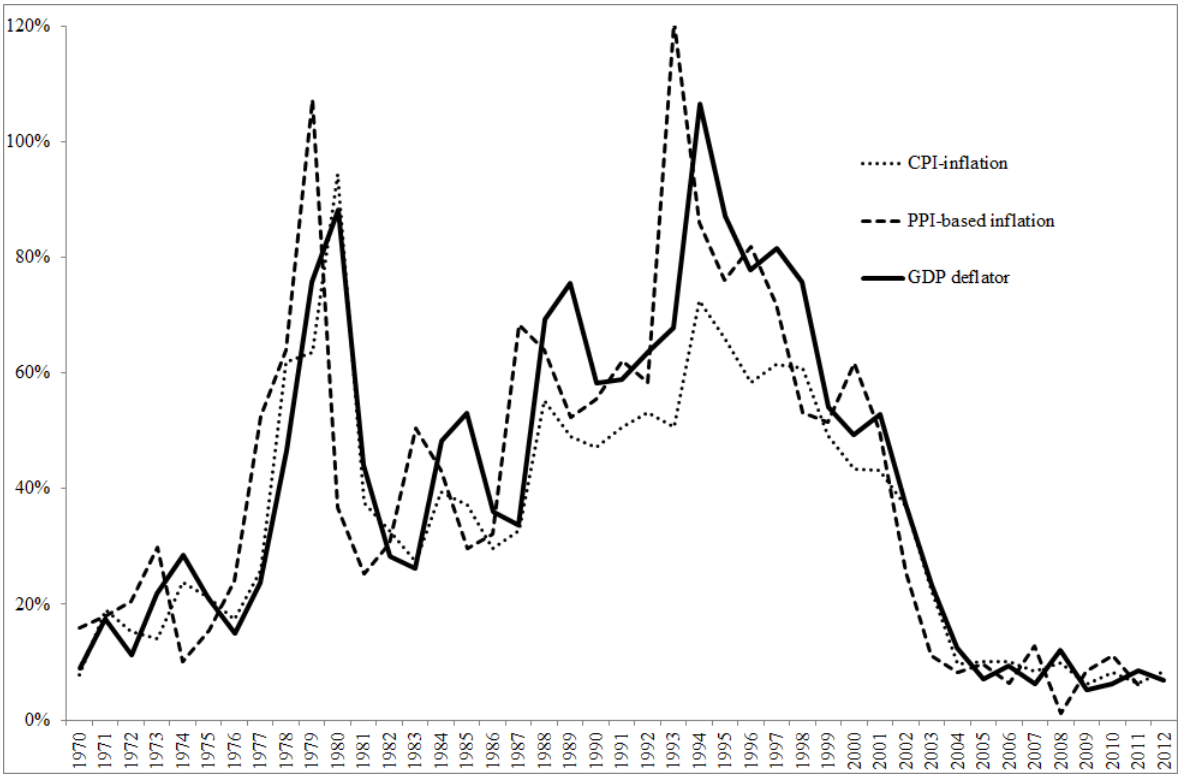
Figure 1: Inflation rates based on diffent price indices (1970-2012)



Notes: 1. CPI data Data for 1970-1982 are computed from Istanbul Cost of Living Index; data for 1983-1987 are based on consumer price indices (CPI) with 1978-79 as the base year; data for 1983-1987 are based on CPI with 1987 as the base year; the remaining data are based on data CPI figures with 1994 as the base year.
2. PPI data for 1970-1980 are computed from wholesale price indices (WPI) with 1963 as the base year; data for 1981-1987 are based on WPI with 1981 as the base year; data for 1988-1994 are based on WPI with 1987 as the base year; the remaining data are based on data WPI figures with 1994 as the base year.
3. GDP deflator data are obtained from the Ministry of Development.
Source of data: Turkstat and Ministry of Development.

Figure 2: Decomposition results by sectors, 1973-1979

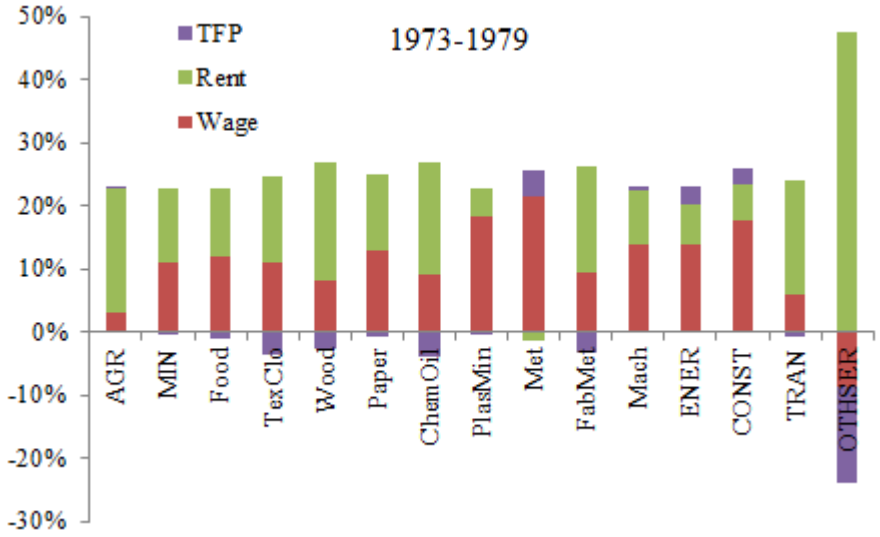


Figure 3: Decomposition results by sectors, 1979-1985

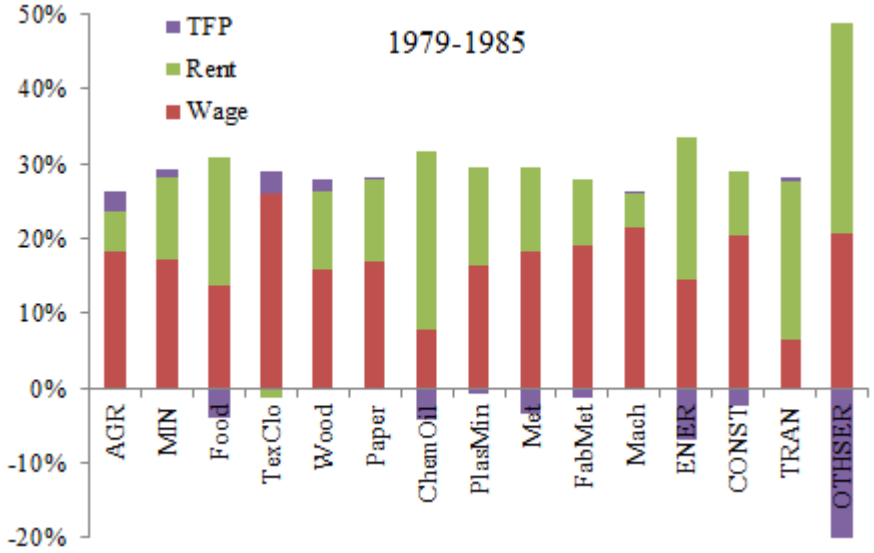


Figure 4: Decomposition results by sectors, 1985-1990

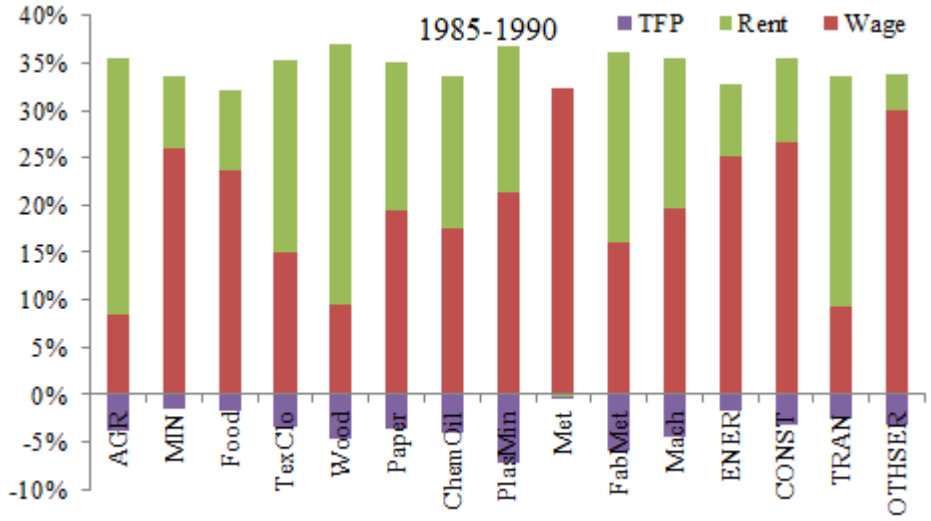


Figure 5: Decomposition results by sectors, 1990-1996

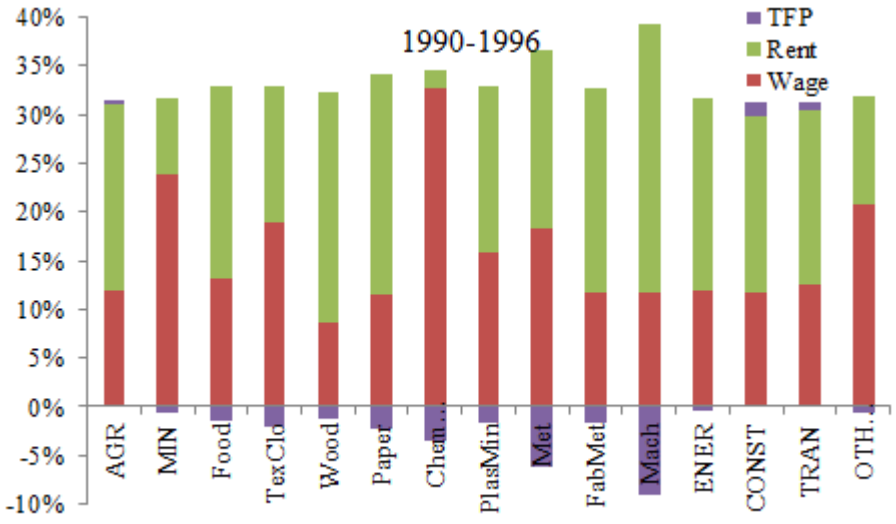


Figure 6: Decomposition results by sectors, 1996-2002

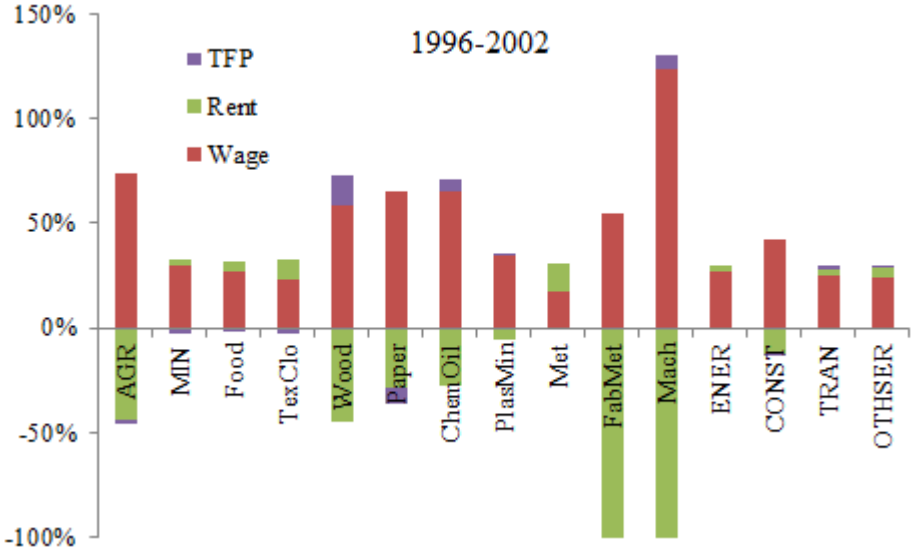


Table 1: List of sectors and codes in the I-O tables

		1973, 1979, 1985, 1990	1996	2002
AGR	Agriculture	01–04	01–07	1–3
Min	Mining	05–10	08–12	04–08
Food	Food and beverages	11–19	13–25	9–10
TexClo	Textiles and clothing	20–24	26–32	11–13
Wood	Wood and cork	25–26	33–34	14
Paper	Paper and printing	27–28	35–37	15–16
ChemOil	Chemicals, refined oil products	29–33	38–43	17–18
PlasMin	Plastic and non-metallic minerals	34–38	44–49	19–20
Met	Iron, steel, metallic products	39–40	50–51	21
FabMet	Fabricated metal products	41	52–54	22
Mach	Machinery and equipment	42–49	55–68	23–31
ENER	Energy (electricity, gas, water)	50–51	69–71	32–33
CONST	Construction	52–53	72	34
TRAN	Transport services	56–59	78–82	39–42
OTHSER	Other services (trade, finance, etc.)	54–55, 60–64	73–77, 83-98	35–38, 43–59

Table 2: Decomposition results, unit: %

	Direct Effects				Indirect Effects			TOTAL
	Wage	Rent	TFP	Total	Own	Others	Total	
	1973-1979							
AGR	10.9	69.2	-0.5	80.6	14.9	-72.6	-57.7	22.8
MIN	48.1	51.4	1.4	98.1	1.0	-76.7	-75.7	22.4
Food	65.2	60.0	5.1	120.2	16.0	-114.2	-98.3	21.9
TexClo	63.6	79.9	21.7	121.8	37.7	-138.6	-100.9	20.9
Wood	45.1	103.3	14.8	133.7	34.6	-144.1	-109.5	24.2
Paper	74.1	68.7	4.0	138.8	20.7	-135.3	-114.6	24.2
ChemOil	50.2	100.8	21.7	129.3	9.8	-115.9	-106.1	23.2
PlasMin	98.4	23.7	1.4	120.7	6.5	-104.6	-98.1	22.6
Met	84.4	-5.5	-16.7	95.6	44.5	-115.9	-71.3	24.3
FabMet	54.1	99.8	18.8	135.1	3.0	-114.9	-112.0	23.2
Mach	70.8	43.1	-3.5	117.3	22.1	-116.3	-94.2	23.2
ENER	61.0	28.7	-12.8	102.4	4.7	-84.0	-79.3	23.2
CONST	66.6	21.4	-9.6	97.6	0.0	-71.8	-71.8	25.8
TRAN	29.9	91.6	4.6	117.0	4.8	-98.6	-93.8	23.2
OTHSER	9.7	-53.8	-17.5	-26.7	-1.6	51.9	50.3	23.6
	1979-1985							
AGR	16.2	4.5	-2.5	23.2	3.6	-0.4	3.2	26.4
MIN	61.2	38.7	-4.0	103.9	0.6	-75.2	-74.6	29.2
Food	51.1	63.8	14.4	100.5	14.0	-87.4	-73.4	27.1
TexClo	48.7	-2.6	-5.5	51.5	17.7	-41.8	-24.0	27.5
Wood	27.3	17.7	-2.7	47.7	6.1	-25.9	-19.8	27.9
Paper	59.1	38.3	0.0	97.4	21.5	-91.0	-69.4	28.0
ChemOil	26.0	79.9	14.1	91.8	12.3	-76.6	-64.2	27.6
PlasMin	78.2	61.0	3.7	135.6	7.8	-114.7	-106.9	28.6
Met	92.6	57.0	17.5	132.1	58.2	-164.1	-105.9	26.2
FabMet	48.9	22.4	3.4	67.9	1.5	-42.8	-41.3	26.6
Mach	61.3	13.4	-0.7	75.3	15.3	-64.3	-49.0	26.4
ENER	62.4	81.6	29.7	114.4	6.8	-94.6	-87.9	26.5
CONST	83.7	35.2	10.2	108.8	0.0	-82.3	-82.3	26.5
TRAN	20.1	65.7	-1.6	87.4	5.1	-64.3	-59.2	28.2
OTHSER	67.1	91.5	69.4	89.2	5.8	-67.6	-61.8	27.4
	1985-1990							
AGR	19.3	62.6	8.9	73.0	11.0	-52.2	-41.3	31.7
MIN	64.8	18.8	3.8	79.8	0.2	-48.0	-47.8	32.1
Food	45.2	16.1	3.1	58.2	8.0	-35.7	-27.7	30.5
TexClo	45.4	60.5	10.4	95.5	29.8	-93.5	-63.7	31.8
Wood	30.4	86.6	14.8	102.3	22.0	-92.0	-70.0	32.3
Paper	64.8	51.7	11.9	104.6	37.1	-110.2	-73.2	31.5
ChemOil	26.2	24.3	6.0	44.5	7.5	-22.4	-14.9	29.6
PlasMin	59.6	42.8	19.9	82.4	6.9	-59.7	-52.8	29.6
Met	83.2	-0.5	0.6	82.2	39.4	-89.6	-50.2	32.0
FabMet	50.0	62.2	18.4	93.8	4.8	-68.3	-63.5	30.2
Mach	61.6	49.7	14.0	97.3	21.0	-87.2	-66.2	31.1

ENER	56.0	17.1	3.6	69.5	4.2	-42.5	-38.4	31.2
CONST	94.9	32.3	11.3	116.0	0.0	-83.6	-83.6	32.4
TRAN	22.1	57.8	6.1	73.8	4.2	-46.9	-42.8	31.0
OTHSER	67.6	8.7	7.2	69.1	5.7	-44.1	-38.4	30.7
	1990-1996							
AGR	21.9	34.7	-0.9	57.5	11.4	-37.5	-26.1	31.4
MIN	63.4	21.2	1.6	83.0	0.5	-52.5	-51.9	31.1
Food	45.0	67.4	5.1	107.4	15.4	-91.2	-75.9	31.5
TexClo	47.3	34.9	5.0	77.3	28.8	-75.3	-46.5	30.8
Wood	27.1	74.5	4.1	97.5	29.2	-95.8	-66.6	30.9
Paper	53.5	104.3	10.4	147.4	43.0	-158.5	-115.5	31.8
ChemOil	32.8	1.9	3.4	31.2	5.1	-5.1	0.0	31.2
PlasMin	51.9	56.5	5.6	102.7	8.5	-80.0	-71.6	31.2
Met	74.0	73.8	25.1	122.7	45.8	-138.0	-92.2	30.5
FabMet	40.0	71.2	5.8	105.4	5.6	-80.2	-74.5	30.9
Mach	49.8	116.7	38.4	128.1	25.3	-123.1	-97.8	30.2
ENER	44.6	74.4	1.4	117.7	5.3	-91.6	-86.3	31.4
CONST	45.4	70.8	-5.4	121.6	0.1	-90.5	-90.4	31.2
TRAN	31.4	44.4	-2.2	78.1	4.6	-51.4	-46.8	31.3
OTHSER	72.9	39.0	2.2	109.7	14.2	-92.7	-78.5	31.2
	1996-2002							
AGR	25.2	-15.0	0.6	9.7	2.2	16.5	18.7	28.3
MIN	73.7	6.1	7.0	72.9	2.3	-45.5	-43.2	29.7
Food	44.4	7.0	3.0	48.4	8.8	-27.4	-18.6	29.8
TexClo	62.8	25.7	8.5	80.0	46.6	-97.0	-50.3	29.6
Wood	45.9	-34.6	-12.5	23.8	6.5	-2.2	4.3	28.1
Paper	55.5	-24.1	6.9	24.4	8.5	-4.2	4.3	28.8
ChemOil	52.4	-22.5	-6.3	36.3	8.9	-14.6	-5.7	30.6
PlasMin	55.8	-8.5	-1.7	48.9	5.8	-24.2	-18.4	30.6
Met	56.6	41.3	3.1	94.8	56.4	-121.4	-65.1	29.7
FabMet	51.9	-110.2	-18.8	-39.5	-2.4	71.5	69.1	29.6
Mach	59.3	-48.4	-3.1	14.0	4.0	11.2	15.3	29.3
ENER	37.3	4.1	0.3	41.0	13.7	-24.9	-11.3	29.8
CONST	40.8	-12.0	0.7	28.2	0.3	0.8	1.1	29.3
TRAN	35.9	3.7	-3.4	43.0	5.4	-18.6	-13.1	29.9
OTHSER	59.4	11.1	-3.5	74.0	15.5	-59.3	-43.8	30.1

Table 3: Decomposition results by wage, rental rate, and TFP, unit: %

	1973 - 1979			1979 - 1985			1985 - 1990			1990 - 1996			1996 - 2002		
	Wage	Rent	TFP	Wage	Rent	TFP	Wage	Rent	TFP	Wage	Rent	TFP	Wage	Rent	TFP
AGR	3.1	19.6	-0.1	18.7	5.4	2.4	8.4	27.2	3.9	12.0	18.9	-0.5	74.0	-44.0	1.6
MIN	11.0	11.7	0.3	17.2	10.9	-1.1	26.0	7.6	1.5	23.8	7.9	0.6	30.0	2.5	2.8
Food	11.9	10.9	0.9	13.8	17.2	3.9	23.7	8.4	1.6	13.2	19.8	1.5	27.4	4.3	1.8
TexClo	10.9	13.7	3.7	26.0	-1.4	-2.9	15.1	20.1	3.5	18.9	13.9	2.0	23.3	9.5	3.2
Wood	8.2	18.7	2.7	16.0	10.4	-1.6	9.6	27.3	4.7	8.6	23.7	1.3	58.4	-45.0	14.7
Paper	12.9	12.0	0.7	17.0	11.0	0.0	19.5	15.6	3.6	11.6	22.5	2.3	65.3	-28.4	8.1
ChemOil	9.0	18.1	3.9	7.8	24.0	4.2	17.4	16.1	4.0	32.7	1.9	3.4	65.3	-28.0	-6.7
PlasMin	18.4	4.5	0.3	16.5	12.9	0.8	21.4	15.4	7.2	15.8	17.1	1.7	34.8	-5.3	-1.1
Met	21.4	-1.4	-4.2	18.3	11.3	3.5	32.4	-0.2	0.2	18.4	18.3	6.2	17.7	12.9	1.0
FabMet	9.3	17.1	3.2	19.1	8.8	1.3	16.1	20.1	5.9	11.7	20.9	1.7	55.0	-116.9	91.5
Mach	14.0	8.5	-0.7	21.5	4.7	-0.2	19.7	15.9	4.5	11.7	27.6	9.1	123.9	-101.0	-6.4
ENER	13.8	6.5	-2.9	14.5	18.9	6.9	25.1	7.7	1.6	11.9	19.8	0.4	27.1	2.9	0.3
CONST	17.6	5.7	-2.5	20.4	8.6	2.5	26.5	9.0	3.1	11.7	18.2	-1.4	42.4	-12.4	0.7
TRAN	5.9	18.2	0.9	6.5	21.2	-0.5	9.3	24.3	2.6	12.6	17.8	-0.9	25.0	2.6	-2.4
OTHSER	-8.6	47.7	15.5	20.6	28.1	21.3	30.0	3.9	3.2	20.8	11.1	0.6	24.2	4.5	-1.4