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.Research Article

Role of Capital Productivity in Economic Growth

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Abstract:
The main aim of this study is to measure the value of the capital in labour productivity growth at Turkish manufacturing industry within the years of 1980-2011 by applying an econometric model that account for cross-section dependence and heterogeneity of production technology in a panel setting, which is not done before. That is the common correlated effects (CCE) type estimator of Pesaran is applied. The cross-sectional averages of the dependent and explanatory variables are used at the CCE estimator. The main findings of the study are; first, individual industry regression results convey apparent technology heterogeneity across the industries. Second, imposing slope homogeneity restriction in the pooled models lends a lot of precision to the capital productivity estimate.When tested, the industries are not poolable. But, interestingly, the mean-group and pooled estimates of technology coefficients are close. The technology estimates are sensitive to the presence of observed and unobserved common factors, justifying the use of CCE estimators.

Keywords: Panel Data, Cross-Section Dependence, Heterogeneity, Manufacturing İndustry, CCE Estimator JEL Codes: O40,O43, O47

1.Introductıon:

The main aim of this study is to measure the value of the capital, in labour productivity growth at Turkish manufacturing industry within the years of 1980-2011. An econometric model that account for cross-section dependence and heterogeneity of production technology in a panel setting is applied. Therefore, the study aims to fill the gap in the literature on Turkish manufacturing industry b a parametric estimation of the long-run of the production function which is not done before. The paper is structured in four sections as follows. Following this introduction, Section 2 explains the economic environment in Turkey following the foreign exchange crisis of 2001. This then is utilized in Section 3 to design an econometric model employed and the data. Section 4 presents the results, focusing mainly on the impact of dismissal regulations on productivity, along with several extensions, including the effect of hiring regulations, and a battery of robustness checks, including dealing with endogeneity issues. Government.Banking and the agriculture sectors were keysectors to implement the structural reforms. Economy's resistance to shocks has improved due to the measures to strengthen the banking sector. Much of the sectors are deregulated such as tobacco, sugar, electricity, telecommunication and gas. Transparency of the public accounts and increase of the public sector efficiency were some of the important steps of the reform programme. Several attempts have been taken to eliminate the share of the state enterprises in the market. Government price subsidies to agriculture prices has been eliminated liberalize the markets. Also there are new measures such as the adoption of a law on FDI, a reform of the direct tax law, the establishment of an employment agency and the adoption of a labour law. In November

2002, the new government continued to implement the reform targeted to make key structural changes and to reduce the inflation rate to a single digit level. Besides, several steps have been taken to with IMF in January 2002. The programme has programme designed by the previous in a large The main aim of this study is to measure the value of the capital, in labour productivity growth at Turkish manufacturing industry within the years of 1980-2011. An econometric model that account for cross-section dependence and heterogeneity of production technology in a panel setting is applied. Therefore, the study aims to fill the gap in the literature on Turkish manufacturing industry by a parametric estimation of the long-run of the production function which is not done before. The paper is structured in four sections as follows. Following this introduction, Section 2 explains the economic environment in Turkey following the foreign exchange crisis of 2001. This then is utilized in Section 3 to design an econometric model employed and the data. Section 4 presents the results, focusing mainly on the impact of dismissal regulations on productivity, along with several extensions, including the effect of hiring regulations, and a battery of Robustness checks, including dealing with endogeneity issues.

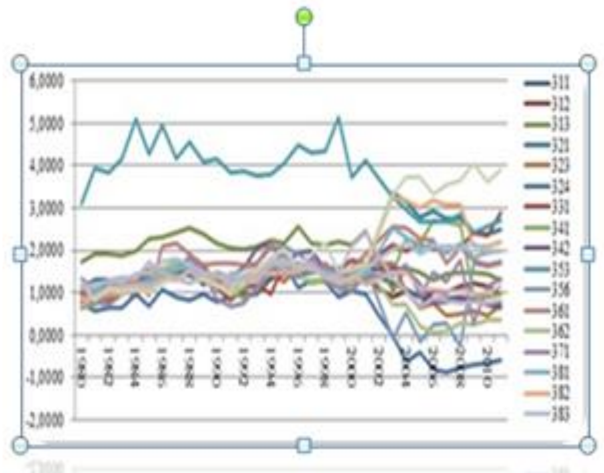
Turkish Economic Environment:

After the foreign exchange crisis of 2001, a new three-year stand-by programme has been arranged with IMF in January 2002. The programme has targeted to make key structural changes and to reduce the inflation rate to a single digit level. Besides, several steps have been taken to liberalize the markets. Also there are new measures such as the adoption of a law on FDI, a reform of the direct tax law, the establishment of an employment agency and the adoption of a labour law. In November 2002, the new government continued to implement the reform programme designed by the previous government. Banking and the agriculture sectors were key sectors to implement the structural reforms. Economy's resistance to shocks has improved due to the measures to strengthen the banking sector. Much of the sectors are deregulated suchas tobacco, sugar, electricity, telecommunication and gas. Transparency of the public accounts and increase of the public sector efficiency were some of the important steps of the reform programme. Several attempts have been taken to eliminate the share capital stock and to improve the market access. For instance, low levels of research and development (R&D) activities and the lack of foreign know-how could be counted as the reasons of inadequate FDI. After the 2001 crisis, the banking sector reforms caused structural changes in some other sectors like agriculture and energy. Also, there is an accelaration to restructuring the enterpreneurship. With these deregulations, state owned economic activities has been reduced (Communities 2002).After the foreign exchange crisis of 2001, a new three-year stand-by programme has been arranged scale. Therefore, tobacco and sugar prices are let to be set by the demand and supply equilibrium. Real cost has been decreased via the new policy adoptions on energy prices and the prices of the state enterprises's products. Barriers to market entry and exit arereduced. One can say that only positive meaure on labour market side is to introduce a new unemployment insurance scheme together with the establishment of labour market offices and of an Economic and Social Council. Besides, there is a failure to attract foreign investment due to some important missed opportunities as to renew and modernize the The level of competitiveness of the economy has been affected by progressive reductions in tra to the capital accumulation driven growth after mid-1990 (Filiztekin 2001, Altıok and Tuncer 2012, Saygılı, Cihan, and Yurtoğlu 2005, Altuğ, Filiztekin, and Pamuk 2008, Alvan and Ghosh2010). Further, productivity increase in the sector was due to productivity increase within plantsrather than relocation between plants (Taymaz, Voyvoda, and Yılmaz 2008). However, positive TFP growth has been limited to a few industries which together produce 26 percent of the manufacturing sector value added (Alvan and Ghosh 2010) . On the other hand, parametric studies which estimate the production function of the manufacturing industries relate productivity mainly to trade openness of Turkey and imported intermediates (Taymaz and Yılmaz 2007, formation reached an annual average rate of 9.1 percent during 2001-2012 from 1.1 percent through 1980-2000 (UNCTAD 2003). Much of the evidence on Turkish manufacturing covers the period before 2000s, focusing on the effect of policy changes on productivity growth. Growth accounting studies show that productivity growth With deregulations and privatizations in energy, telecommunications, and banking, FDI inflows to Turkey as percent of its gross fixed capital was TFP driven during the instigation of neo-liberal percent of preferential tariff to non-agricultural goods imported from countries outside the EU barriers. As of 2011, Turkey applies an average of 2.9 percent most favored nation's tariff and 1.1 economic policies in 1980-1988 in contrast Filiztekin 2001, Ozler and Yilmaz 2009), outsourcing (Paul and Yasar 2009), and foreign ownership of manufacturing firms (Yasar and Paul 2007).The post-2002 economic environment in Turkey differed markedly from the previous three decades. Following the import substitution industrialization policies in the 1970s, Turkey applied liberal trade policies by the beginning of 1980s. Imports were eased by tariff reductions and rapid relaxation of quantitative restrictions to boost exports. Government subsidies to total exports were above 20 percent during 1980-1994. The key factor in international competitiveness of the manufacturing firms was low labor costs achieved by measures against organized labor and restraining wages (Metin-Ozcan, Voyvoda, and Yeldan 2000, Şenses and Taymaz 2003). Turkey adopted the EU's common external tariff (CET) for most industrial products, as well as for the industrial components of agricultural products in 1996. Both the EU and Turkey agreed to eliminate all customs duties, quantitative restrictions and charges with equivalent effect on their bilateral trade. As part of financial liberalization program, Turkey opened its capital account completely in August 1989. In the face of chronicly high inflation rates and interest rates, the soaring government borrowing requirements were met by foreign funds channelled through banks into the financial system. However, the financial system was not properly regulated to equip the shocks from highly volatile short-term capital flows (Öniş and Şenses 2009). In global investors' anticipation of deteriorating fiscal balances and incredibility of the monetary policy, Turkish economy has experienced two severe crises, currency crisis in 1994 and financial crisis 2001, as foreign funds from the financial system were withdrawn. The productivity in the overall economy fell by 11 percent in 1994 and 4 percent in 2001. The negative effect of the crisis on manufacturing sector was more drastic, materialized by 17 percent fall in 1994 and 6 percent fall in 2001 in productivity.The investigation is conducted on a balanced panel dataset for 20 manufacturing industries observed annually over the 32 years from 1980 to 2011. In addition to individual industry estimates, it is also investigated if a single parameter estimates of the long-run value added productivity of capital can summarize the entire Turkish manufacturing sector in a panel setting. For this purpose, the pooled and mean-group CCE estimators of Pesaran are used (2006).The results suggest that there is considerable technology heterogeneity in the Turkish manufacturing industry across the industries as well as across the time dimension.The results of pooled estimations confirm the past findings on the structural change Turkish economy has gone following the crisis in the 2000s (Atiyas and Bakis 2015). After accounting for the heterogeneity among the sectors of manufacturing industry, via using pooled CCE estimators (in combination with FGLS) for the differential impact of macroeconomic changes, one percent growth in capital per labor leads to 43 percent labor productivity growth after 2002, compared to 0.30 percent growth during 1980- 2002. Results at the sectoral level show that the returns to capital range from -0.46 (leather sector) to 2.34 (non-electrical machinery). In the literature, the negative returns to capital is explained by capacity under-utilization, reorganization adjustments drawing resources from use of capital in production (Prescott and Visscher 1980). The positive returns which are largely above the income share of this factor (under the assumption of constant returns to scale), suggests that capital may also be a source of externalities in some sectors. The wide disparity in the sectoral capital coefficients and the standard errors, in addition to the small sample size (N) suggest choosing weighted mean group CCE over simple mean group CCE estimators. Accordingly, the growth in capital could account for about 51 percent of productivity growth since 2002, compared to 40 percent during 1980- 2002.

3. Econometrıc Model And Data:

Although time series dimension of our panel data suffice individual regressions, OLS estimates are biased and inconsistent if there is correlation between individual-specific unobserved effects hidden in regression errors. To avoid this problem, we use pooled models which allow such correlation.The productivity the Turkish manufacturing industry is estimated using common correlated effects (CCE) type estimator of (Pesaran 2006) which makes use of cross-sectional averages of the dependent and explanatory variables of the regression equation to remedy the cross-section dependence problem arising from unobserved common effects and/or error spill-over effects due to spatial or other forms of local dependencies (Pesaran and Tosetti 2011). The advantage of CCE approach is that it yields consistent estimates under a variety of other situations, such as serially correlated and heteroscedastic errors, possible contemporaneous dependence of the individual-specific regressors with the observed and unobserved common effects (Kapetanios and Pesaran 2007), structural breaks in the data (Kapetanios and Marcellino 2009), and unit roots in the common effects (Kapetanios, Pesaran, and Yamagata 2011). They can account for the presence of strong factors as well as an infinite number of weak factors, while no prior knowledge of the cointegrating properties of the observables and/or the unobservable is required (Kapetanios and Marcellino 2009). Another nice feature is the small sample properties of CCE estimators that meet the conditions of this study. Among the empirical studies that use CCE estimators are by (Kapetanios and Pesaran 2007) on individual asset returns; (Holly, Pesaran, and Yamagata 2010) on modelling house prices in the US; (Cavalcanti, Mohaddes, and Raissi 2011) on growth, development and natural resources; (Eberhardt, Helmers, and Strauss 2013) on estimation of private returns to R&D; and (Castagnetti and Rossi 2013) credit spread changes in the Euro corporate bond market. Our study follows closely that of (Eberhardt and Teal 2012) which adopts CCE model approach to estimate production functions for agriculture and manufacturing in a panel of 40 developing and developed countries for the period from 1963 to 1992.The results in this paper are based on panel data, comprising annual series from 1980 to 2011 for 20 industries covering the entire manufacturing sector.Theoutputand input data are based on the Turkish National Income and Product Accounts, published by the State institute of Statistics (SIS). The institute uses international standards of industrial codes (ISIC) to depict each industry in the manufacturing sector: ISIC-NACE. REV.1.1 for the period 1980-2001 and NACE.REV.2 2003-2011. A separate table including the explanations of those codes is provided in the appendix of this study. The latest vintage of the SIS database follows instead the ISIC classification. Hence, the Turkish manufacturing industry brunches are matched from the ISIC and the NACE REV 1.1 to NACE REV.2. classification using the many-to-one method used by O'Mahony and Timmer to backcast value-added data, so that there are 20 industries for the period 1980-2011 (O'Mahony and Timmer, 2009) (See Appendix).Output is real value added and labour input is the wage rate of each sub sector that is adjusted for changes in labor quality . Figure 1 presents the time series plot of log value added per capital over the sample period. Following the twin financial crisis in 2001, the dispersion of labour productivity across the manufacturing industries is a striking feature. Labour productivity growth in food (311), beverage (313), leather (323), footwear (324), and glass (362) industries declined below their 1980 levels whereas it significantly increased in textiles (321), wood (331), metal products (381), machinery (382), electrical machinery (383), and professional, scientific, measuring instruments (385) industries in post-2002 period.

Figure 1: Time series plot of log value added per labour of 20 Turkish manufacturing industries over 1980-2011



The general econometric model and then use the CCE solution proposed by (Pesaran 2006) to account for the cross-sectional correlations in residuals across industries is proceeded. We let y_{it} be the level of output of industry i at time t for $i = 1,\cdots,N,\quad t = 1,\cdots,T$ and we suppose that it is generated according to the linear heterogenous panel data model

$$y_{it} = \boldsymbol{\alpha}_i \boldsymbol{d}_t + \boldsymbol{\beta}'_i \boldsymbol{x}_{it} + e_{it}$$

,(1)where $\boldsymbol{d}_t$ is a n-dimensional vector of observed common effects (including deterministics such as intercepts), $\boldsymbol{x}_{it}$ is a k-dimensional vector of factor inputs, and $\boldsymbol{\alpha}_i$ is n-dimensional vector of coefficients of $\boldsymbol{d}_t$. Following the random coefficient model of (Swamy 1970), (Pesaran 2006) allows $\boldsymbol{\beta}$ to be heterogeneous accross industries in k-dimension. The idiosyncratic error term e_{it} is further decomposed as

$$e_{it} = \boldsymbol{\gamma}'_i \boldsymbol{f}_t + \varepsilon_{it},$$

(2)where $\boldsymbol{f}_t$ is the m-dimensional vector of unobserved common effects and ε_{it} is the industry-specific idiosyncratic error that is assumed to be independent of $\boldsymbol{d}_t$, $\boldsymbol{f}_t$, and $\boldsymbol{x}_{it}$. $\boldsymbol{d}_t$, and $\boldsymbol{f}_t$can be either integrated of order one, I(1), or stationary, I(0). The coefficient, $\boldsymbol{\gamma}'_i$, allows identify the differential effect of unobserved common factors specific to each industry. Writing $\boldsymbol{d}_t$ = 1, $\boldsymbol{f}_t$ = 1 and $\boldsymbol{\gamma_i}$ = $\boldsymbol{a_i}$ reduces the general model to the one with industry- specific effects only, $(\boldsymbol{\alpha}_i + \boldsymbol{\gamma}_i)$, which vary across industries but stays constant over time. Whereas, writing $\boldsymbol{f}_t$ = $\boldsymbol{\theta}_t$ (a scalar) and $\boldsymbol{\gamma_i}$ = 1, and $\boldsymbol{\alpha}_i$= 1 reduces the general model to the one with common observed and unobserved time effects, $(\boldsymbol{d}_t + \boldsymbol{f}_t)$, which vary across time but stay constant over industries. Here, the presence of common time effect, $\boldsymbol{f}_t$, makes the error terms of industries cross-correlated. Nonetheless, efficiency of estimators can be achieved by using generalized least squares based on the factor error structure. To allow for possible correlation between the unobserved common factors, $\boldsymbol{f}_t$, and regressors, $\boldsymbol{d}_t$, and $\boldsymbol{x}_{it}$, we let the data generation process for $\boldsymbol{x}_{it}$ follow

$$\boldsymbol{x}_{it} = \boldsymbol{A}'_i \boldsymbol{d}_t + \boldsymbol{\Gamma}'_i \boldsymbol{f}_t + \boldsymbol{v}_{it}($$

(3)where $\boldsymbol{A}_i$ and $\boldsymbol{\Gamma}_i$ are n x k and m x k, factor loading matrices with fixed components, and v_{it} are the idiosyncratic errors that are independent of the common effects and across industry i, but assumed to follow general covariance stationary processes. We combine equations (1) to (3) into

$$\boldsymbol{z}_{it} = \begin{pmatrix} y_{it} \\ \boldsymbol{x}_{it} \end{pmatrix} = \boldsymbol{B}'_i \boldsymbol{d}_t + \boldsymbol{C}'_i \boldsymbol{f}_t + \boldsymbol{u}_{it},$$

(4)where $\boldsymbol{B}_i = (\boldsymbol{\alpha}_i + \boldsymbol{A}_i^{'}\boldsymbol{\beta}_i,\ \boldsymbol{A}_i^{'})$ is n x (k+1), $\boldsymbol{C}_i = (\boldsymbol{\gamma}_i + \boldsymbol{\Gamma}_i^{'}\boldsymbol{\beta}_i,\ \boldsymbol{\Gamma}_i^{'})$ is m x (k+1), and $u_{it} = (\boldsymbol{\beta}_i^{'}\boldsymbol{v}_{it} + \varepsilon_{it}, \boldsymbol{v}_{it})$ is (k + 1) x 1.

To capture the effect of unobserved common factors in regression, Pesaran suggests augmenting the observed regressors, $\boldsymbol{x}_{it}$, with cross-section averages of y_{it} and $\boldsymbol{x}_{it}$ in a least squares regression as follows. Taking cross-section average of equation (4) at each t, and we obtain

$$\bar{\boldsymbol{z}}_t = \begin{pmatrix} \bar{y}_t \\ \bar{\boldsymbol{x}}_t \end{pmatrix} = \bar{\boldsymbol{B}}^{'}\boldsymbol{d}_t + \bar{\boldsymbol{C}}^{'}\boldsymbol{f}_t + \bar{\boldsymbol{u}}_t$$

(5)as the number of cross-sections increases, given $\varepsilon_{it} = 0$. Then we have

$$\boldsymbol{f}_t = \begin{pmatrix} \bar{y}_t \\ \bar{\boldsymbol{x}}_t \end{pmatrix} = (\bar{\boldsymbol{C}}\bar{\boldsymbol{C}}^{'})^{-1}\bar{\boldsymbol{C}}(\bar{\boldsymbol{z}}_t - \bar{\boldsymbol{B}}^{'}\boldsymbol{d}_t - \bar{\boldsymbol{u}}_t).$$

(6)In this way, the differential effects of unobserved common factors are eliminated, yielding consistent and asymptotically normal parameter estimates both when T is fixed and N goes to infinity as well as when both N and T jointly goes to infinity. Hence, we proxy $\boldsymbol{f}_t$ in equation (4) with

$$\boldsymbol{f}_t = \bar{\boldsymbol{z}}_t = \mathrm{N}^{-1}\sum_{\mathrm{i}=1}^{\mathrm{N}} \boldsymbol{z}_{it}$$

and subsitute it into the general equation (8). We finally have the CCE augmented equation as follows:

$$\boldsymbol{z}_{it} = \begin{pmatrix} y_{it} \\ \boldsymbol{x}_{it} \end{pmatrix} = \boldsymbol{B}_i^{'}\boldsymbol{d}_t + \boldsymbol{C}_i^{'}\bar{\boldsymbol{z}}_t + \boldsymbol{u}_{it}$$

(7)We borrow from (Eberhardt and Teal 2012) and suggest that $\boldsymbol{C}_i^{'}\bar{\boldsymbol{z}}_t$ can partially account for the differential impact, $\boldsymbol{C}_i$, of a common TFP, $\bar{\boldsymbol{z}}_t$, in the production process over cross-sections. We consider two alternative CCE estimators (Pesaran 2006) which allow the slope coefficients on the implied common factors to differ across countries: the mean group estimator (CCE-MG) and the pooled estimator (CCEP). In CCE-MG allows for presence of heterogeneous slopes by assuming that coefficients estimated in individual regressions are generated at random (Swamy 1970). We define $\boldsymbol{F} = (\boldsymbol{f}_1, \ldots, \boldsymbol{f}_T)'$; $\boldsymbol{X}_i = (\boldsymbol{x}_{i1}, \ldots, \boldsymbol{x}_{iT})'$; $\boldsymbol{\epsilon}_i = (\epsilon_{i1}, \ldots, \epsilon_{iT})'$; $\boldsymbol{y}_i = (y_{i1}, \ldots, y_{iT})'$; $\boldsymbol{z}_{it} = (y_{it}, \boldsymbol{x}_{it}{}')'$; $\boldsymbol{z}_\mathrm{i} = (\boldsymbol{z}_{i1}, \boldsymbol{z}_{iT})'$ and $\bar{\boldsymbol{H}}_\mathrm{w} = n^{-1}\sum_{i=1}^{n}\boldsymbol{z}_i$. We define the matrice $\bar{\boldsymbol{M}}_{\boldsymbol{w}} = \boldsymbol{I}_{\boldsymbol{T}} - \bar{\boldsymbol{H}}_{\boldsymbol{w}}(\boldsymbol{H}_{\boldsymbol{w}}^{'}\bar{\boldsymbol{H}}_{\boldsymbol{w}})^{-1}\boldsymbol{H}_{\boldsymbol{w}}^{'}$. Based on this, the individual slope coefficient $\boldsymbol{\beta}_i$ in (5) are estimated as

$$\widehat{\boldsymbol{\beta}}_{\boldsymbol{i}} = \left(\boldsymbol{X}_\mathrm{i}^{'}\bar{\boldsymbol{M}}_{\boldsymbol{w}}\mathbf{X}_\mathrm{i}\right)^{-1}\left(\boldsymbol{X}_\mathrm{i}^{'}\bar{\boldsymbol{M}}_{\boldsymbol{w}}\mathbf{y}_\mathrm{i}\right)$$

(8)Then, a non-parametric approach is applied to obtain mean group coefficients and standard errors that are robust to both spatial and serial error correlations. We compute mean group slope estimators, as simple average, $\widehat{\boldsymbol{\beta}}_{\boldsymbol{MG}}$ and as weighted average, $\widehat{\boldsymbol{\beta}}_{\boldsymbol{WMG}}$, of individual slope estimators, $\widehat{\boldsymbol{\beta}}_{\boldsymbol{i}}$, in two alternative ways. First, we take the simple average of the individual estimates, $\widehat{\boldsymbol{\beta}}_{\boldsymbol{i}}$ obtained from OLS regression of equation (4) as follows

$$\widehat{\boldsymbol{\beta}}_{\boldsymbol{MG}} = \boldsymbol{N}^{-1}\sum_{\boldsymbol{i}=\boldsymbol{1}}^{\boldsymbol{N}} \widehat{\boldsymbol{\beta}}_{\boldsymbol{i}}$$

(9)The MG estimation is very sensitive to outliers which are a common feature of the group specific estimates, particularly if the number of cross-sections is small. As an alternative, (Pesaran 2006) suggests weighted mean group estimator, $\widehat{\boldsymbol{\beta}}_{\boldsymbol{WMG}}$, which is based on (Swamy 1970) random coefficient (RC). RC estimator is a feasible GLS estimator, which is briefly equivalent to the weighted average of the individual estimates, $\widehat{\boldsymbol{\beta}}_{\boldsymbol{i}}$ with weights being inversely proportional to the sum of coefficient variance, $\widehat{\boldsymbol{\Omega}}_\mathbf{v}$, and individual regression error variance, $\widehat{\boldsymbol{\Sigma}}_{\mathrm{T,b_j}}$. It is assumed that each cross-section-specific $\boldsymbol{\beta}_{\boldsymbol{i}}$ is related to an underlying common parameter vector β:

$$\boldsymbol{\beta}_{\boldsymbol{i}} = \boldsymbol{\beta} + \boldsymbol{v}_{\boldsymbol{i}}$$

(10)where

$E(\boldsymbol{\beta}_{\boldsymbol{i}}) = \boldsymbol{\beta}$, and

$$E(\boldsymbol{\beta}_{\boldsymbol{i}} - \boldsymbol{\beta})(\boldsymbol{\beta}_{\boldsymbol{i}} - \boldsymbol{\beta})' = \begin{cases} \widehat{\boldsymbol{\Omega}}_\mathbf{v} & \text{if } \mathrm{i} = \mathrm{j}, \\ \mathbf{0} & \text{if } \mathrm{i} = \mathrm{j}; \end{cases},$$

imply that that the regression coefficient vectors $\boldsymbol{\beta}_{\boldsymbol{i}}$ are random and uncorrelated across sections, but follow the same distribution with mean $\boldsymbol{\beta}$ and variance-covariance matrix $\boldsymbol{\Omega}_\mathbf{v}$. This distribution is assumed to be stable over time.

$$\widehat{\boldsymbol{\beta}}_{\boldsymbol{WMG}} = \sum_{\boldsymbol{i}=\boldsymbol{1}}^{\boldsymbol{N}} \widehat{\boldsymbol{\theta}}_{\boldsymbol{i,rc}}\widehat{\boldsymbol{\beta}}_{\boldsymbol{i}}$$

(11)where

$$\widehat{\boldsymbol{\theta}}_{i,rc} = \left(\sum_{j=1}^{N}\left(\widehat{\boldsymbol{\Sigma}}_{\mathrm{T,b_j}} + \widehat{\boldsymbol{\Omega}}_\mathbf{v}\right)^{-1}\right)^{-1}\left(\widehat{\boldsymbol{\Sigma}}_{\mathrm{T,b_i}} + \widehat{\boldsymbol{\Omega}}_\mathbf{v}\right)^{-1}$$

$$\widehat{\boldsymbol{\Sigma}}_{\mathrm{T,b_j}} = \hat{\sigma}_{\mathrm{jj}}\left(\mathbf{X}_\mathrm{j}^{'}\bar{\boldsymbol{M}}_{\boldsymbol{w}}\mathbf{X}_\mathrm{j}\right)^{-1}$$

A consistent OLS estimate of σ_{jj} is given by

$$\hat{\sigma}_{jj} = (T-k)^{-1}\, \mathbf{y}_j' \mathbf{M}_j \mathbf{y}_j$$

where $\mathbf{M}_j = \mathbf{I} - (\bar{\boldsymbol{M}}_w \mathbf{X}_j)'(\mathbf{X}_j' \bar{\boldsymbol{M}}_w \mathbf{X}_j)^{-1}(\bar{\boldsymbol{M}}_w \mathbf{X}_j)'$.

(Swamy 1970) shows that a consistent estimator of $\boldsymbol{\Omega}_v$ is given by

$$\widehat{\boldsymbol{\Omega}}_v = (N-1)^{-1}\left(\sum_{j=1}^{N} \widehat{\boldsymbol{\beta}}_i \widehat{\boldsymbol{\beta}}_i' - N^{-1} \sum_{j=1}^{N} \widehat{\boldsymbol{\beta}}_i \sum_{j=1}^{N} \widehat{\boldsymbol{\beta}}_i'\right) - N^{-1}\left(\sum_{j=1}^{N} \hat{\sigma}_{jj} (\mathbf{X}_j' \mathbf{X}_j)^{-1}\right)$$

(12)(Pesaran and Smith 1995) suggests dropping the final term of $\widehat{\boldsymbol{\Omega}}_v$ to consistently estimate the variance-covariance matrix of coefficients, $\boldsymbol{\Sigma}_{MG}$, non-parametrically. Under the random effects assumptions, the MG estimator is consistent (not unbiased) and asymptotically normally distributedas N gets large with fixed T.

The pooled CCE estimator (CCEP) is based on the assumption that individual slope coefficients are homogenous, $\boldsymbol{\beta}_i = \boldsymbol{\beta}$, while the slope coefficients of the common effects are allowed to differ across i. The latter is made possible by de-factoring the original series in individual regressions prior to pooling as follows:

$$\widehat{\boldsymbol{\beta}}_{CCEP} = \left(\sum_{i=1}^{N} \boldsymbol{X}_i \bar{\boldsymbol{M}}_w \mathbf{X}_i\right)^{-1} \sum_{i=1}^{N} \boldsymbol{X}_i \bar{\boldsymbol{M}}_w \mathbf{y}_i$$

(13)We also provide a generalization of the CCEP, the Feasible Generalized Least Squares estimator of CCEP, (CCEP-FGLS) which accounts for heteroskedasticity and serial correlation in the errors as follows:

$$\widehat{\boldsymbol{\beta}}_{CCEP-FGLS} = \left(\sum_{i=1}^{N} \widehat{\boldsymbol{\theta}}_{i,p} \boldsymbol{X}_i \bar{\boldsymbol{M}}_w \mathbf{X}_i\right)^{-1} \sum_{i=1}^{N} \widehat{\boldsymbol{\theta}}_{i,p} \boldsymbol{X}_i \bar{\boldsymbol{M}}_w \mathbf{y}_i$$

(14)where the pooling weights are

$$\widehat{\boldsymbol{\theta}}_{i,p} = \left(\sum_{j=1}^{N} \widehat{\boldsymbol{\Sigma}}_{T,\beta_i}^{-1}\right)^{-1} \widehat{\boldsymbol{\Sigma}}_{T,\beta_i}^{-1}$$

In pooled estimation we use (Newey and West 1987) estimator of residual variance to smooth the sample residual autocorrelation function, by assigning declining kernel weights to sample auto co-variances as number of lags increases.

4. Results :

In this section, the estimation results for individual industry specifications in Table 1, the panel pooled specifications in 2, and panel mean-group specifications in 3 are given. The empirical regressions express all variables in log terms. Following Eberhardt and Teal we specify labour productivity function in unrestricted form by including labor in addition to capital per labor in our estimations (Eberhardt and Teal 2012). The coefficient on labor variable implicitly represents $\beta_L + \beta_K - 1$. The inclusion of labor variable therefore indicates the deviation from constant returns to scale. Hence, the production function exhibits: constant returns to scale if the coefficient on log labor is not statistically significant; increasing (decreasing) returns to scale if the coefficient on log labor is statistically significant and positive (negative). The divergence of labour productivity over the industries in post-2002 hints for a possible structural break in the long-run relationship. The assumption of the constancy of relationship parameters may not be valid as policy interventions to the economy may give raise to a state dependent type of behavior or structural changes, parameter instability. In their non-parametric studies on Turkish manufacturing productivity, Atiyas and Bakış explain the increase in labor productivity in the 2000s with: Firstly, following the 2000-2001crisis the macroeconomic conditions have been stabilized and improved (Atiyas and Bakis 2015). Secondly, there is a change in industrial policy, i.e. TUBITAK –TEYDEB research and development support program (Tandoğan 2011). Atiyas and Bakış for instance, argue that instead of a selective industrial policy, the government adopt an incentive system which has become less discretionary, and an objective and transparent eligibility criteria for incentives (Atiyas and Bakis 2015). On the other hand, draw attention to the changes in data collection and sampling methodology in Turkstat which may result in an apparently misleading increase in labour productivity. As a result, we include interaction of a time dummy for the period 2003-2011 with the intercept and with the capital coefficient in the models. Based on the residuals from preliminary pooled estimations on 22 industries, two industries are outliers, namely tobacco and miscellenaous products of petrolium and coal. Therefore, estimations are proceeded on a restricted sample of 20 industries. The technology coefficient estimates are sensitive to the presence of the observed common factors, i.e. inflation, trade openness, financial development, and telecommunication penetration, in regressions and regression error estimates are lower. Therefore, in addition to the unobserved common factors, we keep observed factors as deterministic regressors. However, we do not present them in the tables as they are not the center of interest in this study.The residual diagnostics for all panel estimations are also presented. The presence of cross-section dependence in the residuals indicates that the regression model fails to capture the cross-correlation in the estimated residuals across industries. To avoid spurious estimates, stationarity in the residuals using Engle-Granger type residual-based co-integration test are tested. If the estimated residual series are stationary, the estimated production function is identified as not being spurious but co-integrated, and *t*-statistics are valid (Kao 1999), despite the presence of unit root, I(1), in the series. In that respect, we present (Pesaran 2007)CIPS panel unit root test which has the null of non-stationary process series in all cross-sections.[1]Table 1 contains the individual industry results for Turkish manufacturing sector. Estimations are based on equation (4) using OLS method. In addition to the standard inputs, common correlated effects in regressions included but do not present the effects in the table.[2] Panel A reports the results for the basic model. The increased dispersion of labour productivity over the industries in post-2002 calls for a check of a structural break in the long-run productivity relationship. For this purpose, Panel B adds the interaction of capital with the post-2002 period time dummy. For comparison of industry results with the manufacturing sector as a whole, the last row of Table 1 presents the simple mean of industry coefficients. Overall, the results of individual industry regressions show there is an apparent dispersion of point estimates on capital productivity and returns to scale across industries. In addition, the standard error estimates are fairly large resulting in insignificant technology coefficient estimates. These findings are against our expectation that a single wage rate for labor and rental rate for capital exists across industries in the Turkish manufacturing sector. Individual regressions may fail to capture the peculiarity of each industry. In a single cross-section, there may be no internal evidence of an omitted-variable bias. Using for instance, fixed industry effects,in a pooled model can partially overcome such failure. To reduce the uncertaint in the industry estimates, we employ a panel approach and pool the data over the industries. The results are reported in the next sub-section.

Table 1. Labor productivity in Turkish manufacturing sector: Industry Regressions, (1980-2011)

		PANEL A					PANEL B						
		labor	s.e.	capital per labor	s.e.	returns to scale	labor	s.e.	capital per labor	s.e.	capital pl * post2002	s.e.	returns to scale
1	Food	0.683 **	(0.25)	1.235 **	(0.32)	IRS	1.142 **	(0.27)	1.742 **	(0.31)	-0.661 *	(0.22)	IRS
2	Food n.e.c.	1.106 **	(0.34)	1.155 *	(0.47)	IRS	0.536	(0.32)	0.807	(0.38)	0.654 *	(0.44)	CRS
3	Beverage	-0.729 **	(0.21)	0.595 **	(0.18)	DRS	-0.434 *	(0.33)	0.552 *	(0.22)	0.402	(0.25)	DRS
4	Textiles	-0.530	(0.37)	0.704	(0.40)	CRS	-0.238	(0.37)	0.946 *	(0.39)	-0.592	(0.23)	CRS
5	Leather and leather products	-1.050 *	(0.43)	-0.462	(0.31)	DRS	-0.560	(0.34)	-0.173	(0.22)	0.354	(0.28)	CRS
6	Footwear	-1.135 **	(0.28)	-0.389	(0.24)	DRS	-1.216 **	(0.31)	-0.383	(0.32)	-0.047	(0.58)	DRS
7	Wood and wood-cork products	-1.070 *	(0.45)	-0.220	(0.42)	DRS	-1.059	(0.60)	-0.140	(0.53)	-0.079	(0.85)	CRS
8	Paper and paper products	-0.559	(0.79)	0.273	(0.71)	CRS	-0.388	(0.60)	-0.579	(0.52)	1.081 **	(0.23)	CRS
9	Printing, publishing	0.186	(0.58)	0.698	(0.39)	CRS	0.205	(0.67)	0.685	(0.41)	-0.695	(0.37)	CRS
10	Petrolium refineries	-0.293	(0.22)	0.851 **	(0.20)	CRS	-0.684	(0.30)	0.757 **	(0.25)	-1.545 *	(0.44)	CRS
11	Plastic products n.e.c.	0.561	(0.56)	1.306 **	(0.38)	CRS	0.726	(0.36)	1.076 **	(0.35)	-0.051	(0.70)	CRS
12	Pottery and china	-0.263	(0.28)	0.269	(0.26)	CRS	-0.563	(0.38)	0.029	(0.27)	-0.414	(0.27)	CRS
13	Glass and glass products	-0.990 **	(0.38)	-0.054	(0.31)	DRS	-0.922 *	(0.38)	-0.372	(0.35)	0.539 **	(0.41)	DRS
14	Iron and steel basic industries	0.902	(0.82)	0.684	(0.62)	CRS	1.281	(0.91)	0.171	(0.55)	1.165	(1.13)	CRS
15	Fabricated metal products	-0.308 *	(0.15)	0.222	(0.15)	DRS	-0.240	(0.15)	0.260	(0.14)	0.329 *	(0.13)	CRS
16	Machinery except electrical	0.085	(0.66)	2.340 **	(0.82)	CRS	0.343	(0.66)	2.787 **	(0.80)	0.035	(0.37)	CRS
17	Electrical machinery apparatus	0.071	(0.25)	0.371	(0.25)	CRS	0.049	(0.22)	0.271	(0.18)	0.042	(0.26)	CRS
18	Transport equipment	0.406	(0.25)	0.332	(0.14)	CRS	-0.759	(0.32)	-1.022	(0.42)	1.103 *	(0.42)	CRS
19	Professional, scientific, measuring instr.	0.548 *	(0.26)	1.074 **	(0.23)	IRS	0.398	(0.28)	0.778 *	(0.41)	0.030	(0.43)	CRS
20	Other manuf. industries	0.559	(0.40)	1.828 **	(0.63)	CRS	0.062	(0.47)	1.517 *	(0.69)	-0.709	(0.76)	CRS
	Manufacturing Sector mean	-0.091		0.641			-0.116		0.485		0.047		
	Manufacturing Sector median	-0.096		0.640			-0.239		0.412		0.033		

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Table 2 reports the pooled estimation results on the long-run relationship between capital and labour productivity. Parameter homogeneity on factor inputs while allowing for parameter heterogeneity on TFP via observed and unobserved time-variant common factors across industries is assumed. We expect that these time effects fairly capture the effects of macro-economic shocks on productivity of the manufacturing industries. For comparison, we provide the results of two-way fixed effects model (2FE) which captures the fixed cross-section and time effects on output growth. A shortcoming in 2FE model is the assumption of homogenous slope coefficients on fixed time effects across cross-sections; such as a financial crisis is expected to negatively affect the output level of the industries to the same extent. The coefficient estimates are presented together with robust t-ratios computed using standard errors based on Newey-West type variance estimator. The capital coefficient estimate can be interpreted as the productivity of capital in per labor terms. The pooled results, CCE models in particular, are consistent in terms of sign and magnitude with the average results for individual

[1]We abstain from using transcendental form in the productivity function, i.e. by first differencing the series to circumvent the spuriousness due to non-stationarity in the variables. We believe this approach would drop valuable information regarding the industry-specific effects, which can be very important in evaluating the impact of capital on productivity

[2] We can provide the full results upon request

industries in 1. As mentioned, the coefficients to the capital and the interaction term equal 0.532 and 0.015 in the CCEP (column 4), whereas the individual industry regressions lead to mean coefficients of 0.485 and 0.047 (panel B), respectively. The fact that the pooled estimates remain very close to the average of industry-specific results supports the poolability of the industries in the panel.

Table 2. Labor Roductivity In Turkish Manufacturing Sector: Pooled Regressions, 20 Industries,(1980-2011)

	(1) 2FE	(2) CCEP	(3) CCEP-FGLS	(4) CCEP	(5) CCEP-FGLS
Estimates					
Log labor (L) : βl + βk - 1	-0.482**	-0.004	-0.136	-0.142	-0.291 **
s.e.	(0.06)	(0.12)	(0.08)	(0.12)	(0.08)
Log capital per labor : βk	0.288**	0.696 **	0.510**	0.532**	0.301 **
s.e.	(0.06)	(0.10)	(0.08)	(0.12)	(0.08)
Log capital pl*post-2002: βk* dummy				0.015	0.132
s.e.				(0.12)	(0.07)
implied returns to scale	DRS	CRS	CRS	CRS	DRS
Residual diagnostics					
ESS	...	13.385	13.505	11.466	11.594
RMSE	0.394	0.145	0.145	0.134	0.135
mean_abs (rho)	0.520	0.226	0.230	0.208	0.202
stationarity	I(1)	I(0)	I(0)	I(0)	I(0)
Stability diagnostics					
F-test				106.47***	104.87 ***
Slope homogeneity- Delta statistic		18.8***	13.2 ***	10.6 ***	9.1 ***
Total Panel Observations	640	640	640	640	640

Notes: All variables are expressed in log levels. 2FE is the two-way fixed effect estimator, CCEP is the pooled Common Correlated Effect estimator of (Pesaran 2006), CCEP-FGLS is the Feasible Generalized Least Squares estimator of CCEP; the standard errors are calculated using Newey and West (Newey & West, 1987) estimator of residual variance;. *, **, *** represent statistical significance at the 10%, 5% or 1% level, respectively. CD_lm is the cross-sectionally augmented IPS test of (Pesaran 2007) Delta statistic is the slope homogeneity test of Pesaran and Yamagata (Pesaran and Yamagata 2008). Data sources: Standard inputs value added, labour and capital investment series are from Turkish National Income and Product Accounts, published by the State Institute of Statistics. Capital stock and quality-adjusted labor input series are constructed earlier by (Alvan & Ghosh, 2010.Next, the robustness of the pooled model results by applying tests on the residuals and test of coefficient homogeneity across industries is investigated. The residual diagnostic tests seem to favor CCE estimators over 2FE specification in pooled regressions. The root mean squared errors (RMSE) in CCE models (0.145 in columns 2 and 3; 0.134 in columns 4 and 5) is considerably lower than that in 2FE (0.394), the latter due to the variance of the residuals which inflates in the post-2002 period. This may be due to the failure of 2FE to model the deepening differential impact of economy wide shocks, namely the impact of Turkish financial crisis in 2001 and the global depression in 2009 on industries resulting in differential capacity utilization rates. Compared to 2FE specification, cross-section dependence is milder in CCE models, as the mean absolute cross-correlation of errors is about 0.52 in 2FE whereas it is about 0.20 to 0.23 in CCE models. The unit root tests indicate that, in contrast to the 2FE estimators, the CCE estimators yield stationary residuals indicating a co-integrating relationship in the model. In conclusion, the pooled specification results confirm the past findings that the structural change Turkish manufacturing sector has gone following the crisis in the early 2000s. Accounting for the differential impact of common factors on the productivity of manufacturing industries using pooled CCE-FGLS estimators, one percent increase in capital services per labor results in 43 percent increase in labor productivity in after 2002, compared to 0.30 percent increase before 2002. However, when tested the industries are not poolable. In the next section, we consider mean-group CCE estimation which is robust to dispersion of slope coefficients including outliers.Table 3 presents the simple mean and the weighted mean of the individual industry coefficient estimates as well as their dispersion. The CCE estimators (columns 3 to 6) additionally account for unobserved common factors across the industries. In regressions without unobserved common factors (columns 1 and 2), the coefficient on labor is positive and significant (0.443 and 0.249) in indicating increasing returns to scale in production. Furthermore, the weighted mean of industry capital coefficients indicates increasing returns (1.152), suggesting that the quality or level of norms that amass with capital defines a higher level of production technology in a typical manufacturing industry. When the industry estimates are weighted, capital productivity in pre-2002 is lower, 0.393, but the increase in capital productivity in post-2002 is higher, 0, 12. Accordingly, one percent increase in capital services results in 0.513 percent increase in output per labour after 2002. The weighted mean-group magnitudes are close to those obtained in pooled CCEP-FGLS specifications in Table 2.

Table 3. Labor productivity in Turkish anufacturing sector: Mean Group Results, 20 industries, (1980-2011)

	(1) MG	(2) WMG	(3) MG-CCE	(4) WMG-CCE	(5) MG-CCE	(6) WMG-CCE
Estimates						
Log labor (L) : β1+βk−1	0.443**	0.249	-0.091	-0.216	-0.116	-0.124
s.e.	(0.16)		(0.16)		(0.12)	
Log capital per labor: βk	1.152**	0.977	0.641**	0.656	0.485***	0.393
s.e.	(0.13)		(0.16)		(0.12)	
Log capital pl*post-2002: βk* dummy					0.047	0.120
s.e.					(0.12)	
implied returns to scale	IRS		CRS		CRS	
# of industries CRS is rejected			7		4	
RMSE	0.171		0.129		0.118	
mean_abs (rho)	0.200		0.182		0.177	
Stationarity	I(0)		I(0)		I(0)	
Total Panel Observations	640		640		640	

Notes: All variables are expressed in log levels. The mean-group (MG) and the weighted meangroup (WMG) estimators are the means of the industry-specific slope coefficients. The CCE estimators (column 3-6) additionally account for common correlated effects across the industries. (Pesaran 2006) The standard errors of the coefficients are based on non-parametric variance estimator in Pesaran (Pesaran 2006); *, **, *** represent statistical significance at the 10%, 5% or 1% level, respectively. CD_lm is the cross-sectionally augmented IPS test of (Pesaran 2007).
Data sources: Standard inputs value added, labour and capital investment series are from Turkish National Income and Product Accounts, published by the State Institute of Statistics. Capital stock and quality-adjusted labor input series are constructed earlier by (Alvan & Ghosh, 2010).

Next, from the diagnostics results, the root mean of squared errors obtained from industry regressions is lower in CCE-MG models (0.129-0.118) than that in MG model (0.171). According to CIPS tests, the residuals are stationary in all models, confirming the co-integration relationship estimated in pooled CCE models.

4. Concluding Remarks:

The aim of this study is to weigh the capital in the productivity growth of the value added at Turkish manufacturing industry between the years 1980 and 2011. For this purpose, common correlated effects (CCE) type estimator of (Pesaran 2006) is applied. The CCE type estimator was applied under three versions: individual industry, pooled, group-mean. Overall, the individual industry, pooled and group-mean specifications yield the following main conclusions. 1. Individual industry regression results convey apparent technology heterogeneity across the industries. However, some of the individual industry estimates seem implausible whilst most of them are imprecise. 2. Imposing slope homogeneity restriction in the pooled models lends a lot of precision to the capital productivity estimate. However, when tested, the industries are not poolable. The finding that industries are not poolable may be due to reasons that in some industries there is increased use of intermediate goods, imported goods in particular, being less than perfectly competitive, i.e state monopoly in the petroleum refineries until 2000, powerful unionization of labor, rigid labor markets, structural rigidity due to sector-specific investment in capital or human resources that cannot shift across sectors, i.e. resource rich industries such as oil, etc., privatization and deregulation in some industries. But, interestingly, the mean-group and pooled estimates of technology coefficients are close. 3. The technology estimates are sensitive to the presence of observed and unobserved common factors, justifying the use of Common Correlated Effects estimators. We identify four observed factors that render the coefficient estimates sensitive, namely, trade volume, inflation rate, penetration, and financial development. As a result, they are included in the regressions, despite the fact that the factors are not statistically significant in all models (Stock and Watson 2007), pp-478-479).[3] 4. Compared to pre-2002 period, labour productivity across industries is widely dispersed in post-2002 period. By the end of 2011, in some industries labour productivity is well below 1980 levels. The econometric results in this study confirm the past surveys on Turkish manufacturing industry which argue that there is a structural change in Turkish manufacturing sector following the financial crisis

[3]For a thorough discussion of robustness check, see Lu and White (Lu and White 2014).

in 2001. Using Common Correlated Effects estimators of (Pesaran 2006), we find that one percent increase in capital services per labor results in 0.301 to 0.393 percent increase in labor productivity in a typical manufacturing industry in the pre-2002 period. The value is lower than those found growth accounting studies on Turkish manufacturing sector but closer to those found in other countries. However, following 2002, capital services alone fail to explain the wide dispersion in productivity observed in the manufacturing industries.The finding that industries are not poolable may be due to the industry peculiarities varying over the period of this study. For instance, the petroleum refineries industry was a state monopoly until 2009. The estimates suggest increasing returns to capital in pre-2002, but decreasing returns in post-2002 in this industry. The automotive sector grew rapidly in 2000s as it got closely integrated to global value chains. Especially after 1980, there was a structural change at Turkish manufacturing industry and at 2000s low-tech industries share in value added of total industry are around 66%, medium-tech industries are around 24 % and only a little share of high tech-industries.Surveys in the literature point to the increased use of imported intermediate goods and integration into global value chains in the 2000s. The manufacturing sector includes industries that are largely engaged in the physical or chemical transformation of materials into new products. The changes in the input mix over time, particularly with regards to the relative contribution from the intermediate inputs, i.e. energy, materials, and services, are crucial in explaining productivity growth in manufacturing industries. Use of intermediates allows firms reallocate resources to their best use, specialize in production and reduce production cycle time. Indeed, access to high quality materials can improve the quality of the production system by eliminating breakdowns and delays arising from using own but low quality materials. For instance, in their survey covering 145 large scale Turkish manufacturing firms, Saygili et al. reports that a seamless and an uninterrupted process flow as one reason, among others, why respondent firms source to imported goods (Saygili et al. 2014). Therefore, including intermediates and using gross product as a measure of output will bring further insights into this analysis. With respect to intermediate materials, government policy has an important role in hindering/promoting the productivity growth of firms through trade regulations. Protection of an upstream industry through import restrictions increases the cost of imported inputs in the downstream industries, resulting in a new input composition depending on the substitutability of the imported material with other inputs. For instance, for Hungary over the period 1993-2002, Halpern et al. find that importing all input varieties increases a firm’s revenue productivity by 22 percent, about half of which is due to imperfect substitution between foreign and domestic inputs (Halpern, Koren, and Szeidl 2015). Yalçın, Saygılı et al. report that the share of imported inputs of foreign origin increased by 10 per cent during the 2002-2007 period (Yalcin et al. 2012). This was followed by Turkey applying global safeguard and antidumping measures, affecting imports of industrial goods amounting 1.6 billion US dollars during 2008-2011, according to World Bank estimates. It is expected that, during 2008-11, increased protection in the textiles and steel industry alone may affect up to 9 percent of Turkey’s manufacturing imports.[4] Therefore, we anticipate that increased use of trade barriers by the government in 2000s via its effect on imports of intermediate goods can explain the productivity heterogeneity in Turkish manufacturing industries.

The analysis in this study can enhance by using measures correcting for cyclical changes in the input utilization, including intangible capital built through accumulation of investments in organizational change, research and development activities, patents, etc. and also other sources of network externalities or spillovers that cannot be associated with classic factor inputs.

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Appendix. International Sectoral Codes Of Manufacturing Industry:

ISIC-NACE REV.1.1-NACE REV.2	SEKTÖR ADI
311-15-10	Food manufacturing
312-15.89-10.89	Manuf. Of food products not elsewhere classified
313-15.91-11.01	Beverage industries
314-16-12	Tobacco manufactures
321-17.11-13	Manufacturing of textiles
323-18.10-14.11	Manuf. Of leather and products of leather, leather substitutes and fur, except footwear and wearing apparel
324-19.30-15.20	Manuf. Of footwear, except vulcanize or moulded rubber or plastic footwear
331-20.10	Manuf. Of wood and woodcork products except furniture
341-21.12-17.12	Manuf. Of paper and paper products
342-22.10-18.10	Printing, publishing and allied industries
353-23.20-19.20	Petrolium refineries
354-24.10-20.10	Manuf. Of miscellenaous products of petrolium and coal
356-24.16-22.20	Manuf. Of plastic products not elsewhere classified
361-26.21-23.41	Manuf. Of pottery china and elsewhere
362-26.11-23.11	Manuf. Of glass and glass products
371-27.10-24.10	Iron and steel basic industries
381-28.75-25.99	Manuf. Of fabricated metal products except machinery and equipment
382-29.10-28.10	Manuf. Of machinery except electrical
383-31.20-27.10	Manuf. Of electrical machinery apparatus appliances and supplies
384-34.10-29.10	Manuf. Of transport equipment
385-30.02-26.20	Manuf. Of Professional and scientific and measuring and controlling equipment not elsewhere classified, and photographic and optical goods
390-36.63-32.99	Other manuf. industries