Agglomeration and Growth in Turkey, 1980-1995

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Abstract

This paper examines the extent at which dynamic scale externalities affected employment growth in Turkey during 1980-1995 period, using panel data on manufacturing industry. Localization economies are found to have negative effect on employment growth in the short-run but there is evidence in favor of specialization once additional lags are allowed for. The paper finds no evidence in favor of diversity in major industries but for high-tech industry. The results also indicate positive effects of backward- and forward linkages. Moreover, highly dense areas are found to attract firms at the beginning but over time congestion drives firms out of such centers. Finally the paper reports that the effect of competition is differential depending on the sector. In industries where competition for inputs is crucial, such as heavy industries, it reduces employment growth but in industries that have differentiated products and continuous innovations are important, such as high-tech industries, the effect of competition on growth is positive.

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1. Introduction

This paper investigates the effects of local scale externalities on employment growth in Turkish private manufacturing industry. Urban and regional economists emphasized the importance of the effects of scale externalities on growth for a long time (Henderson [12]). Recent models of endogenous economic growth revived the interest in spillovers (Romer [21] and Lucas [19]) and there are an increasing number of studies on economic geography in the last decade (Quigley [20]). The main question of the existing theoretical research is why industries concentrate on certain locations and they provide a wide variety of explanations for spatial agglomeration based on some form of externalities. The significance of this research lies in the fact that understanding of reasons for spatial agglomeration could lead to resolution of many controversial issues in trade theory or economic growth.

Empirical studies to confirm the theoretical claims are far from being conclusive for a variety of reasons as discussed in Hanson [11]. Most importantly, the lack of appropriate data, or the unobservable characteristics of external economies, makes it very difficult to estimate the effects of agglomeration economies, thus researchers have to rely on indirect inferences about their existence and importance. Consequently, there is an ongoing debate about the relative importance of different types of scale economies. For example, the study by Glaeser et al. [9] shows that diversity, the existence of urbanization economies, is an important factor for growth of cities in the U.S. for the period 1956-1987. In contrast, Henderson et al. [15] estimate strong impact of localization economies, that is, specialization in a particular area, using data from the U.S. between 1970 and 1987 and some evidence for diversity only for high-tech industry. Henderson [14] using production approach for machinery and high-tech industries in the U.S. reaches similar conclusion that localization economies contemporaneously and with a lag enhance growth however he fails to find any correlation between diversity and growth. In contrast to the findings for the American economy, Combes [6], using French data, obtained opposite results. He finds that both diversity and specialization reduced growth in French employment zones during the 1984-1993 period.

Equally interesting research question is whether the findings for the developed economies hold as well for developing countries. Empirical research using developing country data are very few. Hanson [10] examines employment growth in Mexico. He focuses on the effect of trade, particularly the effect of Nafta, on spatial distribution of industrial activity in Mexico and finds that after Mexico joined Nafta, there was a strong deconcentration of industry from Mexico City towards the Mexican-American border. Thus, international trade accompanied with transportation costs and increasing returns to scale comes out as a major determinant of location choice of firms and spatial agglomeration in Mexico. He also finds evidence in favor of backward-forward linkages and weak evidence for diversity but rejects that specialization did improve growth performance of industries.

In another study of spatial agglomeration in developing country framework, Henderson et al. [16] test the effects of scale externalities using data from South Korean manufacturing industry. During massive liberalization in Korea between 1983 and 1993 they find that there was a strong tendency for deconcentration of industry from traditional centers, yet reconcentration in other parts of the country. In this process there is evidence in favor of static localization economies but no evidence for dynamic localization and urbanization economies of any kind. Based on their estimates they conclude that the form and magnitude of scale externalities are alike developed countries.

This paper contributes to the same debate in the context of Turkey between 1980 and 1995 and asks the question whether the experience of Mexico and Korea could be expanded to other developing economies. Turkey as its counterparts in the above mentioned studies experienced a trade liberalization in 1980 after two decades of import substituting industrialization. Industry was agglomerated mainly and even more heavily in major traditional centers. However, Turkey differs from the previous examples in that Turkey did not engage in a large scale trade agreement during the period examined, as Mexico did, and the massive deconcentration in Korea was, as the authors suggest, “unlike developing country context” (Henderson et al. [16], p. 479), thus it is not observed in to Turkey.

Nevertheless using a panel data on Turkish private manufacturing industry, the findings of this paper support early research for the U.S. and Korean economies. There is negative effect of localization economies in the short-run, however the effect is positive when medium-run is considered. There is no evidence in favor of diversity except for high-tech industries. The results also indicate existence of other type of externalities. Backward- and forward linkages seems to be a strong determinant of industrial growth in Turkey. Highly dense areas attract firms at the beginning but over time congestion drives firms out of such centers. Moreover, employment growth increases with the average size of firms and finally the effect of competition is differential depending on the sector.

The next section describes the underlying theoretical framework for the estimated equation and data. Section 3 discusses environment in Turkey during the investigation period and discusses the evolution of size distribution of province-industries. Section 4 presents the estimation of agglomeration economies and the results. Finally, Section 5 concludes.

2. Theory and data

This section discusses a simple theoretical framework to estimate agglomeration economies and describes the data and how different externalities are measured.

Theory

To test the effects of local scale externalities on growth, a profit-function approach is implemented as usually used in the literature. Each firm's employment decision is obtained by maximizing profits:

$$L_{ijt} = -\frac{\partial \Pi_{it}(w_{ijt}, r_{ijt}, a_{ijt})}{\partial w_{ijt}} \tag{1}$$

where L is employment, $\Pi(.)$ is the profit function, w is wage rate, r is the vector of prices of all other inputs, a is overall level of technology which is a function of nationwide technological progress and local technological and market based externalities, and i indexes industry, j province and t time. To test for dynamic externalities the growth rate of regional labor demand is considered. Furthermore, employment growth in each province-industry is normalized relative to nationwide industrial growth. By assuming that prices of other inputs, especially of capital, same in every province, the relative growth approach allows me to avoid the lack of reliable local price series for other inputs. The relative growth approach also controls for nationwide industry specific shocks. For example, it is possible that opening the economy to free trade may result in specialization in certain products because of comparative advantage of the country in that product and hence, excess growth in areas that specialized in the exported products. Thus, the analysis here, rather than explaining absolute growth, describes the economic structure in which a province-industry grew more rapidly than national industry. Therefore, Equation (1) is specified as:

$$\Delta \ln\left(\frac{L_{ijt}}{L_{it}}\right) = \beta_1 \Delta \ln\left(\frac{w_{ijt}}{\overline{w}_{it}}\right) + \beta_2 \Delta \ln\left(\frac{a_{ijt-1}}{\overline{a}_{it-1}}\right) \tag{2}$$

To estimate the impact of externalities an explicit functional form for relative technology growth has to be specified as well. It is usually assumed that it is a logarithmic function of a set of lagged proxies for external effects, thus the parameters can be interpreted as elasticities:

$$\Delta \ln\left(\frac{a_{ijt}}{\bar{a}_{it}}\right) = a_t + \sum_{k=1}^{K}\sum_{m=1}^{M}\gamma_k \ln\left(\frac{X_{ijt-m}^{k}}{\bar{X}_{it-m}^{k}}\right) + (\varepsilon_{ijt} - \bar{\varepsilon}_{it}) \tag{3}$$

where X^k is the proxy for kth external effect, K is the number of total external factors and M denotes lags. a_t is nationwide shock across all provinces and industries. The last term in Equation (3) denotes idiosynchratic shocks to each province-industry.

Combes [6] provides a detailed survey of agglomeration and dispersion forces. One can braodly categorize these forces into two groups, information spillovers and market-based externalities. Information spillovers are important when firms do not have complete information, instead each firm possesses different pieces of information. In addition, if information acquiring is costly and distance impedes transmission of information, firms rely on turnover of skilled labor and/or formal and informal contacts to obtain information on demand conditions and on innovations as well as to improve their organization structure. What kind of economic structure, however, enhances information spillovers is an ongoing debate. If there are localization economies, firms prefer to be located near to firms that operate in the same industry as themselves. Consequently, particular regions specialize in one specific industry. On the other hand, if urbanization economies are prevalent, firms prefer to locate in regions where there are many diverse firms. In such an environment innovations in one sector are expected to diffuse easily to other sectors of the economy or provoke innovation in other sectors due to information spillovers.

Similarly, market forces may also induce agglomeration. In the presence of non-negligible transportation costs and increasing returns, firms prefer to locate near large input and output markets. Combes [4] shows that when firms produce homogeneous goods and face imperfect competition, specialization enhances employment growth. In a different setting, when production contains several intermediate stages each of which is cahracterized by increasing returns to scale, as in Krugman and Venables [18], firms prefer locations where they can have a large number of upstream and/or downstream firms. In that case, firms prefer diversity. Conversely, large local economies may also act as dispersion forces. For example, large markets by attracting many firms and therefore increasing competiton for demand or for inputs may slow down growth. Moreover, increasing size of an economy may increase congestion in terms of higher rents for land, higher costs due to pollution etc.

The impact of agglomeration forces on employment growth becomes more complicated when they interact with economic structure. For example, the magnitude and quality of information spillovers heavily depends on the size of the economy; until the number of firms reach a critical level, there may not be any significant exchange of ideas. Strategic decisions of firms to locate where there is low degree of competition leads firms choose periphery despite a central location means higher demand for their products. However, decreased competition may also lower potential spillovers. Shumpeterian models emphasize that competition provides incentives for firms to innovate, yet, rapid technological growth reduces the return to innovations and creates a disincentive.

The average size of plants is also an important factor that affects the impact of agglomeration forces on economic growth. In monopolistic competition models with internal scale economies, the larger plants have an advantage, whereas when the externalities are external, large firms are punished. Concerning information spillovers there is an ambiguity with respect to the impact of size. Despite large firms spend more on research and development, some empirical studies show that efficiency of such activities decline with size. On the other hand, small firms usually do not engage in research and development activities and rely on leaders, that is large firms with research output, in industry.

The identification of different agglomeration forces is, thus, not possible because of data limitations. This is a major problem in all existing research about agglomeration and this study is not an exception. Therefore, the estimation results will only shed light on the local economic structure that fosters growth rather than being used to distinguish what kind of forces are prevalent.

Data

The theory suggest many different elements in a given economic structure that may enhance or lower growth under nonnegligible transportation costs and scale economies. To test what kind of structures are most important in Turkey detailed data on manufacturing industry that are collected by State Institute of Statistics (SIS) of Turkey are used. The data is for 1980–1995 period in five-year intervals and obtained by annual surveys of SIS. Firms for which data are collected employ at least ten persons for four-digit ISIC (Rev. 2) and covers all provinces in Turkey[1]. There is also the distinction between state and private enterprises. The paper focuses only on private manufacturing industry because the location decision and employment changes in public sector is arbitrarily made depending on political and popular pressures on successive governments[2]. The employment is measured as persons engaged in production. The data also has information about gross output and material inputs. However, capital stock data is not available to estimate production functions for each industry as in Henderson et al. [16].

There are 86 four-digit industries, and therefore 5590 potential observations. However, many industries do not exist in every province, leaving 996, 1201, 1149 and 1369 data points for 1980, 1985, 1990 and 1995, respectively. Three provinces in the

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[1] There are 65 provinces in the data. A province is an administrative unit and the number of such entities increased from 67 to 76 from 1990 to 1995. To be consistent over time the provincial territories are reconstructed. In one case three provinces are split into five in later years. By combining them to one unit, we ended up with 65 provinces.

[2] At the beginning of the Republican era (1920s and 1930s), the location decisions of state enterprises were quite strategic to establish regional centers. However, this vision is abandoned as Turkey moved

eastern Turkey never appeared in any sample, and four four-digit industries did not have any private employment[3].

The following describes the measures of externalities used in the empirical part. Specialization in a local economy is measured as the ratio of share of industry *i* in local economy to the share of the same industry in national economy, as suggested by Glaeser et al. [9]:

$$LE_{ijt} = \ln\left(\frac{L_{ijt} / L_{jt}}{L_{it} / L_{t}}\right) \tag{4}$$

The diversity is measured as the inverse of a Herfindahl index of industrial concentration as suggested by Henderson et al. [15]:

$$UE_{ijt} = \ln\left(\sum_{n \neq j} \left(L_{nt} /(L_{t} - L_{it})\right)^{2}\right) - \ln\left(\sum_{n \neq j} \left(L_{njt} /(L_{jt} - L_{ijt})\right)^{2}\right) \tag{5}$$

It should be noted that the first term increases with diversity and the measure here is not negatively related to specialization as in Henderson et al. [16].

Two different variables are used to control for various effects of the size of the economy. Following Hanson [10], the ratio of total employment in the aggregated industry in which a firm belongs to total local employment is used as the first measure that controls for backward and forward linkages. Two-digit classification is used to measure aggregate industry and four-digit classification is used to depict individual industries.

$$BF_{ijt} = \ln\left(\sum_{m \neq i} (L_{mjt} / L_{jt})^{2}\right) - \ln\left(\sum_{m \neq i} (L_{mt} / L_{t})^{2}\right) \tag{6}$$

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from single party regime to democracy in 1950s and populism became more dominant way of central decision making.

[3] These are distilling and blending spirits, refineries, coke and coal production and railroad equipment. During the sample period Turkish law required production of these goods to be controlled by the state.

where m is all other industries that belong to the same aggregate industry. The assumption is that aggregate industry combines all firms that have some sort of buyer-seller relationship. As a second measure for local size of the economy, density is used:

$$D_{jt} = \ln\left(L_{jt} / Area_j\right) \tag{7}$$

expecting that it will capture congestion costs after backward and forward linkages are controlled for.

To measure competition earlier research use a local Herfindahl index (Combes [6]) or the ratio of number of workers per establishment (Glaeser et al. [9] and Hanson [10]). The former requires information at the plant level and the interpretation of the later is ambiguous. Instead, the paper empoys an industry level markup measure first proposed by Domowitz, Hubbard, and Petersen [7]:

$$MKUP_{ijt} = \ln\left(\frac{(OP_{ijt} + CIS_{ijt} - TP_{ijt} - IP_{ijt})}{(OP_{ijt} + CIS_{ijt})}\right) \tag{8}$$

where OP, CIS, TP and IP are output, change in stocks, total wage payments and input, respectively. As the ratio increases, industry i in location j gets more monopolistic.

Finally the ratio of total employment to total number of establishments controls for average establishment size:

$$ESTSIZE_{ijt} = \ln\left(L_{ijt} / N_{ijt}\right) - \ln\left(L_{it} / N_{it}\right) \tag{9}$$

where N denotes for total number of establishments. Instead of using this variable as a proxy for competition, it is interpreted as a measure of internal scale economies as Combes [6].

3. The Environment and mobility across provinces

Turkey, after twenty years of import-substituting industrialization, which came to an end in 1979 in the form of a severe balance of payment crisis, is forced to move to an outward-oriented growth strategy by liberalizing first trade and then the financial system[4]. In January 1980, Turkish government undertook a major devaluation of the currency and used a variety of tools such as tax rebates, credit subsidies and foreign exchange allocations for the imports of intermediate goods to encourage exports. In 1984, an Import Program is initiated[5]. During the same period a significant cut in real wages is also observed. The share of wages in value added fell down to 17% in 1988 from 30 % in 1980. Reduced wages meant cheap inputs for the industry as well as a reduction in domestic absorption, both of which contributed to increase exports.

The first phase of liberalization ended when the distributional issues became a problem in front of fast growth goal. The policies of a few years earlier caused increases in public deficit, inflation and domestic and foreign indebtedness. Consequently, real exchange rate is left to appreciate and capital account is fully liberalized and domestic currency is declared to be convertible. The new policies aimed to increase inflows of funds into the domestic economy in order to ease the financing of public deficit. Coupled with the removal of barriers in political life that were established in 1980 after a coup and strong pressures by trade unions, real wages started to increase and populist pressures on government mounted.

Despite successful and rapid liberalization of trade and capital markets, the macroeconomic stability cannot be established. Inflation fared around 35% in the first few years of reform after it had rose above three digit level in 1980, and settled at an over 60% plateau after 1988. Fiscal deficit kept increasing and public sector borrowing requirement reached well above 10% in the early years of 1990s.

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[4] The nature and effects of liberalization have been discussed in detail in Aricanli and Rodrik [1], Senses [22] and Togan and Balasubramanyam [23], among others.

In terms of regional policy, Turkey has established 'Priority Areas for Development' (PAD) in late sixties as a part of central planning, covering mostly eastern and southeastern provinces. The successive Five-Year Plans acknowledge the differences in terms of development between regions and urges governments to direct sources to PAD. The Plans also suggest provision of investment incentives for private sector in terms of tax deductions. Despite the aims stated in the plans there were no significant effort by any government to support industrialization in low-income regions. Very few of planned state infra- and manufacturing investments are realized. Moreover, almost all governments subsidized agricultural production heavily which has lower productivity compared to other sectors but higher political returns and subsequently these policies slowed down industrialization of these areas. Furthermore, political pressures forced governments to increase the number of provinces in the 'Priority Areas'. At the late seventies the number of such provinces reached 41 from original 22 in 1968 out of 67 provinces. In 1981 an attempt to reduce the numbers to 25 failed and as of 1996 there were 38 provinces classified as PAD. Practically, the entire country is declared as a 'Priority Area' except a few traditional industrial centers and thus the original intent is diluted to a great extent.

Agglomeration

Throughout the century, Istanbul, Izmir and Ankara were the most populous provinces; the latter is also the capital city of Turkey. Together with Kocaeli as a periphery to Istanbul and Bursa and Adana by inheriting their industrial formation form Ottoman era form the traditional industrial centers in Turkey. In 1980, at the end of import substituting growth period, these six provinces had a share of 74.4% of total industrial employment (Table 1). Although employment in these provinces increased 2.9% per annum, their share in total industrial employment decreased to 68.4% at the end of 1995.

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[5] With this program quantity restrictions are eliminated significantly (60 percent of 1983 imports are liberalized) and tariffs for majority of imports are reduced by 20 percent (Baysan and Blitzer [2]). As of 1988, major trade liberalization was already established.

Earlier research indicated that the concentration pattern could be varying for different industries. Following, Henderson et al. [16], industries are also grouped into four main categories, traditional industries (food processing, beverage, apparel, textiles, manufacture of wood products and paper industry), heavy industries (chemicals, rubber and plastic, non-metallic minerals, metal industries and fabricated metal industry), machinery (machinery, electrical machinery and transportation equipment) and high-tech industries (office, computing machinery, professional and scientific equipment, photographic equipment, watches, jewelry, musical and sporting equipment)[6]. Table 1 also provides deconcentration of employment by major industrial classification. Despite substantial growth differentials in all industries against traditional industrial centers, they still employ a large share of workers. Nevertheless, the figures imply significant amount of deconcentration from old centers to new locations.

The underlying hypothesis in Hanson's [10] study is that trade changes reference market for the economy. In a closed economy, location choice of firms is arbitrary and once certain locations are established as industrial centers, they persist. However when the economy is opened to trade, the prediction is that firms will locate in regions that are either closer to exporting countries (as firms in Mexico moved to north, closer to the American border) or to regions that has easy access to ports. It should be noted that, except Ankara, all six traditional centers are port cities and except Ankara and Adana all of them are located in the west of the country (closer to major trading partners of Turkey, namely Europe). The evidence here is that other forces are outweighing the benefits of lower transportation costs to a certain degree. In fact, regions to the west and north west of the country grew as fast as the aggregate or a little higher, but exceptional growth rates are observed for northern and eastern regions that had very small industrial bases at the beginning of sample period.

[6] Henderson et al. [16] defines a fifth category, transportation equipment industry. Since in Turkey the number of transportation equipment-producing provinces is very small, they are grouped together with machinery industries.

Deconcentration can also be examined by considering a simplified version of Ellison-Glaser index [8]. For industry i in time t, the index is:

$$GE_{it} = \sum_{j=1}^{J} \left(\frac{L_{ijt}}{L_{it}} - \frac{L_{jt}}{L_t} \right)^2 \tag{10}$$

where J is total number of provinces. The index lies between zero, when there is total deconcentration, and two when an industry is totally concentrated in a particular location. Table 2 provides the index for four major industrial groups. Highest concentration is observed for high-tech industries and then for machinery. Concentration in traditional industries is by far lower than the others. The ordering of industries according to their concentration is very similar to South Korea. Henderson et al. [16] interpret their finding of higher concentration of modern industries as a consequence of 'strong government influence' and 'regulation' of these industries. The findings here suggest that the same pattern applies even to the case where government involvement in these industries is not significant. A further observation from the table is that deconcentration occurs much faster for machinery and heavy industries but it is not as dramatic as it happened in Korea.

Evolution of the distribution

The primacy rates in the first table and concentration indices in the second table describe the extreme ends of the distribution. In the following mobility of industries across provinces is examined using Markov chains. The methodology is also used to examine the evolution of size distribution of cities in the U.S. by Black and Henderson [3] and the evolution of size distribution of industries across cities in the U.S. by Henderson [14]. The size distribution of province-industries is assumed to follow a first order stationary process. There is continuous entry and exit of province-industries in Turkey. The number of industries increased almost 70% from 1980 to 1995. Among 1369 province-industries in 1995, 40% did not exist in 1980. On the other end, 17.5% of province-industries that existed in 1980 are not observed in 1995.

To account for entry and exit, an extended version of Markov chains is used as in Black and Henderson [3] where they model the evolution of urban system. Let F_t denote the distribution of size. The evolution of the distribution is governed by the following equation of motion:

$$F_t = (1-e)\, M_t\, F_{t-1} + e\, E_t \tag{11}$$

where M_t is the matrix that maps distribution at time $t-1$ into distribution at time t. E_t is the vector of entrants and e is the net entry rate. The assumption of stationarity and homogeneity of the transition probabilities implies a constant mapping of the distribution over time, that is M is a constant matrix. By assuming that the net entry rate and the vector of entrants are also constant and iterating M forwards one can obtain future cross-section distributions:

$$F_{t+\tau} = (1-e)^{\tau} M^{\tau} F_t + \sum_{s=0}^{\tau-1} (1-e)^{s} M^{s} e E_s \tag{12}$$

or

$$F_{t+\tau} = (1-e)^{\tau} M^{\tau} F_t + \left[I - (1-e)M\right]^{-1} \left[I - (1-e)^{\tau} M^{\tau}\right] eE \tag{13}$$

Furthermore letting τ to go infinity, we obtain the implied ergodic distribution (or long-run distribution) of sizes. Then transition probabilities of province-industries from one (in practice, discretized) segment of distribution to another are estimated empirically by counting the number of transitions out of and into each state. Using the transition probabilities from one state to another, one can also calculate how much time is required on average to move up or down in the distribution. The so-called first passage times can be computed as

$$Y_{jk} = \sum_{s=1}^{\infty} s \pi_{jk}^{s} \tag{14}$$

where Y_{jk} is years required for transition from state j to state k and π_{jk} is the probability of moving from cell j to k.

Before estimating the transition matrix, employment in each province-industry is normalized by total industry employment. It is assume that there are four discrete states and that there are equal numbers of units in each cell at 1980. Table 3 shows the estimation results for all industries. There are significant differences from the pattern observed for developed economies, specifically from the U.S. The diagonal entries in the transition matrix indicate little persistence. The chance to move up and down from the middle-sized province-industries is 50%. Starting with a uniform distribution, we observe that the distribution of province industries is getting skewed towards the lower end and ergodic distribution implies that as of 1995 the process is not come to an end. This is unlike what Henderson [14] observed for machinery and high-tech industries in the U.S. The reason for the observed pattern in Turkey is mostly because of high entry at the lowest cell and persistence at the upper end. Nevertheless the time required to move from lowest cell to highest and from the highest cell to the lowest is not significantly different from each other and around 20 years. Compared to Henderson's [14] findings for the U.S., it also takes considerably less time for a province-industry to move up and down in the distribution.

It is also important to examine mobility within particular industries. Table 4 provides first passage time estimates for each of the four groups defined earlier. An interesting result that emerges from this table is that moving up in the distribution is considerably shorter for manufacturing and high-tech industries compared to traditional and heavy industries and the time required moving down is also longer for modern industries. The entry rates to higher cells for these industries are also significantly higher than traditional and heavy industries. The analysis of mobility confirms previous findings; modern industries are more concentrated and require higher degrees of scale economies. Nevertheless, these industries seem to be more mobile.

4. Estimating scale economies

In this section the effects of scale economies on employment growth are estimated. The data is in unbalanced panel format The dependent variable is logarithmic differences of employment growth between 1980-85, 1985-90 and 1990-95, thus constituting a maximum of three observations for each province-industry. In the theoretical model, growth is a function of changes in relative wages, however, to avoid endogeneity initial level of wages are used instead. Furthermore, all scale variables enter in the equation as of the beginning period, assuming five years is long enough for dynamic effects to reveal.

The shocks are allowed to have province, industry and time specific components. Since employment growth is modelled in relative terms, industry and time effects are eliminated. Thus the estimation equation also includes a set of dummies for each province.

The dataset covers only establishments with at least ten workers therefore the sample is truncated. Moreover, the sample selection rule depends on an unobserved random variable. Following Henderson et al. [16] and Combes [6], a generalized Tobit model is used to estimate. To control for the selection rule data from other sources, such as General Population Survey and Production Accounts both conducted and published by the SIS of Turkey are utilized. The variables that enter to the selection equation are density as defined above, distance to nearest large urban center defined as the provincial center with at least 300 thousand residents. When the center lies within a province it is assumed that the distance is just one kilometer. A third variable that enters in the selection equation is a dummy variable that takes value of one if a state-owned enterprise exists in that province belonging to the two-digit industry classification in which a four-digit private province-industry operates. The share of agricultural output in total gross domestic product in a province is also used to control for selection. Heavy agricultural subsidies are assumed to create disincentives for industrial entrepreneurship. Two other variable controls for social environment. The first one is average years of schooling in that province and the second is the share of young population (people aged less than 25 years) in total.

The estimation equation includes relative wage, indices of localization and urbanization economies, a set of variables that controls for backward and forward linkages, density, competition and average establishment size. An additional variable, the existence of state establishments in the same industry as defined above is also included. Table 5 presents the estimation results.

The first column in the table shows the estimated elasticities for all province-industries, denoted as "all-industries". All variables in the selection equation are significant and have expected signs. Firms choose to locate highly dense areas and selection probability declines as the province is farther away from any large urban center. The existence of state industry also increases the likelihood of observing private industry in that province indicating that the vision of establishing industrial bases via direct government involvement in production in early Republican era has some merit. However, higher agriculture production prevents formation of industries. As discussed above, by subsidizing agriculture heavily the government reduces incentives for private enterpreneurs to start large scale industrial production. A more educated population is also seen as favorable amenity by the private sector whereas younger population deters entry.

The selection variables have same sign and significance in each and every industry group, except that schooling for machinery and existence of government enterprises for high-tech industry are not significant. An interesting result in this table is that coefficient of schooling variable has highest value for high-tech industries. This is probably high-tech firms have more need for skilled labor in their production.

In none of the equations relative wages are significant. Lower wages throughout the examination period do not induce higher growth. It is possible that low wages also correspond to lower labor productivity.

The results indicate no evidence in favor of localization economies. In fact, specialization slows down employment growth in all equations. Glaeser et al. [9] find no evidence in favor of localization economies whereas Henderson et al. [15] report significant and positive effect of specialization for the U.S. Combes [6] shows that specialization is negatively correlated with employment growth in France, contrary to the evidence found for the U.S. In developing country studies, Henderson et al. [16] show that specialization, indeed, is an important element for production in South Korea, whereas Hanson [10] finds negative effect of specialization to employment growth in Mexico before joining Nafta and positive but insignificant effect after trade liberalization. The negative finding contradicts the predictions of the theory. One plausible explanation for negative effect of specialization can be cycles in the life of a product (Combes [6])[7]. Products are first developed in certain locations and then diffuse to other regions.

There is also no evidence in favor of urbanization economies in all industries but high-tech. The coefficient for machinery industry is also positive though not significant. The model that assumes monopolistic competition with differentiated products applies to high-tech industries in Turkey. This finding confirms earlier results obtained by Henderson et al. [15] for the U.S. economy and Henderson et al. [16] for South Korea.

The next two variables measures the effect of the size of the local economy. The first variable, backward-forward linkages, measures the demand for the output of a particular industry and/or cheaper inputs for production in that industry. The backward-forward linkages is positive and significant for traditional and heavy industries, as well as in “all-industries” equation. The eleasticity estimate indicates that a percent increase in the backward-forward linkage improves employment growth by 1.9%. The coefficient is negative and significant at 10% confidence level for machinery industry and insignificant for high-tech industry. The second variable,

[7] Combes [5] provides an explanation why estimated specialization coefficient for the U.S. economy can be upward biased. He shows that including sectoral employment level in the estimating equation

density, controls for congestion. The coefficient of density is insignificant in all equations, but negatively significant for heavy industry.

Competition variables is insignificant for “all-industries”, traditional and machinery industries. It is negative and significant for heavy industries. Together with the negative effect of density, negative elasticity of competition reflects the fact that heavy industries usually have high fixed costs and competition for inputs lead to congestion. For high-tech industries, the elasticity of competition is positive and around 18%. The nature of high-tech firms that they have to innovate continously requires an environment where they can enjoy higher markups in the spirit of new endogenous growth models.

Average establishment size has a negative impact in all equations, but insignificant only in manufacturing industry. The magnitude is similar for traditional and heavy industries but much higher for high-tech industry. This is very likely because small firms enjoy information spillovers more than the large ones. A different explanation could be that small firms are more flexible and adjust to new conditions more easily than others.

Finally, the existence of state owned enterprise in the same industry does not effect employment growth in all but high-tech industries. In Turkey, state firms usally spend more money on training their workers compared to private firms, and existence of skilled worker is more important for industries that use more advanced technology.

Lag structure of dynamic externalities

Another interesting question is related about how long it takes for economic structure to affect growth. New locations may not be prefered by firms just because they do not have enough stock of inofrmation and thus the longer externalities persist the more firms agglomerate in that region. Henderson [13] using a panel data estimates the lag

makes is hard to interpret the coefficient in front of the specialization index.

structure of dynamic externalities and shows that localization economies affect level of employment in five to six years whereas urbanization economies takes a little longer. Exploiting the panel structure of Turkish data, the model is re-estimated by including one lag of all externalities, that is values of ten years ago are included in the estimation equation at a cost of loosing one of three observations for each province-industry.

Table 6 presents the results. While the general conclusions of the previous analysis holds, there are some differences. Especially, lagged specialization has positive effect in all equations despite specialization at the beginning of the period still has negative coefficients. Dynamic externalities are indeed important, however, firms benefit more from specialization the longer they persist, that is dynamic stock of ‘local trade secrets’ is very important as conjectured in Henderson [13]. The negative impact in the short-run indicates that once products are well-developed, production diffuse to other areas.

For other variables, controlling lagged levels wipes out the significance of backward and forward linkages, but ten years is a long time for transportation technology to change, especially in a developing country. The density variable is now significantly negative for “all-industries” and traditional industries as well as heavy industry. The lagged density variable for all-industries and heavy industries are positive and significant, indicating that initially large markets improve growth but congestion effect sets in as time passes. Competition variable became also significant in this set of regressions, nevertheless the positive coefficient for high-tech industries is unaltered. In fact, persistently high markups in this industry enhances growth more.

5. Conclusion

This study investigates the effects of local scale externalities on employment growth in Turkish private manufacturing industry. In 1980 Turkey switched from import substituting industrialization to export oriented growth and liberalized its economy.

These changes are expected to have some significant effects not only on the aggregate economy but also on the regional distribution of production. While there is no large changes in this distribution as observed in other developing economies, such as Mexico and South Korea, there is some significant deconcentration of industry from historical industrial bases.

The paper finds that localization economies have negative impact on employment growth in the short-run, however, there is positive effect of specialization on growth once extra lags are allowed for. The paper also finds evidence in favor of urbanization economies for high-tech industries. This shows that diversity attracts high-tech firms whereas the same cannot be said for other industries. Another important factor for growth is the existence of backward and forward linkages. Firms develop much faster in provinces where they have upstream and/or downstream firms. Competition affects employment growth differently depending on the industry. In heavy industries it reduces growth, but firms in high-tech industries benefit from decreased competition. The findings emphasize the importance of dynamic scale externalities in a developing country context and confirms, in general, the findings for developed economies.

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Table 1: Deconcentration of industry in Turkey

	Turkey		Traditional Industrial Centers		Rest of the country	
	1980	Annual growth rate	Share in 1980	Annual growth rate	Share in 1980	Annual growth rate
Traditional	242,432	3.95	68.58	3.50	64.06	4.85
Heavy	161,166	3.12	73.93	2.65	68.94	4.29
Machinery	91,755	2.54	87.84	1.75	78.00	6.49
High-tech	13,108	4.03	94.62	3.58	88.38	9.17
Aggregate	508,461	3.46	74.42	2.90	68.40	4.87

Table 2: Ellison-Glaeser index of concentration

	1980	1995	Change
Traditional	4.18	3.50	-16.14
Heavy	10.97	7.46	-31.96
Machinery	21.07	12.77	-39.39
High-tech	55.29	46.25	-16.35

Table 3: Evolution of province-industry distribution

Transition Matrix					
	0.0	***0.1***	***0.2***	***∞***	***Entry Rate***
0.02	0.6494	0.2778	0.0556	0.0172	0.5035
0.05	0.2277	0.4847	0.2642	0.0234	0.2765
0.18	0.0537	0.2366	0.5652	0.1445	0.1624
∞	0.0103	0.0138	0.1471	0.8287	0.0576

Initial Distribution			
0.2500	0.2500	0.2500	0.2500
Final Distribution			
0.3095	0.2526	0.2409	0.1971
Ergodic Distribution			
0.3239	0.2732	0.2312	0.1717

First Passage Time			
1.5	4.5	7.6	19.2
9.9	2.1	5.6	17.8
13.8	6.8	1.8	14.4
18.5	12.0	6.8	1.2

Table 4: First passage times

	Traditional Industries			
	Lowest	*Middle Low*	*Middle Upper*	*Highest*
Lowest	1.5	5.2	8.6	21.1
Middle Low	5.2	2.2	7.5	20.2
Middle Upper	8.7	6.0	2.1	15.8
Highest	12.7	10.2	5.9	1.3
	Heavy Industries			
	Lowest	*Middle Low*	*Middle Upper*	*Highest*
Lowest	1.7	3.9	6.4	18.5
Middle Low	14.0	1.9	4.8	16.9
Middle Upper	18.5	8.0	1.6	13.5
Highest	22.4	13.3	7.0	1.2
	Machinery Industries			
	Lowest	*Middle Low*	*Middle Upper*	*Highest*
Lowest	2.5	3.2	6.8	9.4
Middle Low	19.0	2.3	5.4	8.2
Middle Upper	29.8	13.9	2.2	4.8
Highest	34.1	18.6	7.8	1.2
	High-tech Industries			
	Lowest	*Middle Low*	*Middle Upper*	*Highest*
Lowest	1.9	3.1	7.9	15.5
Middle Low	10.7	2.4	6.6	13.8
Middle Upper	18.7	8.0	1.8	9.9
Highest	23.7	13.0	8.7	1.2

Table 5: Estimation of scale externalities

	All Industries	*Traditional Industries*	*Heavy Industries*	*Machinery Industries*	*High-tech Industries*
Relative Wage	0.0035	0.0064	0.0054	-0.0418	0.0469
	(0.0071)	(0.0107)	(0.0114)	(0.0262)	(0.0302)
Specialization	-0.0138*	-0.0176*	-0.0199*	-0.1025*	-0.0461**
	(0.0038)	(0.0059)	(0.0070)	(0.0285)	(0.0221)
Diversity	-0.0070	-0.0040	-0.0100	0.0079	0.1254**
	(0.0126)	(0.0154)	(0.0287)	(0.0433)	(0.0603)
B-F. Linkages	0.0186*	0.0128*	0.0145**	-0.0550***	0.0044
	(0.0039)	(0.0061)	(0.0073)	(0.0287)	(0.0205)
Density	-0.0016	0.0002	-0.0053***	-0.0008	0.0042
	(0.0014)	(0.0023)	(0.0027)	(0.0025)	(0.0027)
Competition	-0.0027	0.0116	-0.0233**	-0.0063	0.1821**
	(0.0082)	(0.0118)	(0.0102)	(0.0107)	(0.0814)
Avg. Est. Size	-0.0221*	-0.0231*	-0.0205**	-0.0032	-0.1019*
	(0.0055)	(0.0078)	(0.0100)	(0.0180)	(0.0356)
Gov. Est.	-0.0004	-0.0030	0.0033	-0.0539	0.0622**
	(0.0088)	(0.0130)	(0.0160)	(0.0382)	(0.0287)
Selection Equation					
Density	0.0248*	0.0233*	0.0232*	0.00948*	0.0398*
	(0.0019)	(0.0024)	(0.0043)	(0.0046)	(0.0074)
Distance	-0.0014*	-0.0011*	-0.0015*	-0.0024*	-0.0020*
	(0.0001)	(0.0001)	(0.0001)	(0.0003)	(0.0006)
Gov. Est.	0.4221*	0.4914*	0.4017*	0.1434	0.1288
	(0.0242)	(0.0359)	(0.0436)	(0.0742)	(0.1211)
Sh. of Agr.	-1.1965*	-0.8807*	-1.4142*	-2.2848*	-1.5040*
	(0.1174)	(0.1661)	(0.2117)	(0.3130)	(0.5509)
Schooling	0.2097*	0.2222*	0.2015*	0.0867	0.4450*
	(0.0251)	(0.0364)	(0.0443)	(0.0646)	(0.1185)
Sh. of Young	-0.0238*	-0.0186*	-0.0240*	-0.0326*	-0.0422**
	(0.0038)	(0.0057)	(0.0066)	(0.0087)	(0.0174)

Note: The numbers in parantheses are heteroskedasticty corrected standard errors.
*, ** and *** denote significance at 1%, 5% and 10% confidence interval, repectively.

Table 6: Dynamic structure of scale externalities

	All Industries	*Traditional Industries*	*Heavy Industries*	*Machinery Industries*	*High-tech Industries*
Relative Wage at (t-1)	0.0066 (0.0104)	0.0339 (0.0177)	-0.0189 (0.0128)	-0.0679 (0.0349)	-0.0406 (0.0840)
Relative Wage at (t-2)	-0.0021 (0.0087)	-0.0055 (0.0140)	0.0118 (0.0124)	-0.0138 (0.0362)	0.0304 (0.0483)
Specialization at (t-1)	-0.0486* (0.0115)	-0.0473** (0.0191)	-0.0503* (0.0172)	-0.1588** (0.0669)	-0.1183** (0.0464)
Specialization at (t-2)	0.0422* (0.0118)	0.0344*** (0.0189)	0.0478* (0.0177)	0.1579* (0.0473)	0.1629* (0.0577)
Diversity at (t-1)	-0.0082 (0.0204)	-0.0421 (0.0290)	-0.0071 (0.0370)	-0.0488 (0.0717)	0.2557** (0.1013)
Diversity at (t-2)	-0.0010 (0.0192)	0.0190 (0.0241)	-0.0492 (0.0439)	-0.1156 (0.1028)	0.1096 (0.1472)
B-F. Linkages at (t-1)	0.0254** (0.0103)	0.0183 (0.0166)	0.0193 (0.0157)	-0.1012 (0.0662)	0.0222 (0.0370)
B-F. Linkages at (t-2)	0.0013 (0.0107)	-0.0006 (0.0159)	0.0165 (0.0178)	0.1240** (0.0478)	0.0590 (0.0556)
Density at (t-1)	-0.1103* (0.0324)	-0.0783*** (0.0433)	-0.1300* (0.0501)	-0.0859 (0.1161)	-0.0314 (0.1892)
Density at (t-2)	0.0759* (0.0244)	0.0493 (0.0327)	0.0909** (0.0378)	0.0573 (0.0875)	0.0286 (0.1424)
Competition at (t-1)	-0.0144** (0.0068)	0.0227 (0.0407)	-0.0236** (0.0108)	-0.0199** (0.0093)	0.2701*** (0.1519)
Competition at (t-2)	0.0000 (0.0130)	-0.0068 (0.0189)	0.0014 (0.0277)	-0.0172 (0.0237)	0.2947** (0.1457)
Avg. Est. Size at (t-1)	0.0132 (0.0116)	-0.0042 (0.0186)	-0.0057 (0.0188)	0.0233 (0.0312)	-0.0448*** (0.0682)
Avg. Est. Size at (t-2)	-0.0256** (0.0111)	-0.0197 (0.0177)	-0.0016 (0.0186)	-0.0222 (0.0310)	-0.1702 (0.0991)
Gov. Est. at (t-1)	-0.0324*** (0.0192)	-0.0255 (0.0327)	-0.0375 (0.0318v	0.0332 (0.1680)	0.0845 (0.0812)
Gov. Est. at (t-2)	-0.0209 (0.0171)	-0.0027 (0.0304)	-0.0193 (0.0246)	-0.0371 (0.0556)	-0.0681 (0.0856)

Table 6 (cont'd): Dynamic structure of scale externalities

	All Industries	***Traditional Industries***	***Heavy Industries***	***Machinery Industries***	***High-tech Industries***
Selection Equation					
Density	0.0131*	0.0156*	0.0066***	0.0094**	0.0349*
	(0.0021)	(0.0027)	(0.0037)	(0.0045)	(0.0061)
Distance	-0.0014*	-0.0012*	-0.0015*	-0.0023*	-0.0018**
	(0.0001)	(0.0001)	(0.0002)	(0.0004)	(0.0008)
Gov. Est.	0.3884*	0.4525*	0.3925*	0.0784	0.0690
	(0.0307)	(0.0455)	(0.0539)	(0.0916)	(0.1596)
Sh. of Agr.	-0.8695*	-0.4596**	-1.1987*	-2.0298*	-1.1800
	(0.1561)	(0.2245)	(0.2764)	(0.3903)	(0.8075)
Schooling	0.6209*	0.6393*	0.5837*	0.5407*	0.8968*
	(0.0308)	(0.0458)	(0.0498)	(0.0776)	(0.1754)
Sh. of Young	-0.0082*	-0.0015	-0.0059	-0.0187	-0.0297
	(0.0040)	(0.0062)	(0.0061)	(0.0110)	(0.0210)

Note: The numbers in parantheses are heteroskedasticty corrected standard errors.
*, ** and *** denote significance at 1%, 5% and 10% confidence interval, repectively.