AGGLOMERATION, FIRM ENTRY AND EXIT

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Abstract

This paper aims to examine the relationship between agglomeration and firm entry and exit in Turkish manufacturing firms. The Ellison and Glaeser index is employed to measure the degree of agglomeration in Turkish manufacturing industries. Seemingly Unrelated Regression (SUR), Count Data Models and Tobit model are used in order to investigate the issue in depth. The results are in line with the symmetry hypothesis and indicate that entry and exit are interdependent in Turkish manufacturing industries. Furthermore, the results show that geography is a crucial aspect for firm entry and exit in Turkish manufacturing industries.

Keywords: Agglomeration, entry-exit, Turkish manufacturing industry

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1 This paper is presented at the 9th ENEF Workshop 2012, Bologna.
2 Hacettepe University, Department of Economics
3 University of Sheffield, Department of Economics
4 Ellison& Glaeser (1997)
1. Introduction

Entry and exit of firms are highly discussed topics in the economics literature because firm mobility plays a crucial role in all markets. The main reasons behind entry and exit have been investigated for decades. Theory and empirical work on the subject indicate that there are several incentives and barriers (impediments) to entry and exit.\(^5\)

High rates of current and past profits and high or increasing rates of market demand are seen as incentives to entry. On the other hand barriers to entry can be summarized as; scale economies, cost barriers, multi-plant operations, limit pricing, excess capacity, advertising.

There are also some factors that can be seen as incentives and/or barriers under different circumstances. For instance; product differentiation, R&D and innovation, and diversification can be classified as when they are realized by entrants however are entry barriers when realized by incumbents.

Low current and past profit rates, low or declining rates of market demand, displacement of old firms with new firms can be listed as incentives to exit. On the other hand, barriers to exit are; sunk costs, low managerial skills and diversification.

Entry and exit are important in a market because, entry can increase competition in the market. Even when there is no entry, threat of entry can force incumbents to act as if they were operating in a competitive market. Further, entry brings new and efficient technology and also new products to the market. In addition, entry increases employment opportunities. Exit, on the other hand can have severe increasing effects on unemployment; however, it can be argued that in the long run exit clears out the old and inefficient technology from the market (Sigfried & Evans, 1994; Ilmakunnas & Topi, 1999; Kleijweg & Lever, 1996).

2. Empirical Background

As mentioned before there are several studies on firm mobility patterns and its determinants.

Dunne et al. (1988) use plant level US data to examine patterns of gross entry, exit and survival rates of firms in US manufacturing industry, covering a period of 1963-1982. Their findings show that the highest survival rates are observed among diversifiers.

\(^5\) Incentives and barriers to entry and exit are summarized following Sigfried and Evans (1994).
Baldwin and Gorecki (1991) investigate firm entry and exit in Canadian manufacturing covering the 1970-1982 period. Their data allow following plants through time and also making it possible to link plants under common ownership. With such detailed information, authors grouped firms as entrants, exitors and continuing. However, the authors only performed descriptive analysis of the data and reveal patterns of firm mobility in Canadian manufacturing.

Mayer and Chappell (1992) use the same data set as Chappell et al (1990) however employed a slightly different methodology. Determinants of entry and exit are investigated using 1972-1977 US manufacturing industry data in both studies. Chappell et al (1990) argues entry and exit data are integer values and hence needed to be handled differently than classical regression assumptions. According to Chappell et al (1990) entry and exit data should be estimated using probability distribution models and hence employs a univariate Poisson distribution. Mayer and Chappell (1992) on the other hand use bivariate Poisson distribution analysis, arguing that observations on entry and exit have some common aspects. They argue that even though entry and exit can be influenced by common elements, it is important and essential to separate the two. The authors estimate entry and exit models which have common independent variables with a quasi-maximum likelihood method.

Ilmakunnas and Topi (1999) investigate determinants of entry and exit on Finnish manufacturing industry for 1988-1993. They argue, however, that macroeconomic factors have equally important effects on firm entry and exit as microeconomic factors. They use both macro and micro variables as determinants of entry and exit. Micro variables include profit rates, market size and demand growth. Macro variables include variables such as GDP growth and unemployment. The authors consider the possibility of interdependency between entry and exit and therefore included lagged values of each in their models. However, they still estimated two separate entry and exit models. They use Poisson and negative binomial models as a method of estimation. Their findings indicate macroeconomic influences are also important on firms’ entry and exit decisions.

Doi (1999) investigates firm exit only in Japanese manufacturing industries using profitability, industry growth and several exit barriers such as concentration rate, scale economies, R&D intensity as independent variables. Doi employs OLS as a method of estimation.
Dunne et al. (2009) investigate the determinants of entry and exit using US census data via estimating a profit function using entry and exit as independent variables for dentistry and chiropractor industries.

The empirical literature on firm mobility reviewed so far, mainly neglects the interdependence of entry and exit on the models they use. Some like Ilmakunnas and Topi (1999) mention a possible interdependence, however they still choose to estimate entry and exit separately. Such studies, however intuitively appealing, might be missing quite important and relative information on firm mobility by not considering the effect of entry and exit on each other.

The “symmetry hypothesis” suggested by Caves and Porter (1976) implies a symmetrical relationship between entry and exit barriers.

Shapiro and Khemani (1987) investigate the symmetry hypothesis using data from Canadian manufacturing industry for the years 1972-1976. They estimate two equations while employing entry in the exit equation and vice versa. They adopt seemingly unrelated regressions technique as an estimation method. Authors use pretty standard independent variables such as profitability, industry growth rate, economies of scale, advertising ratio, concentration index etc. Their findings support the symmetry hypothesis and indicate that such symmetry arises because barriers to exit are also barriers to entry.

Austin and Rosenbaum (1990) examine the determinants of entry and exit rates in US manufacturing industries using 4-digit data. They employ OLS and simultaneous equations as methods of estimation. Their findings indicate profits increase entry rates and advertising and sunk costs act as barriers to entry. However they argue while entry and exit are definitely related, it seems unclear whether they are simultaneously determined or not.

Flynn (1991), investigates the determinants of exit in U.S manufacturing sector covering the 1978-1984 period. He uses basic independent variables such as profit, concentration, industry growth and size. He also uses entry as an independent variable suggesting a possible interdependence between entry and exit. However he employs OLS as a method of estimation. Therefore it is possible to say that Flynn (1991) implies the possibility that entry and exit to be interdependent however does no employ the proper methodology to take into account this relationship econometrically. He finds that profit, industry growth and entry foster exit in U.S manufacturing.
Kleijweg and Lever (1996) examine entry and exit in Dutch manufacturing industries for the years 1986-1990. They use different definitions of entry and exit to investigate similarities and differences among their determinants. The authors also specify entry and exit as a function of incentives and barriers. As incentives they use export share, expected profitability and production growth. As barriers they use capital intensity, advertising intensity, R&D intensity and the concentration ratio. Entry and exit equations are estimated both separately and simultaneously. Their findings indicate that there are different patterns for different kinds of entry and exit.

While these studies take firm mobility studies one step further by taking into account the fact that entry and exit are interdependent, they once again neglect an important and vital piece of the puzzle; spatial variation.

Fritsch (1992) investigates regional differences in new firm formation in West Germany for the years 1985, 1986 and 1987. He uses a large number of independent variables such as share of employment, unemployment, regional income tax, salaries, skilled/unskilled workers, share of housing. He employs OLS as a method of estimation. The findings suggest that unemployment rate of a specific region is positively related to new firm formation in that region. Skilled labour force and income levels also have positive effects on firm entry. This study is important because it investigates firm entry on a regional level and suggest that regional factors are important. However it is not possible to say that this study takes into account specialization in any form or agglomeration.

Garofoli (1994) states that higher firm birth rates are observed in Italy when compared to other countries. He also states that new firm formation differs in region and hence investigates the regional factors in firm entry. This paper covers the 1987-1991 period for 84 provinces in Italian manufacturing. Garofoli (1994) also chooses to employ OLS as a method of estimation. His findings suggest that local production structure, firm size, social structure and employment structure are the most important factors in new firm formation and for its regional differentiation. This study gains importance because it takes into account the spatial factors. However again it is not possible to say that it takes into account agglomeration or regional specialization.
It should also be noted that new firm formation is only one specific branch of firm entry. Although the above studies are important in the sense that they take into account the regional factors, unfortunately they do it only for one type of entry.

Love (1996) on the other hand investigates the determinants of variations in exit rates across the British counties during the 1980-1988 period. He uses entry rate, GDP per capita, wage, unemployment, change in unemployment, socioeconomic class and population density as independent variables in the study. This study is quite important because it takes into account both the interdependence of entry and exit rates and the spatial side of the story. The results indicate that entry and exit are interrelated, local labour market conditions have an important effect on firm exit and agglomeration – proxied by population density - has a significant effect on exit. Furthermore the results from population density variable indicates that agglomeration has a positive effect on firm exit as opposed to Krugman (1991).

Davidsson et al. (1994) examine new firm formation and regional development in Sweden using establishment data for the 1985-1989 period. They use data on regional characteristics such as entrepreneurial culture and living conditions. They suggest that the pattern of firm mobility differ considerably across countries and also regions.

Johnson and Parker (1996) investigate spatial variations in the determinants of firm mobility. They use one year data; 1990 for UK on county level. They use VAR (vector autoregressive regression) technique assuming full interdependency between all variables in the system. This study accounts for both regional aspects of firm mobility and interdependence.

Devereux et al. (1999) investigate job creation and job destruction rates via entry, exit and survival of firms considering their geographical distribution. They investigate firm mobility and job creation and destruction on a geographical basis in UK for the years 1985-1991. Their findings indicate geography to be an important aspect of entry, exit and survival. However, they keep this analysis on a descriptive level.

Berglund and Brannas (2001) investigate entry and exit in Swedish municipalities. In this study they use plant level data in order to capture the regional effect better. Although, realizing regional effects might be important and attempting to capture spatial variations, they proxy agglomeration economies with population density. They argue agglomeration economies have a negative impact on exit. However, population density is a very poor proxy for agglomeration economies. A good proxy for agglomeration should include industrial and
geographical characteristics. Population density on the other hand includes neither. They employ GMM as a method of estimation for the analysis. A dynamic model, whilst it can capture the effect of past values of the dependent variable, however completely neglects a more important aspect; interdependency.

Huiban (2011) investigates the spatial demography of new plants in France between 1993 and 2002. Using a quite rich data set, the author includes a location dummy alongside the usual survival determinants. Findings indicate that new plant formation is easier in urban areas; however it is easier for firms to survive in rural areas. Huiban suggests agglomeration forces can explain such results.

Numerous empirical works on entry and exit imply high current and past profit rates and market growth triggers entry and reduce exit. Highly concentrated industries usually have lower entry rates. However there is less support and ambiguous results from evidence that entry and exit barriers from scale economies, excess capacity and limit pricing. Sunk costs have been found to be significant actors as exit barriers. Finally R&D intensity does not seem to be an efficient entry barrier. Further a common finding in the literature is that entry and exit are interdependent. Recent studies also show that spatial characteristics are important on firms’ entry and exit decisions. However to our knowledge, there is a gap in the literature that tries to combine spatial characteristics with firm mobility. This gap arises from using poor proxies for agglomeration economies or only regional dummies to analyze the effect of regional effects. Therefore it is essential to examine the effect of agglomeration on firm entry and exit with proper tools.

3. Data and Methodology

This paper analyses the effect of agglomeration on firm entry and exit behaviour using 1995-2001 data set providing information on; number of firms, number of workers, number of workers on payroll, payments to workers on payroll, total hours worked, changes in stocks, changes in fixed capital, value of inputs, value of outputs, value added, total income, total labour cost, Herfindahl index. The data set provides information on gross firm entry and exit on industry level. The data set only covers a 7 year period because of unavailability of gross entry and exit data regarding Turkish manufacturing industry prior to 1995. Further data sets end at year 2001, because data for post 2001 period is not compatible with pre 2001 data because of major changes in data collection procedures. Data are obtained from Turkish Statistical Institute (TurkStat).
Evidence from previous literature suggests that profit rates and/or profitability of firms are important on firms’ entry and exit decisions. Dunne et al (2009) estimate a profit function and find that profitability has an important and significant affect on potential entrants. Sigfried and Evans (1994) find that current and past profits are one of the main incentives to enter and usually have a positive relationship with entry. Further, Austin and Rosenbaum (1990) finds that for US manufacturing industries high profits increase entry rates. Similarly Storey (1991) lists profit levels under the “pull hypothesis”; i.e. profits are seen as the main attraction for firms to enter the market. Doi (1999) while examining firm exit in Japanese firms also considers profitability to be one of the main determinants and finds a significant and negative impact from profitability on firm exit. Ilmakkunnas and Topi (1999) while investigating both microeconomic and macroeconomic influences on entry and exit also argue as a microeconomic factor high profit rates attract entry and low profit rates or losses encourage exit. Klaijweg and Lever (1996) includes expected profitability in both entry and exit equations as an incentive to entry and barrier to exit. Mayer and Chappel (1992) use profit rates in entry and exit equations and find significant impact from profits on both entry and exit. As a result it is possible to say that, most researchers use profit rates or profitability in their analyses and find that profit is one of the main factors that affects entry and exit.

Another important variable that influences entry and exit is industry growth. Similar to profit, industry growth is also used in most of the empirical studies and findings indicate that it has a positive impact on entry and a negative impact on exit. Hence; it can be said that industry growth act as an incentive to entry and a barrier to exit.6

Apart from profitability and industry growth, those seen as two main factors that affect entry and exit, several additional variables are also used in previous studies such as; scale economies, cost barriers, limit pricing, excess capacity, product differentiation, R&D expenditures, sunk costs and many others as incentives and/or barriers to entry and exit.

Following the literature some standard independent variables are used such as profitability, industry growth, labour productivity and sunk costs. However, the main focus of this paper is to examine the relationship between agglomeration and entry-exit behaviour of firms. Hence

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6 (Baldwin & Gorecki, 1991); (Berlgrund & Brannas, 2001); (Chappell, Kimeyni, & Mayer, 1990); (Doi, 1999); (Dunne, Klimek, Roberts, & Xu, 2009); (Dunne, Roberts, & Samuelson, 1988); (Georski, 1995); (Ilmakunnas & Topi, 1999); (Mayer & Chappell, 1992).
the E-G index\(^7\) of agglomeration is also used as an independent variable. The variables used and their definitions and sign expectations are presented in table 1:

**Table 1:** Variable definitions and sign expectations

<table>
<thead>
<tr>
<th>Definition</th>
<th>Sign Expectation</th>
<th>Entry</th>
<th>Exit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PROFITABILITY</strong>&lt;br&gt;(PROFIT)</td>
<td>Measured by price-cost margin</td>
<td>Positive</td>
<td>Negative</td>
</tr>
<tr>
<td><strong>INDUSTRY GROWTH</strong>&lt;br&gt;(IGR)</td>
<td>Measured by income growth of the industry</td>
<td>Positive</td>
<td>Negative</td>
</tr>
<tr>
<td><strong>AGGLOMERATION</strong></td>
<td>E-G index</td>
<td>Ambiguous</td>
<td>Ambiguous</td>
</tr>
<tr>
<td><strong>PRODUCTIVITY</strong></td>
<td>Labour productivity</td>
<td>Not included in entry equation</td>
<td>Negative</td>
</tr>
<tr>
<td><strong>SUNK COSTS</strong></td>
<td>Investments in fixed capital</td>
<td>Not included in entry equation</td>
<td>Negative</td>
</tr>
</tbody>
</table>

Profitability, industry growth and agglomeration are included in both entry and exit equations. However, labour productivity and sunk costs are not included in entry equation while included in exit equation because these two variables are expected to have an effect on incumbent firms’ exit decisions only.

In this paper, in order to analyse the effects of agglomeration on firm entry and exit, seemingly unrelated regression, count data models and censored regression models (Tobit) are used.

**4. Seemingly Unrelated Regression**\(^8\)

Seemingly unrelated regressions approach is quite popular in econometrics. This approach allows the researcher to estimate a set of equations with different dependent variables, which can potentially be estimated on their own, as a system. Zellner’s (1962) seemingly unrelated regressions (SUR) approach allows for estimating p equations assuming error terms are correlated across equations. The general model can be specified as:

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\(^7\) Ellison and Glaeser (1997)

\(^8\) (Baltagi, 2001) (Wooldridge, 2002)
Avery (1977) considers such model (26) with error component disturbances and Nguyen and Nguyen (2010) develop a model for SUR in panel data building upon Biorn (2004). This model particularly deals with unbalanced panels; however it can be used with balanced panels as well. Hence with Avery (1977) the composite error term can be written as; 
\[ u_{it} = \mu_i + v_{it} \]
and with Nguyen and Nguyen’s (2010) work, \( \beta \)'s can be estimated using a one way random effects estimation, letting the composite error terms in each equation interact with each other while estimating.

This approach allows fitting a many-equation SUR model using random effects estimators and is based on constructing a stepwise algorithm using GLS and maximum likelihood (ML) procedures. Since it uses a random effects GLS estimator, the SUR model also requires all composite error terms to be uncorrelated with the explanatory variables. Again, in this case, inference depends on the large population from which the sample was randomly drawn.

5. Count Data Models

A count variable can only take on nonnegative integer values. In principle, we can analyse such data using linear regression methods. However, since the data is discrete in nature it is possible to improve on the linear estimation methods by employing a specific methodology which accounts for the discrete structure of the data. The Poisson regression model is one of the main methodologies employed when the dependent variable is count data. The specification of such modelling is as follows:

\[ \text{Prob}(Y_i = y_i|x_i) = \frac{e^{-\lambda_i} \lambda_i^{y_i}}{y_i!} \]  

\[ (2) \]

---

\(^9\) (Greene, 2002) (Wooldridge, 2002) (Cameron & Trivedi, 1998)
Where, $y_i=0,1,2,...$

The most common formulation for $\lambda_i$ is the log linear model:

$$\ln\lambda_i = \mathbf{x}_i'\beta$$

(3)

The expected number of events per period is given by:

$$E[y_i|x_i] = \text{var}[y_i|x_i] = \lambda_i = e^{\mathbf{x}_i'\beta}$$

(4)

Hence;

$$\frac{E[y_i|x_i]}{\partial x_i} = \lambda_i\beta$$

(5)

The poisson model is simply a nonlinear regression; however it is easier to estimate the parameters of the model with maximum likelihood techniques. The log-likelihood function in such case is:

$$\ln L = \sum_{i=1}^{n} [-\lambda_i + \mathbf{y}_i\mathbf{x}_i'\beta - \ln y_i!]$$

(6)

However widely used, the Poisson model is criticized because it assumes that the variance of $y_i$ is equal to its mean. Many extensions to the Poisson model which relaxes this assumption are proposed in the literature\(^{10}\).

The assumption of equal mean and variance is, as mentioned above the major shortcoming of the Poisson model. The most common method used as an alternative to the Poisson model is the negative binomial model. To specify the negative binomial model, the Poisson model is generalized by introducing cross-section heterogeneity in the formulation via adding an individual, unobserved effect into the conditional mean of the Poisson model:

$$\ln\mu_i = \mathbf{x}_i'\beta + \epsilon_i = \ln\lambda_i + \ln v_i$$

(7)

Poisson and negative binomial models can also be applied to panel data. Hausman, Hall and Griliches (1984), who were examining the relationship between patent applications of firms and their R&D activities, is considered as the pioneering work in unobserved effects count

\(^{10}\) See: Hausman, Hall and Griliches (1984); McCullagh and Nelder (1983); Cameron and Trivedi (1986) for detailed information.
The fixed effects Poisson regression approach is specified as follows:

\[ \ln \lambda_{it} = x_{it}' \beta + \alpha_i \]  

(8)

The fixed effects approach has the same advantages and disadvantages in this setting as the linear regression models. Further, again similar to the linear regression; random effects in this setting assumes the composite error term to be uncorrelated with the explanatory variables. If the assumption holds, the random effects model is an alternative model. Further, again similar to the linear models, the Hausman specification test can be used as a specification test. However, different than the linear model case, GLS is not applicable in this setting. The approach used for random effects Poisson or similarly negative binomial model is that formulating the joint probability conditioned upon the heterogeneity and then integrate it out of the joint distribution.

In the literature, the preference is usually for the fixed effects over the random effects. However, a serious shortcoming arises from the use of fixed effects model in Poisson and negative binomial models. The fixed effects setting is preferred because usually the unobserved heterogeneity in the composite error term is correlated with the explanatory variables and in such cases random effects setting will result in inconsistent estimates as discussed in the linear case. However, when the fixed effect setting is used, since the time invariant parameters are wiped out from the model; such as \( \alpha_i \) in equation (8), and hence the constants are necessary to calculate the marginal effects obtaining marginal effects in such case becomes impossible.

6. The Censored Regression (Tobit) Model\(^ {11} \)

The Tobit model involves a censored dependent variable. Which means that the dependent variable is continuous but constrained in some way. Such a model; which have a dependent variable which is constrained to be nonnegative \((y \geq 0)\) is first analysed by Tobin (1958) and hence called the Tobit model. The general formulation of the model is:

\[ y_i^* = x_i' \beta + e_i \]  

(9)

\[ y_i = 0 \text{ if } y_i^* \leq 0 \]  

(10)

\(^ {11} \) (Greene, 2002); (Griffiths, Hill, & Judge, 1992)
\[ y_i^* = y_i \text{ if } y_i^* \geq 0 \] (11)

Here \( y_i^* \) is a latent variable which can be observed only when it is nonnegative. For the cases that the latent variable is negative zero is observed instead.

Tobin (1958) investigates household expenditures on durable goods. In such case the dependent variable can sometimes be zero for some household and positive for others. In any case the dependent variable is nonnegative hence censored. The Tobit model uses MLE (maximum likelihood estimation) technique.

For panel data; it is possible to adapt the random effects model to the censored regression using a simulation or quadrature –the adaptive Gauss-Hermite quadrature in this case-. Fixed effects model on the other hand is more problematic then the random effects because a sufficient statistic does not exist allowing the fixed effects to be conditioned out of the likelihood. There has been some work which tries to make fixed effects work for censored regression models however unconditional fixed effects estimates are usually biased.

For this study, apart from the seemingly unrelated regression and the count data models the Tobit model is also used. When SUR and count data models are used the dependent variable is used as counts as in numbers of entry and exit of firms in a given year. However; with the Tobit model the dependent variable is used as rate, as in the rate of entry and exit. The reasoning behind using rates rather than count numbers is to take into account the industry size. It is clear that in a large industry entry and exit will be a lot higher in numbers. In order to take into account of this fact the dependent variables are also used as rates which is obtained by dividing the entry/exit counts to the total number of firms in that industry.

7. Results

Entry and exit equations estimated are as follows:

ENTRY = f (Profitability, Industry Growth, Agglomeration)

EXIT = f (Profitability, Industry Growth, Agglomeration, Productivity, Sunk Costs)

7.1. Results from Count Data Estimations

Figures A.1 and A.2 show the distribution of entry and exit. From these figures it is clear that count data methods should be employed as a method of estimation.
Entry and exit equations are estimated using fixed effects Poisson and Negative Binomial count data models. The fixed effects method is employed according to the result of Hausman test statistics. However, employing the fixed effect Poisson and negative binomial model has an important disadvantage. Since the constant is needed to obtain marginal effects, with the fixed effects model it is not possible to calculate the marginal effects after estimation.

The models estimated using count data models are as follows:

\[
\text{ENTRY}_{it} = \beta_0 + \beta_1 \text{PROFIT}_{it} + \beta_2 \text{IGR}_{it} + \beta_3 \text{AGGLOMERATION}_{it} + \epsilon_{it} \tag{12}
\]

\[
\text{EXIT}_{it} = \beta_0 + \beta_1 \text{PROFIT}_{it} + \beta_2 \text{IGR}_{it} + \beta_3 \text{AGGLOMERATION}_{it} + \beta_4 \text{PRODUCTIVITY}_{it} + \beta_5 \text{SUNK COSTS}_{it} + \epsilon_{it} \tag{13}
\]

When Poisson estimation results are investigated from Table A.1, it is clear that agglomeration is negatively correlated with entry and positively correlated with exit. Industry growth has a negative sign in the entry equation in contrast to expectations. Finally sunk costs act as exit barriers.

However over dispersion of the data indicates the negative binomial model is a better fit for such modelling. The descriptive statistics are provided in table A.2 of the appendix indicates that, means of entry and exit variables are greater than the standard deviations of the corresponding variables. Hence using the Poisson regression method, which assumes the mean and the standard deviation to be equal, would be wrong. Further, even though there are significant numbers of zeros in dependent variables in both data sets predicted probabilities from the negative binomial and zero inflated negative binomial models are similar or slightly in favour of the negative binomial method.

Table 2 shows the results from fixed effects negative binomial regression estimation:
### Table 2: Negative Binomial Regression results

<table>
<thead>
<tr>
<th></th>
<th>Entry</th>
<th>Exit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PROFIT</strong></td>
<td>0.8424**</td>
<td>-0.1861**</td>
</tr>
<tr>
<td></td>
<td>(0.489)</td>
<td>(0.061)</td>
</tr>
<tr>
<td><strong>IGR</strong></td>
<td>0.0472**</td>
<td>-0.0409**</td>
</tr>
<tr>
<td></td>
<td>(0.026)</td>
<td>(0.049)</td>
</tr>
<tr>
<td><strong>AGGLOMERATION</strong></td>
<td>-0.1630**</td>
<td>0.1501*</td>
</tr>
<tr>
<td></td>
<td>(0.096)</td>
<td>(0.113)</td>
</tr>
<tr>
<td><strong>PRODUCTIVITY</strong></td>
<td>-</td>
<td>0.0006</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.000)</td>
</tr>
<tr>
<td><strong>SUNK COSTS</strong></td>
<td>-</td>
<td>-0.2485***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.046)</td>
</tr>
<tr>
<td>Prob.(&gt;chi²)</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Number of obs.</td>
<td>446</td>
<td>422</td>
</tr>
<tr>
<td>Number of groups</td>
<td>73</td>
<td>70</td>
</tr>
</tbody>
</table>

**Numbers in parentheses are standard errors**

Results from fixed effects negative binomial regression indicates that profitability and industry growth have positive impacts on firm entry and agglomeration has a negative impact on entry. Further regarding exit, results from table 2 indicate a negative relationship between profitability, industry growth and exit as expected. Sunk costs having a negative impact on firm exit indicate sunk costs act as exit barriers in Turkish manufacturing sectors. Finally agglomeration has a positive impact on firm exit.

### 7.2. Results from Seemingly Unrelated Regression

Count data models, being suitable specifications for such models; however use of count data models means missing out the important effect from the interdependency of entry and exit variables. In order to account for such interdependency net and gross entry and exit data are used to estimate seemingly unrelated regression which allows taking into account the interdependency between entry and exit. Seemingly unrelated regression estimation fits a many equation model allowing their error terms to affect each other. Three equations are estimated simultaneously using seemingly unrelated estimation methodology. The equations estimated are as follows:
ENTRY_{it}=\beta_0+\beta_1 EXIT_{it}+\beta_2 PROFIT_{it}+\beta_3 IGR_{it}+\beta_4 AGGLOMERATION_{it}+\varepsilon_{it} \quad (14)

EXIT_{it}= \beta_0+\beta_1 ENTRY_{it}+\beta_2 PROFIT_{it}+\beta_3 IGR_{it}+\beta_4 AGGLOMERATION_{it}+
\beta_5 PRODUCTIVITY_{it}+\beta_6 SUNK COSTS_{it}+\nu_{it} \quad (15)

STAY_{it}= \beta_0+\beta_1 ENTRY_{it}+\beta_2 EXIT_{it}+\beta_3 PROFIT_{it}+\beta_4 IGR_{it}+\beta_5 AGGLOMERATION_{it}+
\beta_6 PRODUCTIVITY_{it}+\beta_7 SUNK COSTS_{it}+\omega_{it} \quad (16)

Since incumbent firms are making a decision of either exiting or staying in the market a third equation which shows the staying decision of an incumbent firm is also used. Similar to prior equations, productivity and sunk costs are not included in the entry equation because they are seen as factors which can only affect the incumbent firms. These three equations are run simultaneously using net entry-exit data and gross entry-exit data allowing interaction between the equations. Further entry is included in the exit equation and vice versa. Finally entry and exit are both included in equation (16) representing firm immobility.

Table 3: Seemingly unrelated regression results

<table>
<thead>
<tr>
<th></th>
<th>Entry</th>
<th>Exit</th>
<th>Stay</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENTRY</td>
<td>-</td>
<td>0.5218*** (0.017)</td>
<td>-0.5477*** (0.015)</td>
</tr>
<tr>
<td>EXIT</td>
<td>1.3295*** (0.083)</td>
<td>-</td>
<td>-0.0398* (0.021)</td>
</tr>
<tr>
<td>PROFIT</td>
<td>4.0696*** (3.271)</td>
<td>-9.8294*** (9.709)</td>
<td>29.3157*** (5.870)</td>
</tr>
<tr>
<td>IGR</td>
<td>9.0831*** (0.618)</td>
<td>-2.1230*** (0.929)</td>
<td>9.8223*** (0.603)</td>
</tr>
<tr>
<td>AGGLOMERATION</td>
<td>-48.7062*** (6.697)</td>
<td>1.3976** (2.00)</td>
<td>-36.0643*** (1.183)</td>
</tr>
<tr>
<td>PRODUCTIVITY</td>
<td>-</td>
<td>-0.0001*** (0.00)</td>
<td>0.0001*** (0.00)</td>
</tr>
<tr>
<td>SUNK COSTS</td>
<td>-</td>
<td>-18.2507*** (0.993)</td>
<td>33.4578*** (0.596)</td>
</tr>
</tbody>
</table>

Number of obs. 467
Number of eqn. 3
Number of panels 6

*** 0.01<p, ** 0.05<p, * 0.1<p
Numbers in parentheses are standard errors
Results from table 3 indicate entry and exit are interrelated and have positive impacts on each other, consistent with theory and expectations. All variables have expected signs when gross entry and exit data is used. Profit affects entry and firm stay in the market positively while it has a negative effect on firm exit. Industry growth tells a similar story. It is positively correlated with firm entry and stay and negatively correlated with firm exit as expected. Productivity has a quite small impact on incumbent firms’ decisions. Sunk costs on the other hand are valid exit barriers in Turkish manufacturing and also high levels of sunk costs force firms to choose to operate in the market rather than exiting. Finally agglomeration has a negative impact on entry and positive impact on exit, indicating firms do not choose to locate in agglomerated regions. Further as agglomeration increases firm stay decreases indicating a possible increase in competition forces incumbent firms to exit the industry. However, as mentioned before, it is not possible to differentiate between different definitions of firm exit. Hence if firms choose to start operating in another industry where agglomeration is relatively low and which requires similar technology or knowledge, this is also seen as firm exit.

7.3. Results from the Tobit Model

As mentioned above the dependent variable in this case is entry and exit rates rather than count numbers. Similar to the estimations above, the models estimated are as follows:

\[
ENTRY_{it} = \beta_0 + \beta_1 \text{PROFIT}_{it} + \beta_2 \text{IGR}_{it} + \beta_3 \text{AGGLOMERATION}_{it} + \epsilon_{it} \quad (17)
\]

\[
EXIT_{it} = \beta_0 + \beta_1 \text{PROFIT}_{it} + \beta_2 \text{IGR}_{it} + \beta_3 \text{AGGLOMERATION}_{it} + \beta_4 \text{PRODUCTIVITY}_{it} + \beta_5 \text{SUNK COSTS}_{it} + \nu_{it} \quad (18)
\]

Table 4 presents the results from the Tobit estimation.
Table 4: Tobit model results

<table>
<thead>
<tr>
<th>Entry</th>
<th>Coefficients (SE)</th>
<th>Marginal Effects</th>
<th>Exit</th>
<th>Coefficients (SE)</th>
<th>Marginal Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROFIT</td>
<td>1.3218 (0.804)</td>
<td>0.8 (0.489)</td>
<td>-1.9284** (0.974)</td>
<td>-1.0218*** (0.519)</td>
<td></td>
</tr>
<tr>
<td>IGR</td>
<td>0.1526*** (0.043)</td>
<td>0.0923*** (0.026)</td>
<td>-0.0186** (0.032)</td>
<td>-0.0099*** (0.027)</td>
<td></td>
</tr>
<tr>
<td>AGGLOMERATION</td>
<td>-0.6495*** (0.187)</td>
<td>-0.3932*** (0.116)</td>
<td>0.2604*** (0.193)</td>
<td>0.1379*** (0.123)</td>
<td></td>
</tr>
<tr>
<td>PRODUCTIVITY</td>
<td>-</td>
<td>-</td>
<td>-0.0002** (0.000)</td>
<td>-0.0001** (0.000)</td>
<td></td>
</tr>
<tr>
<td>SUNK COSTS</td>
<td>-</td>
<td>-</td>
<td>-0.2907*** (1.05)</td>
<td>-0.154*** (0.051)</td>
<td></td>
</tr>
<tr>
<td>Prob.(&gt;chi^2)</td>
<td>0.0000</td>
<td></td>
<td>0.0000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of obs.</td>
<td>472</td>
<td></td>
<td>476</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of groups</td>
<td>79</td>
<td></td>
<td>79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of left censored observations</td>
<td>106</td>
<td></td>
<td>118</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of uncensored observations</td>
<td>366</td>
<td></td>
<td>349</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of right censored observations</td>
<td>0</td>
<td></td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*** 0.01<p, ** 0.05<p, * 0.1<p
Numbers in parentheses are standard errors

Results from table 4 shows that profit and industry grow rates have positive and significant effects on firm entry. On the other hand agglomeration has a negative and significant effect on firm entry. Which indicates that rising agglomeration deters firm entry. When we look at the results from exit equation it can be seen that the sign of the variables are as expected. Profit, industry growth rates, productivity and sunk costs have negative and significant effects on exit. On the other hand agglomeration has a positive and significant effect on firm exit indicating that exits will be higher in agglomerated regions.

All methods used in this study have some advantages and disadvantages. The only way to incorporate for the interdependency between entry and exit is by using SUR. Furthermore in the Tobit analysis entry and exit rates are used dependent variables to take into account the industry size. Also Tobit model takes into account the censoring in the data. Since the results
from count data models, SUR and Tobit model are quite similar when gross entry and exit data is used in terms of agglomeration and firm mobility, some overall conclusions can be drawn from the results obtained using these distinct methodologies. First, similar to the findings from previous literature profit and industry growth act as incentives to entry and barriers to exit in Turkish manufacturing industries. Second, sunk costs act as an important exit barrier in Turkish manufacturing. Productivity on the other hand, while being statistically significant has a quite small affect on exit. Finally, agglomeration deters entry and triggers exit in Turkish manufacturing as opposed to Krugman’s (1991) findings. It should be once again mentioned that all the econometric methods used tackle one side of the story.

8. Summary and Conclusions

Results from the analyses indicate that geography is an important aspect in firm mobility, supporting Devereux et al (1999). Findings in their study indicate that entry and exit are lower in agglomerated regions of the UK. Results from Turkish manufacturing industries are consistent with Devereux et al. (1999). Berglund and Brannas (2001) also examined this important aspect using GMM for Sweden and found a negative effect of agglomeration on firm exit. While agglomeration can have different impacts on firm mobility in different countries, GMM is not the right specification for such analysis; further, they use population density as a proxy for agglomeration economies and as argued before this is a poor proxy. Finally Huiban (2009) argues it is easier to survive in rural areas than urban areas resulting from a study on France and its regions, indicating firms might chose to locate in rural areas or in areas that are not over represented by one industry; i.e. not agglomerated. Results from Turkish manufacturing industry also are consistent with such findings. It is also important to underline that industry level data is not the ideal tool for such analysis. Firm level or plant level data would reveal much more and healthier information on entry and exit patterns of firms in Turkish manufacturing; however as a result of data limitations industry level data is used. Results from Turkish manufacturing using both net and gross entry and exit data reveal quite important information. First, differences in estimation results with different data sets indicate that it is essential to use gross entry and exit data in such studies. Second, using the right specification is also important; however the main point should be seen as taking account of the interdependence between entry and exit to fully understand the underlying patterns. Finally it is necessary and again essential to account for the effects form agglomeration and to do so using the right proxy is vital.
Most important aspect of these results is that they are indicating that firms in Turkish manufacturing do not want to locate in agglomerated regions and clearly do not benefit from agglomeration. This result can explain the declining trend in agglomeration in Turkish manufacturing industries. However the possible explanation for such result should be further investigated.
REFERENCES


Appendix

Figure A.1: Distribution of gross Entry

Figure A.2: Distribution of gross Exit
### Table A.1: Poisson estimation results

<table>
<thead>
<tr>
<th></th>
<th>Entry</th>
<th>Exit</th>
<th>Entry</th>
<th>Exit</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROFIT</td>
<td>0.7397</td>
<td>-0.4877</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.636)</td>
<td>(0.516)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IGR</td>
<td>-0.0610**</td>
<td>-0.006</td>
<td>-0.0610**</td>
<td>-0.006</td>
</tr>
<tr>
<td></td>
<td>(0.030)</td>
<td>(0.088)</td>
<td>(0.030)</td>
<td>(0.088)</td>
</tr>
<tr>
<td>AGGLOMERATION</td>
<td>-0.1535**</td>
<td>0.313**</td>
<td>-0.1535**</td>
<td>0.313**</td>
</tr>
<tr>
<td></td>
<td>(0.049)</td>
<td>(0.142)</td>
<td>(0.049)</td>
<td>(0.142)</td>
</tr>
<tr>
<td>PRODUCTIVITY</td>
<td>-</td>
<td>0.0009</td>
<td>-</td>
<td>0.0009</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.000)</td>
<td></td>
<td>(0.000)</td>
</tr>
<tr>
<td>SUNK COSTS</td>
<td>-</td>
<td>-0.3301***</td>
<td>-</td>
<td>-0.3301***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.089)</td>
<td></td>
<td>(0.089)</td>
</tr>
<tr>
<td>Prob.(&gt;chi²)</td>
<td>0.008</td>
<td>0.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of obs.</td>
<td>446</td>
<td>446</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of groups</td>
<td>73</td>
<td>73</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*** 0.01<p,  ** 0.05<p,  * 0.1<p

Numbers in parentheses are standard error

### Table A.2: Descriptive Statistics

<table>
<thead>
<tr>
<th></th>
<th>Net entry-exit data</th>
<th>Gross entry-exit data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Entry</td>
<td>Exit</td>
</tr>
<tr>
<td>Mean</td>
<td>5.725</td>
<td>4.363</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>22.837</td>
<td>13.931</td>
</tr>
<tr>
<td>Min.</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Max.</td>
<td>551</td>
<td>319</td>
</tr>
</tbody>
</table>