FIRM SIZE, VOLATILITY AND LABOR MARKET THICKNESS

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DECLARATION OF ORIGINALITY

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ABSTRACT

Firm Size, Volatility and Labor Market Thickness

In this thesis, I investigate the relationship between labor market thickness and volatility of sales. Marshall suggests that thick markets occur since industrial organization increases productivity. In Principles of Economics (1890), Marshall explains how economic concentration positively effects productivity, growth, innovation and exposure to shocks. Using a firm-level panel data for 18 countries, I test a new dimension of firm effectiveness, namely sales volatility, and relate it to industry and/or overall economic concentration. In the results of tests, I find that there is a negative relationship between the volatility of sales and both employment level and the share of employment in a region, separately. For the firms which are in same sector, in a given region, as the share of the firms' employment in that region decreases; volatility increases for that firms.

ÖZET

Firma Büyüklüğü, Oynaklık ve İşgücü Piyasası Kalınlığı

Bu tezde, işgücü piyasası kalınlığı ile satışların oynaklığı arasındaki ilişkiyi inceliyorum. Marshall, sınai organizasyonun üretkenliği arttırarak, kalın iş pazarlarını ortaya çıkardığını öne sürmüştür. Ekonomi İlkeleri'nde (1890) Marshall, ekonomik yoğunlaşmanın, verimliliği, büyümeyi, inovasyonu ve şoklara maruz kalmayı olumlu bir şekilde nasıl etkilediğini açıklıyor. 18 ülke için firma düzeyinde bir panel verisini kullanarak, yeni bir firma etkinliği boyutunu, yani satış dalgalanmasını test ediyorum ve bunu endüstri ve/veya genel ekonomik konsantrasyonla ilişkilendiriyorum. Testler sonucunda satışların değişkenliği ile hem istihdam düzeyi hem de bir bölgedeki istihdamın payı arasında negatif bir ilişki olduğunu buldum. Aynı sektörde bulunan firmalar için, belirli bir bölgedeki firmaların o bölgedeki istihdamlarının payının azalmasıyla; bu firmalar için oynaklık artmaktadır.

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CHAPTER 1

INTRODUCTION

Understanding how volatility and labor market thickness are related is the main interest of this paper, and it has a wide-ranging part in economics literature. While the issue has been addressed in many different ways, the firm productivity has not been studied in the sense of accumulation of regional labor force.

To my knowledge, there are not many sources examining the relationship between volatility and labor market thickness in a regional perspective.

The crucial mechanism that might generate a relationship between volatility and economic concentration is the presence of a thicker labor market which increases firm's employment responsiveness to firm or industry level changes (demand or supply shocks). Namely, smaller firms in terms of employment relative to regional employment will find it easier to exchange labor with other firms in close proximity and can respond to demand or supply shocks more easily than otherwise larger firms. This type of volatility is beneficial rather than being detrimental in the sense that being located in a larger labor market decreases the need at the firm level to insure against uncertainty and implies lower adjustment costs. Standard reasoning which typically perceives volatility as negative and larger markets as positive would predict a negative relationship between volatility and economic concentration, which is the opposite of what I postulate here.

The rest of paper is organized as follows: Chapter 2 gives a summary of the previous literature on volatility and related works. Chapter 3 describes a detailed description of the data set. Chapter 4 explains the methodology. Chapter 5 presents

the estimation results using OLS approach. Chapter 6 presents the results of volatility and labor market thickness relationship in other aspects. Chapter 7 concludes.

CHAPTER 2

LITERATURE REVIEW

Before addressing the volatility of the firm and the relationship between labor market thickness, I present some facts about what volatility is, what parameters are involved in the formation of volatility, what factors volatility is related to on aggregate level and firm level.

Macroeconomists mostly focused on the aggregate level outcomes and relations in terms of volatility. The most crucial point of focus is the relationship between volatility and growth.

Great Moderation is the name of the era in which the volatility in business cycle fluctuations in developed and developing countries have decreased gradually compared to previous decades, starting in the mid-1980s and ending in the 2007 crisis (Davis and Kahn-2008). The reasons that are believed to cause this period can be summarized as follows:

1. Good Policy: Properly functioning monetary and fiscal policies, particularly in central banks, have made volatility of output more stable.

2. The Good Luck Hypothesis: The effect of small exogenous shocks.

3. Structural Changes: Increasing resistance to shocks with technological developments and innovations.

On the other hand, the theoretical literature on this linkage is greatly controversial and there are many claims about which one affects the other. General AK models that were developed by King and Rebelo (1993) imply that volatility has a net effect on growth through the the increasing individual savings in one hand, and

decreasing demand of investment on the other hand. The intertemporal elasticity of substitution of the consumers will determine the net effect of volatility on growth. Aghion and Howitt (2006) criticize these models since these models mostly focus on capital accumulation, by using a Schumpeterian approach framework, saying that the investment cannot be the essential part of the effects of volatility on growth. Schumpeter's (1939) idea of creative destruction approaches the downturns as tools to dissolve the misallocations in firms, making improvements to have more organizational efficiency and to allow firms to enter into new markets. Aghion and Howitt (2006) argue that this approach brings positive results in terms of the effect of volatility on growth, however when the credit markets are imperfect, i.e. firms cannot borrow funds or reorganize as free as they want to and workers cannot change their jobs due to the restrictions of investment, volatility has the opposite effect on growth.

Following the Optimal Portfolio Theory, Jean Imbs (2007) shows that volatility and growth correlate positively at the sectoral level covering manufacturing activities at the three-digit level in 47 countries between years 1970 and 1992, where they correlate negatively across countries.

In Koren and Tenyero's Volatility and Development paper (2007), authors search the reasons behind the rich and poor country differences regarding GDP growth volatility. They identify three components of volatility of aggregate GDP growth: sectoral shocks, country-specific shocks and the covariance between these two. They claim there are three reasons for these differences: poor countries specialize in fewer and more volatile sectors; poor countries experience more frequent and more severe aggregate shocks (e.g., from macroeconomic policy); poor countries' macroeconomic fluctuations are more highly correlated with the shocks affecting the sectors they

specialize in.

The fact that volatility can be interpreted as a good or a bad phenomenon depends on the choice of sample, if not completely. According to the Schumpeter's concept of "creative destruction", to build something new, the former must be completely destroyed. In such a case, we cannot argue that the excess volatility is an retrogressive situation in terms of economics. Different findings related to volatility and growth relationship have been obtained depending on the both period and sampling. Ramey and Ramey (1995) present empirical evidence that contains 92 countries within the years 1960-1985, show that countries with higher volatility have lower growth. Fountas and Karanasos (2006) use output data for USA, Japan, and Germany that starts in the mid 1800s and ends at 1999 to investigate the relationship between output growth and volatility. Using the methodology of GARCH models, they find that as the volatility increases, growth rate of output increases in Germany and Japan significantly, and in United States insignificantly. They also examine the opposite effect, the effect of growth on volatility and find that growth rate of output reduces the volatility.

Although the use of macro data to explain the aggregate output volatility and the growth volatility are more prevailing in the literature, it should not be unnoticed that the major reason for these macro changes comes from the the changes in micro data.

Volatility is a very important factor at micro-level for firms and households, since they decide how to distribute their risks according to their assets and how to smooth their consumption. Methods of calculation of micro level volatility are grouped under two main headings in literature:

Unconditional volatility:

Firm-level volatility is measured as the standard deviation of rates of change in real sales, namely change in operational sales for a certain time period. Sales of firms are modified with the sectoral deflators from the gross national records. In general terms, it can provide information that gives a clear framework when the effects of macro variables are not directly addressed or the volatility is not monitored in the growth process.

Conditional volatility:

In addition to the macro shocks, a firm's volatility can also depend on firm related activities and characteristics in firm's itself. Conditional volatility, tries to explain the volatility and the relation between firm-specific parameters and volatility, after clearing of the macro effects from it. In this computational form, after the volatility is regressed on the macro variables, the stored residuals are considered to be the volatility which is the cleared of unobserved effects, and everything else is compared with these last residuals. Vannoorenberghe (2012), Kalemli-Ozcan, Sørensen and Volosovych(2014), Kurz and Senses (2016) use conditional volatility by netting out the other effects to let firms counter heterogeneously to the shocks.

The study of Buch, Doepke and Stahn (2009) that captures the firms of Germany between the years 1971-2005, finds that the conditional volatility for this period did not change much for very old firms, while unconditional volatility decreased significantly during this period and 2 percentage point higher than conditional volatility.

However, conditional volatility account requires a relatively long time interval in order to estimate and calculate the parameters correctly. Of course, this may increase

the likelihood of long-lasting data to have older and larger firms, so there may be a bias in the sample in that case. The Factors affecting the firm level volatility can be summarized as follows: company size, company age, product variety, the openness to trade, financial conditions and company's ownership situation (public or private).

Comin and Mulani (2009) find that general innovations affect all firm in a similar way symmetrically hence they do not have important implications on market shares. R&D spending makes firms to change the ways of operations and products hence have important effects in terms of market shares. Their work shows empirically that R&D spending increases publicly traded firms' volatility. They consider publicly traded firms specifically since almost all private R&D spendings in United States comes from these firms.

Kalemli-Ozcan, Sørensen and Volosovych(2014) find that foreign direct ownership of a firm is positively correlated with its output volatility, using AMADEUS dataset for 16 European countries, emphasizing the fact that foreign investors are more likely to invest in riskier firms.

When we narrow our area of interest to firm level factors, the relationship between the agglomeration of the firms and the volatility is remarkable. The first point to explore is the driving forces behind agglomeration of the firms in a given region (across sectors) and in a given region-industry pair. These forces also explain the relationship mechanism of agglomeration and volatility.

In general, the advantages that encourage all firms in general and the firms related to the same sector to be gathered in certain areas, and how effective they are, have been perceived for a long time and have a wide place in the literature.

Alfred Marshall (1890) suggests that agglomeration economies and thick labor markets occur since it increases the productivity of the firms. These advantages that increase the productivity come from the possibilities of more specialization in thicker labor markets, having similar intermediate suppliers, having a larger pool for employers and availability of transfer in spillovers. Adam Smith (1776) argues that in an area where a large number of workers are engaged in a particular job, the workers are specialized in their work and increase production proportionally.

In their paper, Curuk and Vannoorenberghe (2017) show that there is a link between geographical agglomeration of firms which use similar occupations and the ability to respond aggregate shocks of employment. They use an index of occupational similarity (Employment Responsiveness Index) that measures the size of employment pool with which the industry can exchange labor, if it wants to adjust its employment. They have two main results. The first one is; there is a negative correlation between the ability to respond to aggregate shock, and the share of an industry's employment in a given region *(Lir/Lr)* due to geographical immobility. The second result is; for a given share of employment in a region *(Lr/L)*, an industry may adjust its employment easier, if there are similar occupations in that region due to the inability of changing occupation.

The coexistence of similar occupational groups implies the existence of a flexible and relatively large pool of labor for firms. This specific advantage mostly shows itself when firms exposure to some firm related idiosyncratic shocks. In Geography and Trade (1992) Krugman explains this situation with a simple illustration by comparing two firms in same sector that have good and bad times based on their firm specific characteristics. He assumes that firms want to hire more

employers when things are good, and want to let some of them go when things are bad. He lets the firms to choose of location in two separate regions with same labor force (100 employers) or location in the same region with total labor force of those two regions (200 employers). If they choose to settle in two different regions, they cannot have extra workers in good times since there is not enough. However, if they are in the same region, one firm's bad time may coincide with the other's good time occasionally -not necessarily constantly-, hence there will be additional labor available for both firms. He adds that, even for the workers, when bad times come they can go to the another firm to work, since their skills are still useful in that firm. He considers the cases in which wages are given or flexible and shows that these two cases basically give the same result, also letting the firms gain power from monopsony strengthens the claim.

These results give us a clue as to why the output of the firm may show more volatility in the short run during the reallocation of the excess or lack of labor force in a thicker labor market. I interpret this volatility as a response to idiosyncratic demand and productivity shocks in the needed adjustments at the firm level.

There are many other researches investigating the volatility with different angles.

Cuñat and Melitz (2012) study the relationship between volatility and flexibility of labor market, and they find that countries with more flexible labor markets specialize in higher volatile sectors. In their paper, Malik and Temple (2006) examines the structural elements of output volatility in developing countries, regarding the the roles of geography and institutions.

To my knowledge, there are not many sources examining the relationship

between volatility and labor market thickness.

CHAPTER 3

DATA AND DESCRIPTIVE STATISTICS

3.1 Data

I use cross-country firm level panel data from over 18 European countries to test the relationship between volatility of sales and economic concentration. These countries are as follows: Belgium (BEL), Bosnia and Herzegovina (BOS), Bulgaria (BUL), Crotia (CRO), Czech Republic (CZE), Estonia (EST), France (FRA), Germany (GER), Hungary (HUN), Ireland (IRE), Italy (ITA), Portugal (POR), Romania (ROM), Serbia (SER), Slovakia (SLO), Spain (SPA), Sweden (SWE) and United Kingdom (UNI). The data comes from Bureau van Dijk- AMADEUS Database and it includes the years between 2007 and 2015. I choose this data set of countries between 42 number of countries including the years 2000-2017 for having certain features.

In the beginning, although the data had a large number of countries and observations, it had a very noisy and scattered structure. For all 42 countries, the number of observations in the years 2000-2007 and in the years after 2015 was significantly low. I decided to eliminate these years which include discontinuous and diffuse observations. This elimination immediately reduced my number of countries to 22 from 42. Although I have the highest numbers of observations for all countries in years from 2007 to 2015, I determined that there were too many missing observations and inconsistent information in data. Hence, I follow a method and resolve the data for these years as follows.

Firstly, I eliminate the observations that do not include any information of 4-digit NAICS codes, NUTS-3 region codes, cost of employee (wages), operational revenue and number of employment. Then, I eliminate the observations that have

negative values for cost of employee and operational revenue. I calculate the age of firms based on the information of the foundation year and exclude the observations that are one year old or younger.

Secondly, I eliminate the observations with consolidated accounts, since an international firm may have many operational centers however they maybe located in different countries. In order to calculate the volatility, the number of observations per firm must be continuous. Because the data does not contain many years, any specific year is not taken as a benchmark for sales. To make the data continuous, I exclude the observations which do not include all those nine years. Since I investigate the agglomeration effect of employment, I also eliminate the firms who dominates a region or a dominates over a sector not to have any monopolies in that case.

Thirdly, I eliminate the firms which have only one employer and then I eliminate the one percentage of the employment data both from top and bottom for every country. By doing so, I try to have less outliers in the regression. Before trimming the data, I had 5,039,721 number of observations, after that this number decreased to 4,988,214 in total.

After rearranging, I divide the data into two sections considering that volatility can be too low or too high due to some firm specific reasons. In the first data set, only the above mentioned changes are included, but in the second data set I also check the volatility distribution for each country and eliminate the five percentage of the volatility data both from top and bottom for every country. The main idea considered here is that it may give a false impression that the firm has a low or high volatility in general because of its idiosyncratic features.

I classified the firms based on their numbers of employers and their ages to

have a picture of the distribution for each country. Micro Enterprises include 1 to 10 employers, Small Enterprises include 10 to 50 employers, Medium Enterprises include 50 to 250 employers, Medium-Large Enterprises include 250 to 1000 employers and Large Enterprises include more than 1000 employers. Young Enterprises exist for 1 to 5 years, Intermediate Aged Enterprises exist for 5 to 10 years and Old Enterprises exist for more than 10 years.

For the first data set, the descriptive statistics are given in Table A1. In general, for all countries actual value of volatility is between 0-1 for 75 percentage of the data. However, for some countries standard deviation is higher than the others, i.e. even if the firms with higher volatility consist a small portion in data, their volatility value is too high comparing to average. These countries are: Belgium, France, Germany, Italy and Spain. For these countries, skewness of actual value of volatility is considerably high (and positive). Number of firms (observations) in total is the smallest for Bosnia and Herzegovina which is 1,624 while it is the largest for Spain which is 1.40e+05, number of regions in total is again smallest for Bosnia and Herzegovina which is 2, it is the largest for United Kingdom which is 935, number of sectors based on 4 Digit NAICS code in total is distributed almost equally for every country. The regional data is based on the NUTS 3 (5 digit region codes). The NUTS (Nomenclature des Unités Territoriales Statistiques) codes are defined as a hierarchical subdivision of geographical areas, classifying the areas at a series of nested levels, where NUTS 3 codes in the range 150,000-800,000 population.[1] Hence the surface area for each code can change from region to region. However, it presents a clear picture of urbanization and agglomeration of firms by implication. The details can be seen in

[1] http://www.restore.ac.uk

Table 1.

As it can be seen from Table 2, 40 to 50 percent of firms in these countries are considered as Micro Sized: Czech
Republic, France and Italy. 55 percent of firms in Spain are Micro Sized. This rate is 60 percent for Croatia, Estonia, Romania and 70 percent for Portugal and Sweden, which are the highest. Only 17 percent of firms are Micro in Belgium and Bulgaria. The smallest rates are for Germany and United Kingdom which are 1.62 and 8.28 respectively. 40 to 50 percent of firms in these countries are classified as Small firms: Belgium, Bosnia and Herzegovina, Bulgaria, Hungary, Serbia, Slovakia and Spain. This rate is 30 percent for Croatia, Czech Republic, Estonia, France, Ireland and Romania. None of the countries except Belgium, Bulgaria, Germany, Hungary, Ireland and United Kingdom have large firms in them. The highest ratio of Large firms are 11 percent for Germany and second highest is 7 percent for United Kingdom. For the rest, the ratio is only around 1 percent.

Ratios for Old firms established in a country are as follows: 82.5 percent for Belgium, 75 percent for Germany, 70 percent for United Kingdom; 60 to 70 percent for Croatia, France, Italy, Spain and Sweden. Ratio for Young firms is the highest for Romania which is 31 percent and smallest for Belgium which is 6.56. Ratio for Intermediate Aged firms is the highest for Bosnia and Herzegovina which is 64 percent, and for the rest of the countries this ratio changes between 10 to 20 percent. The details are in Table 3.

Number of industries are almost same for whole countries, i.e. in the data set, every country includes every classifications of industries. The database is more dense in the sectors starting with the codes 23, 31-33, 42-48, 54. These codes represent the

following sectors: 23 Construction; 31-33 Manufacturing; 42 Wholesale Trade; 44 Retail Trade; 45 Retail Trade; 48 Transportation and Warehousing; 54 Professional, Scientific, and Technical Services. In almost all countries, sectors of 81-Other Services (except Public Administration) and 92-Public Administration occupy very small space. The classifications and number of firms can be seen in Table A2.

For the second data set, Descriptive Statistics are presented in Table A3. In general, for all countries actual value of volatility is between 0-0.8 for 75 percentage of the data. For Germany, standard deviation is still higher than the others comparing to the mean.

Skewness of actual value of volatility is higher (and positive) for Belgium and Germany comparing to the others. Number of firms (observations) in total is the smallest for Bosnia and Herzegovina which is 1,460 while it is the largest for Spain which is 1.26e+05, number of regions in total is again smallest for Bosnia and Herzegovina and Serbia which is 2, it is the largest for United Kingdom which is 908, number of sectors based on 4 Digit NAICS code in total is distributed almost equally for every country again. The details can be seen in Table 4.

Trimming the data according to the volatility does not change distribution of firms based on their size and their age significantly. The details are in Table 5 and 6.

The variables I use in estimation are as follows: *ln(vol-opre)*, *Lijr*, *lnempl*, *lnempl-re*, *age*, *lnempl-r*, *lnempl-ir*. *Lijr* shows the employment size of the firm in 2007, i.e. number of workers in a firm where *j* represents firm, *r* represents region and *i* represents industry/sector. 2007 is chosen as the first year of the data. *lnempl* is the natural logarithm of *Lijr*.

lnempl-re is calculated as the natural logarithm of the share of the firm's employment in the region in which the firm is settled:

$$lnempl\text{-}re = \log(\frac{Lijr}{Lr})$$

$$Lr = \sum_{r} Lijr$$

lnempl-r shows the size of the employment in that specific region and calculated as natural logarithm (*log(Lr)*). *age* is only used as dummy variable (as *aged*) in estimations when it is necessary (Young, Intermediate Aged and Old). *lnempl-ir* is the natural logarithm of employment size in an industry/region pair:

$$lnempl\text{-}ir = \log(Lir)$$

$$Lir = \sum_{ir} Lijr$$

Calculation of *ln(vol-opre)* will be given in the next section.

3.2 Descriptive statistics

Table 1. Industry-Region Statistics for First Data Set

NAICS Code: 4 Digit

Country	Number of Firms	Total Number of Industries (4 Digit)	Total Number of Regions	Total Number of Region-Industry Intersections
BELGIUM	10204	219	43	3024
BOSNIA AND H.	1624	138	2	191
BULGARIA	7789	206	28	1857
CROATIA	17196	223	21	2464
CZECH R.	20335	246	98	7501
ESTONIA	7715	195	15	1274
FRANCE	13690	215	93	5142
GERMANY	7225	235	395	5038
HUNGARY	7886	208	20	1876
IRELAND	1891	121	45	514
ITALY	64730	277	109	12322
PORTUGAL	83291	231	308	17101
ROMANIA	72771	236	42	6217
SERBIA	7141	196	2	363
SLOVAKIA	9493	204	79	4183
SPAIN	1.40e+05	246	52	8555
SWEDEN	60956	233	21	3557
UNITED KINGDOM	19570	241	935	11414

Table 2. Classification of Firm Size for First Data Set

NAICS Code: 4 Digit

Class	Freq.	Percent	Freq.	Percent	Freq.	Percent
	BEL		FRA		ROM	
Micro	1,735	17.00	6,791	49.61	45,412	62.40
Small	4,683	45.89	4,949	36.15	21,766	29.91
Medium	3,023	29.63	1,625	11.87	5,184	7.12
Medium-Large	693	6.79	325	2.37	409	0.56
Large	70	0.69	-	-	-	-
Total	10,204		13,690		72,771	
	BOS		GER		SER	
Micro	590	33.26	118	1.62	2,471	32.06
Small	841	47.41	1,017	13.99	3,691	47.89
Medium	292	16.46	2,994	41.19	1,272	16.50
Medium-Large	51	2.87	2,308	31.76	273	3.54
Large	-	-	831	11.43	-	-
Total	1,774		7,268		7,707	
	BUL		HUN		SLO	
Micro	1,349	17.32	2,280	28.91	2,911	30.66
Small	3,535	45.38	3,527	44.72	4,784	50.40
Medium	2,380	30.56	1,697	21.52	1,496	15.76
Medium-Large	519	6.66	374	4.74	302	3.18
Large	6	0.08	8	0.10	-	-
Total	7,789		7,886		9,493	
	CRO		IRE		SPA	
Micro	10,485	60.97	647	34.21	76,392	54.46
Small	5,382	31.30	670	35.43	53,965	38.47
Medium	1,204	7.00	415	21.95	9,103	6.49
Medium-Large	125	0.73	132	6.98	812	0.58
Large	-	-	27	1.43	-	-
Total	17,196		1,891		140,272	
	CZE		ITA		SWE	
Micro	9,727	47.83	27,316	42.20	44,572	73.12
Small	6,811	33.49	26,180	40.44	14,206	23.31
Medium	3,117	15.33	9,609	14.84	2,178	3.57
Medium-Large	680	3.34	1,625	2.51	-	-
Large	-	-	-	-	-	-
Total	20,335		64,730		60,956	
	EST		POR		UNI	
Micro	4,791	62.10	58,645	70.41	1,620	8.28
Small	2,510	32.53	21,609	25.94	5,033	25.72
Medium	414	5.37	3,037	3.65	8,264	42.23
Medium-Large	-		-	-	3,342	17.08
Large	-	-	-	-	1,310	6.69
Total	7,715		83,291		19,569	

Micro Enterprises Include 1 to 10 employers
Small Enterprises Include 10 to 50 employers
Medium Enterprises Include 50 to 250 employers
Medium-Large Enterprises Include 250 to 1000 employers
Large Enterprises Include more than 1000 employers

Table 3. Classification of Firms' Age for First Data Set

NAICS Code: 4 Digit

Class	Freq.	Percent	Freq.	Percent	Freq.	Percent
	BEL		FRA		ROM	
Young	669	6.56	2,038	14.89	22,717	31.22
Intermediate Aged	1,117	10.95	2,532	18.50	16,053	22.06
Old	8,418	82.50	9,120	66.62	34,001	46.72
Total	10,204		13,690		72,771	
	BOS		GER		SER	
Young	147	9.05	625	8.65	1,565	21.92
Intermediate Aged	1,039	63.98	1,158	16.03	1,515	21.22
Old	438	26.97	5,442	75.32	4,061	56.87
Total	1,624		7,225		7,141	
	BUL		HUN		SLO	
Young	1,841	23.64	1,216	15.42	2,352	24.78
Intermediate Aged	2,569	32.98	2,220	28.15	2,595	27.34
Old	3,379	43.38	4,450	56.43	4,546	47.89
Total	7,789		7,886		9,493	
	CRO		IRE		SPA	
Young	3,102	18.04	325	17.19	20,255	14.44
Intermediate Aged	3,069	17.85	537	28.40	31,386	22.38
Old	11,025	64.11	1,029	54.42	88,631	63.19
Total	17,196		1,891		140,272	
	CZE		ITA		SWE	
Young	4,789	23.55	7,289	11.26	10,397	17.06
Intermediate Aged	4,950	24.34	12,200	18.85	11,555	18.96
Old	10,596	52.11	45,241	69.89	39,004	63.99
Total	20,335		64,730		60,956	
	EST		POR		UNI	
Young	1,756	22.76	13,703	16.45	2,285	11.68
Intermediate Aged	2,249	29.15	24,028	28.85	3,496	17.86
Old	3,710	48.09	45,560	54.70	13,789	70.46
Total	7,715		83,291		19,570	

Age of Young Enterprises 1 to 5 years
Age Intermediate Aged Enterprises 5 to 10 years
Age of Old Enterprises more than 10 years

Table 4. Industry-Region Statistics for Second Data Set

NAICS Code: 4 Digit

Country	Number of Firms	Total Number of Industries (4 Digit)	Total Number of Regions	Total Number of Region-Industry Intersections
BELGIUM	9184	219	43	2901
BOSNIA AND H.	1460	135	2	185
BULGARIA	7010	205	28	1753
CROATIA	15473	218	21	2380
CZECH R.	18302	243	98	7103
ESTONIA	6943	194	15	1232
FRANCE	12322	213	93	4843
GERMANY	6496	229	392	4722
HUNGARY	7087	197	20	1779
IRELAND	1694	114	44	477
ITALY	58257	276	109	11760
PORTUGAL	74963	229	307	16282
ROMANIA	65497	236	42	6061
SERBIA	6423	190	2	352
SLOVAKIA	8542	200	79	3933
SPAIN	12.6e+05	246	52	8383
SWEDEN	54861	232	21	3474
UNITED KINGDOM	17594	239	908	10609

Table 5. Classification of Firm Size for Second Data Set

NAICS Code: 4 Digit

Class	Freq.	Percent	Freq.	Percent	Freq.	Percent
	BEL		FRA		ROM	
Micro	1,495	16.28	6,145	49.87	41,134	62.80
Small	4,315	46.98	4,473	36.30	19,495	29.76
Medium	2,739	29.82	1,438	11.67	4,531	6.92
Medium-Large	578	6.29	266	2.16	337	0.51
Large	57	0.62	-	-	-	-
Total	9,184		12,322		65,497	
	BOS		GER		SER	
Micro	457	31.30	79	1.22	1,884	29.33
Small	723	49.52	899	13.84	3,254	50.66
Medium	238	16.30	2,772	42.67	1,060	16.50
Medium-Large	42	2.88	2,080	32.02	225	3.50
Large		-	666	10.25	-	-
Total	1,460		6,496		6,423	
	BUL		HUN		SLO	
Micro	1,215	17.33	2,069	29.19	2,580	30.20
Small	3,251	46.38	3,215	45.36	4,369	51.15
Medium	2,129	30.37	1,492	21.05	1,351	15.82
Medium-Large	411	5.86	307	4.33	242	2.83
Large	4	0.06	4	0.06	-	-
Total	7,010		7,087		8,542	
	CRO		IRE		SPA	
Micro	9,465	61.17	585	34.53	69,212	54.82
Small	4,865	31.44	608	35.89	48,466	38.39
Medium	1,047	6.77	364	21.49	7,901	6.26
Medium-Large	96	0.62	117	6.91	667	0.53
Large	-	-	20	1.18	-	-
Total	15,473		1,694		126,246	
	CZE		ITA		SWE	
Micro	8,595	46.96	24,823	42.61	40,277	73.42
Small	6,284	34.34	23,753	40.77	12,775	23.29
Medium	2,841	15.52	8,383	14.39	1,809	3.30
Medium-Large	582	3.18	1,298	2.23	-	-
Large	-	-	-	-	-	-
Total	18,302		58,257		54,861	
	EST		POR		UNI	
Micro	4,265	61.43	52,875	70.53	1,339	7.61
Small	2,301	33.14	19,382	25.86	4,503	25.60
Medium	377	5.43	2,706	3.61	7,627	43.35
Medium-Large	-		-	-	3,018	17.15
Large	-	-	-	-	1,106	6.29
Total	6,943		74,963		17,593	

Micro Enterprises Include 1 to 10 employers
Small Enterprises Include 10 to 50 employers
Medium Enterprises Include 50 to 250 employers
Medium-Large Enterprises Include 250 to 1000 employers
Large Enterprises Include more than 1000 employers

Table 6. Classification of Firms' Age for Second Data Set

NAICS Code: 4 Digit

Class	Freq.	Percent	Freq.	Percent	Freq.	Percent
	BEL		FRA		ROM	
Young	579	6.30	1,838	14.92	20,570	31.41
Intermediate Aged	1,005	10.94	2,303	18.69	14,500	22.14
Old	7,600	82.75	8,181	66.39	30,427	46.46
Total	9,184		12,322		65,497	
	BOS		GER		SER	
Young	132	9.04	551	8.48	1,436	22.36
Intermediate Aged	941	64.45	1,041	16.03	1,370	21.33
Old	387	26.51	4,904	75.49	3,617	56.31
Total	1,460		6,496		6,423	
	BUL		HUN		SLO	
Young	1,673	23.87	1,100	15.52	2,092	24.49
Intermediate Aged	2,303	32.85	2,032	28.67	2,350	27.51
Old	3,034	43.28	3,955	55.81	4,100	48.00
Total	7,010		7,087		8,542	
	CRO		IRE		SPA	
Young	2,753	17.79	302	17.83	18,330	14.52
Intermediate Aged	2,745	17.74	470	27.74	28,342	22.45
Old	9,975	64.47	922	54.43	79,574	63.03
Total	15,473		1,694		126,246	
	CZE		ITA		SWE	
Young	4,316	23.58	6,569	11.28	9,425	17.18
Intermediate Aged	4,457	24.35	11,082	19.02	10,456	19.06
Old	9,529	52.07	40,606	69.70	34,980	63.76
Total	18,302		58,257		54,861	
	EST		POR		UNI	
Young	1,579	22.74	12,371	16.50	1,975	11.23
Intermediate Aged	1,989	28.65	21,915	29.23	3,125	17.76
Old	3,375	48.61	40,677	54.26	12,494	71.01
Total	6,943		74,963		17,594	

Age of Young Enterprises 1 to 5 years
Age Intermediate Aged Enterprises 5 to 10 years
Age of Old Enterprises more than 10 years

CHAPTER 4

THE ESTIMATION METHOD

On the left hand side I have logarithm of sales volatility (operational revenue) as the dependent variable. The main independent variables of interest are firm size and region size. In our baseline specifications I use employment as a measure of size as would be predicted by theory.

$$ln(vol-opre) = \log(Vol_{ijr}) = \beta_0 + \beta_1 log(\text{empl})_{ijr} + \beta_2 \gamma^i X_i + \beta_3 \gamma^r X_r + \beta_4 aged_{ijr} + u_j$$

where *empl* represents the total number of workers in a firm, *aged* represents the age dummy variables which classify a firm as Young, Intermediate Aged or Old. And volatility is defined as:

$$Vol_{ijr} = \sum_t (g_{jt} - \frac{1}{T}\sum_t g_{jt})^2$$

$$g_{jt} = \frac{opre_{jt} - opre_{j,t-1}}{(opre_{jt} + opre_{j,t-1})/2}$$

I use the definition of the volatility of sales over the years as the variance of the growth rate of its sales (see Vannoorenberghe, 2012) and use the definition of g_{jt} as the mid-point growth rate of sales at t g_{jt} is between -2 and 2 and it has a mean of zero (see Stephen D. et al., 2006).

Region size is measured by the regional stock of labor. j denotes firm, i denotes industry, r denotes region and *opre* denotes operational revenue.

X_i includes industry level variables typically control by industry fixed effects, X_r includes regional covariates which are typically captured the region fixed effects. Once region fixed effects are included, γ^i drops, of course, and can not be estimated.

CHAPTER 5

RESULTS

5.1 Results for First Data Set With 4 Digit NAICS Code

Firstly, I regress the volatility on logarithmic level of employment and there is a negative relationship between the employment level and volatility of sales (Table 7). I use both sectoral and regional dummies. In all of these regressions, I use an industry/year clustering variable to consider the correlation between industry and year. The results are significant for every country at 1 percent level. It can be said that, in the same sector and region, a firm's size is negatively correlated with its volatility. In Table 8, I add age dummy variables and do the same estimation, it gives a similar result.

In Table 9, the results of the regressions of the volatility on share of employment in a region are given. Only sectoral dummies are included here. As it is seen, for the firms which are in same sector, as the share of employment in a region increases, the volatility decreases. In Table 10, same estimation results are given by controlling with age dummy variables, the results are also significant in here.

In Table 11, the results of the regressions of the volatility on logarithmic level of employment and level of regional employment are given. Only sectoral dummies are included here also.

This table can be interpreted with this intuition: Consider two regions with includes firms with same sector and have same employment size. In one of them, firms have smaller employment sizes, these firms have more volatility comparing to the firms in other region. It can also be expressed like this: as the share of employment

of a firm in a given region decreases; volatility increases. The results do not change when I control with age dummies that could be seen in Table 12.

This relationship mostly occurs since in a thicker labor market, the flexibility of the firms to response firm or industry level shocks increases. Hence firms with less labor force relative to regional employment will find it easier to exchange labor with other firms in close proximity and can respond to demand or supply shocks more easily than firms with larger labor force. This is advantageous for firms balancing their workforce with less cost, and it also makes it easier for people looking for jobs in similar sectors to find jobs at less cost. In a bigger region, there will be more options, this will increase volatility but not in the sense as instability.

Table 7. Results for Employment Size and Volatility

Dependent Variable: ln(vol-opre), NAICS Code:4 Digit, Sectoral and Regional Dummy Variables Included

	BEL	BOS	BUL	CRO	CZE	EST	FRA	GER	HUN
lnempl	-0.223***	-0.154***	-0.267***	-0.229***	-0.267***	-0.215***	-0.114***	-0.117*	-0.230***
	(0.0186)	(0.0333)	(0.0198)	(0.0172)	(0.0152)	(0.0205)	(0.0192)	(0.0502)	(0.0153)
cons	-3.017***	-0.439**	0.343**	-0.614***	-0.740***	-0.333***	-0.975***	-2.969***	-0.385***
	(0.133)	(0.164)	(0.115)	(0.0762)	(0.131)	(0.0505)	(0.110)	(0.593)	(0.0624)
R^2	0.302	0.274	0.312	0.247	0.224	0.349	0.213	0.302	0.279
BIC	36871.2	5043.9	23240.9	54134.2	67220.5	22126.7	45695.3	29653.0	23699.2
N	10204	1624	7789	17196	20335	7715	13690	7225	7886
	IRE	ITA	POR	ROM	SER	SLO	SPA	SWE	UNI
lnempl	-0.237***	-0.104***	-0.246***	-0.228***	-0.190***	-0.205***	-0.135***	-0.184***	-0.248***
	(0.0441)	(0.00945)	(0.0135)	(0.0120)	(0.0184)	(0.0196)	(0.0132)	(0.0123)	(0.0110)
cons	0.496	-1.330***	-0.498***	-0.228***	0.217***	0.157	-0.639***	-1.076***	-0.0916
	(0.967)	(0.166)	(0.0852)	(0.0392)	(0.0622)	(0.129)	(0.0421)	(0.0562)	(0.343)
R^2	0.192	0.235	0.286	0.224	0.238	0.311	0.290	0.190	0.274
BIC	6607.3	211213.9	256007.4	212743.6	22142.7	30326.3	443921.7	199213.7	67511.2
N	1891	64730	83291	72771	7141	9493	140272	60956	19570

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
FE: 4 Digit NAICS Code and NUTS 3 Region Code

Table 8. Results for Employment Size and Volatility

Dependent Variable: ln(vol-opre), NAICS Code:4 Digit, Sectoral, Regional and Age Dummy Variables Included

	BEL	BOS	BUL	CRO	CZE	EST	FRA	GER	HUN
lnempl	-0.216***	-0.145***	-0.255***	-0.217***	-0.259***	-0.194***	-0.0851***	-0.115*	-0.218***
	(0.0188)	(0.0343)	(0.0215)	(0.0176)	(0.0163)	(0.0215)	(0.0192)	(0.0514)	(0.0158)
cons	-2.854***	-0.259	0.412***	-0.385***	-0.718***	-0.228***	-0.657***	-2.894***	-0.242***
	(0.161)	(0.182)	(0.112)	(0.0793)	(0.130)	(0.0539)	(0.118)	(0.596)	(0.0676)
R^2	0.303	0.276	0.314	0.255	0.225	0.353	0.221	0.302	0.282
BIC	36865.2	5053.0	23240.7	53959.3	67218.7	22103.0	45580.6	29651.0	23688.3
N	10204	1624	7789	17196	20335	7715	13690	7225	7886
	IRE	ITA	POR	ROM	SER	SLO	SPA	SWE	UNI
lnempl	-0.235***	-0.0904***	-0.222***	-0.208***	-0.181***	-0.201***	-0.111***	-0.166***	-0.238***
	(0.0452)	(0.00966)	(0.0124)	(0.0131)	(0.0173)	(0.0199)	(0.0125)	(0.0125)	(0.0112)
cons	0.525	-1.138***	-0.281**	-0.142***	0.289***	0.175	-0.447***	-0.796***	0.180
	(0.919)	(0.164)	(0.0884)	(0.0391)	(0.0763)	(0.130)	(0.0477)	(0.0601)	(0.280)
R^2	0.193	0.238	0.292	0.230	0.239	0.311	0.296	0.197	0.282
BIC	6619.9	210994.0	255365.1	212227.5	22149.3	30343.1	442824.8	198703.4	67294.3
N	1891	64730	83291	72771	7141	9493	140272	60956	19570

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
FE: 4 Digit NAICS Code and NUTS 3 Region Code

Table 9. Results for Share of Employment Size in a Region and Volatility

Dependent Variable: ln(vol-opre), NAICS Code:4 Digit, Sectoral Dummy Variables Included

	BEL	BOS	BUL	CRO	CZE	EST	FRA	GER	HUN
lnempl-re	-0.151***	-0.135***	-0.147***	-0.168***	-0.211***	-0.109***	-0.113***	-0.134***	-0.160***
	(0.0150)	(0.0252)	(0.0128)	(0.0120)	(0.0135)	(0.0110)	(0.0114)	(0.0367)	(0.0120)
cons	-4.733***	-1.845***	-1.413***	-2.151***	-2.499***	-1.578***	-2.143***	-2.508***	-2.163***
	(0.0956)	(0.200)	(0.0836)	(0.0810)	(0.0988)	(0.0744)	(0.0832)	(0.121)	(0.0852)
R^2	0.292	0.273	0.291	0.238	0.201	0.337	0.202	0.255	0.263
BIC	36629.2	5038.0	23227.1	54153.9	66853.2	22151.1	45012.4	28046.6	23703.0
N	10204	1624	7789	17196	20335	7715	13690	7225	7886
	IRE	ITA	POR	ROM	SER	SLO	SPA	SWE	UNI
lnempl-re	-0.0756***	-0.0563***	-0.0831***	-0.171***	-0.181***	-0.151***	-0.0635***	-0.111***	-0.149***
	(0.0172)	(0.00661)	(0.00755)	(0.00698)	(0.0167)	(0.0146)	(0.00833)	(0.00769)	(0.01000)
cons	-2.235***	-2.458***	-1.187***	-1.820***	-1.998***	-1.351***	-1.255***	-2.268***	-1.839***
	(0.130)	(0.0496)	(0.0444)	(0.0566)	(0.144)	(0.0753)	(0.0768)	(0.0718)	(0.0499)
R^2	0.145	0.220	0.261	0.211	0.237	0.297	0.276	0.184	0.200
BIC	6395.6	211321.0	256310.8	213515.4	22137.8	29798.4	446147.8	199421.7	67039.4
N	1891	64730	83291	72771	7141	9493	140272	60956	19570

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
FE: 4 Digit NAICS Code

Table 10. Results for Share of Employment Size in a Region and Volatility

Dependent Variable: ln(vol-opre), NAICS Code:4 Digit, Sectoral and Age Dummy Variables Included

	BEL	BOS	BUL	CRO	CZE	EST	FRA	GER	HUN
lnempl-re	-0.146***	-0.131***	-0.138***	-0.159***	-0.202***	-0.0988***	-0.0970***	-0.132***	-0.149***
	(0.0150)	(0.0261)	(0.0132)	(0.0120)	(0.0145)	(0.0112)	(0.0116)	(0.0378)	(0.0122)
cons	-4.491***	-1.574***	-1.186***	-1.827***	-2.387***	-1.320***	-1.670***	-2.428***	-1.863***
	(0.139)	(0.235)	(0.103)	(0.0827)	(0.113)	(0.0854)	(0.102)	(0.158)	(0.0974)
R^2	0.294	0.276	0.296	0.247	0.203	0.343	0.210	0.256	0.268
BIC	36614.9	5046.4	23198.3	53951.3	66826.4	22090.9	44899.6	28061.3	23670.3
N	10204	1624	7789	17196	20335	7715	13690	7225	7886
	IRE	ITA	POR	ROM	SER	SLO	SPA	SWE	UNI
lnempl-re	-0.0744***	-0.0491***	-0.0797***	-0.157***	-0.173***	-0.146***	-0.0542***	-0.103***	-0.142***
	(0.0165)	(0.00661)	(0.00672)	(0.00762)	(0.0158)	(0.0147)	(0.00791)	(0.00771)	(0.0100)
cons	-2.114***	-2.128***	-0.869***	-1.563***	-1.826***	-1.260***	-0.902***	-1.864***	-1.353***
	(0.137)	(0.0556)	(0.0499)	(0.0659)	(0.135)	(0.0856)	(0.0701)	(0.0777)	(0.0826)
R^2	0.148	0.224	0.270	0.219	0.239	0.298	0.284	0.192	0.211
BIC	6404.3	210959.8	255266.2	212841.6	22143.7	29810.0	444638.9	198833.1	66781.6
N	1891	64730	83291	72771	7141	9493	140272	60956	19570

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
FE: 4 Digit NAICS Code

Table 11. Results for Employment Size and Volatility in a Particular Sized Region

Dependent Variable: ln(vol-opre), NAICS Code:4 Digit, Sectoral Dummy Variables Included

	BEL	BOS	BUL	CRO	CZE	EST	FRA	GER	HUN
lnempl	-0.223***	-0.154***	-0.267***	-0.225***	-0.267***	-0.214***	-0.116***	-0.124*	-0.230***
	(0.0186)	(0.0333)	(0.0198)	(0.0171)	(0.0150)	(0.0208)	(0.0180)	(0.0558)	(0.0156)
lnempl-r	0.0449*	0.0724	0.0384*	0.0967***	0.0374*	0.0514***	0.110***	0.142***	0.0477**
	(0.0220)	(0.0528)	(0.0157)	(0.0127)	(0.0157)	(0.0110)	(0.0173)	(0.0306)	(0.0148)
cons	-3.460***	-1.097	0.0210	-1.346***	-0.832***	-0.898***	-2.112***	-2.610***	-0.900***
	(0.210)	(0.619)	(0.163)	(0.116)	(0.132)	(0.0963)	(0.158)	(0.236)	(0.144)
R^2	0.298	0.274	0.309	0.242	0.211	0.346	0.202	0.255	0.276
BIC	36546.2	5043.9	23036.7	54074.1	66605.4	22050.2	45021.8	28054.9	23575.1
N	10204	1624	7789	17196	20335	7715	13690	7225	7886
	IRE	ITA	POR	ROM	SER	SLO	SPA	SWE	UNI
lnempl	-0.237***	-0.110***	-0.241***	-0.226***	-0.190***	-0.202***	-0.128***	-0.184***	-0.251***
	(0.0422)	(0.00958)	(0.0134)	(0.0124)	(0.0184)	(0.0199)	(0.0136)	(0.0123)	(0.0122)
lnempl-r	0.0216	0.00860	0.0254**	0.0933***	0.110**	0.0441*	0.0218**	0.0581***	0.0476***
	(0.0215)	(0.00751)	(0.00893)	(0.00806)	(0.0405)	(0.0197)	(0.00748)	(0.00877)	(0.0104)
cons	-1.409***	-1.845***	-0.514***	-0.933***	-1.140*	-0.222	-0.685***	-1.610***	-0.465***
	(0.271)	(0.0749)	(0.0690)	(0.0906)	(0.476)	(0.188)	(0.0771)	(0.0931)	(0.0944)
R^2	0.177	0.224	0.275	0.216	0.238	0.303	0.279	0.188	0.221
BIC	6331.5	210999.5	254714.4	213030.2	22142.7	29737.8	445474.6	199141.5	66522.7
N	1891	64730	83291	72771	7141	9493	140272	60956	19570

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
FE: 4 Digit NAICS Code

Table 12. Results for Employment Size and Volatility in a Particular Sized Region

Dependent Variable: ln(vol-opre), NAICS Code:4 Digit, Sectoral and Age Dummy Variables Included

	BEL	BOS	BUL	CRO	CZE	EST	FRA	GER	HUN
lnempl	-0.216***	-0.145***	-0.255***	-0.212***	-0.259***	-0.192***	-0.0870***	-0.122*	-0.218***
	(0.0188)	(0.0343)	(0.0214)	(0.0175)	(0.0162)	(0.0217)	(0.0181)	(0.0573)	(0.0160)
lnempl-r	0.0448*	0.0829	0.0392*	0.0926***	0.0387*	0.0518***	0.108***	0.141***	0.0480**
	(0.0219)	(0.0536)	(0.0156)	(0.0122)	(0.0154)	(0.0111)	(0.0171)	(0.0311)	(0.0147)
cons	-3.292***	-1.013	0.0819	-1.084***	-0.832***	-0.795***	-1.769***	-2.535***	-0.762***
	(0.217)	(0.623)	(0.163)	(0.106)	(0.133)	(0.103)	(0.165)	(0.228)	(0.148)
R^2	0.300	0.276	0.311	0.251	0.212	0.350	0.210	0.256	0.279
BIC	36539.5	5053.0	23036.3	53881.7	66604.4	22021.9	44906.7	28069.5	23564.3
N	10204	1624	7789	17196	20335	7715	13690	7225	7886
	IRE	ITA	POR	ROM	SER	SLO	SPA	SWE	UNI
lnempl	-0.233***	-0.0951***	-0.218***	-0.206***	-0.181***	-0.199***	-0.104***	-0.166***	-0.240***
	(0.0434)	(0.00976)	(0.0121)	(0.0136)	(0.0173)	(0.0201)	(0.0129)	(0.0126)	(0.0123)
lnempl-r	0.0219	0.0102	0.0302***	0.0920***	0.109**	0.0446*	0.0236**	0.0580***	0.0450***
	(0.0216)	(0.00745)	(0.00834)	(0.00806)	(0.0403)	(0.0196)	(0.00753)	(0.00866)	(0.0104)
cons	-1.366***	-1.656***	-0.348***	-0.831***	-1.063*	-0.216	-0.504***	-1.326***	-0.0644
	(0.257)	(0.0739)	(0.0725)	(0.0882)	(0.477)	(0.187)	(0.0787)	(0.0947)	(0.104)
R^2	0.178	0.227	0.280	0.222	0.239	0.303	0.285	0.195	0.231
BIC	6344.5	210744.4	254119.0	212493.7	22149.3	29754.9	444272.0	198631.6	66300.5
N	1891	64730	83291	72771	7141	9493	140272	60956	19570

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
FE: 4 Digit NAICS Code

5.2 Results for Second Data Set With 4 Digit NAICS Code

In this section, I repeat the estimations for the second data set, in which I eliminate the five percentage of the actual volatility data both from top and bottom for every country considering that firm can have too low or too high volatility because of its idiosyncratic features.

In all of these regressions also, I use an industry/year clustering variable. The results are similar to the First Data Set's results. In Table 13, the results for regression of the volatility on the logarithmic level of employment are given. Table 14 presents the same results after controlling for age dummy variables.

In Table 15, the results of the regressions of the volatility on share of employment in a region are given. In Table 16, same estimation results are given by controlling with age dummy variables. All of the results are significant at 1 percent significance level.

In Table 17 and 18, the results of the regressions of the volatility on level of employment and level of regional employment are given. The main idea that I claim, that is, the firms which are in same industry have higher volatility if their sizes are smaller comparing to the region which they are in, holds in this trimmed dataset too.

Table 13. Results for Employment Size and Volatility for Second Data Set

Dependent Variable: ln(vol-opre), NAICS Code: 4 Digit, Sectoral and Regional Dummy Variables Included

	BEL	BOS	BUL	CRO	CZE	EST	FRA	GER	HUN
lnempl	-0.174***	-0.0996**	-0.197***	-0.164***	-0.185***	-0.173***	-0.100***	-0.128***	-0.161***
	(0.0132)	(0.0297)	(0.0144)	(0.0154)	(0.0103)	(0.0174)	(0.00989)	(0.0384)	(0.0118)
cons	-3.271***	-0.930***	0.0820	-0.806***	-0.731***	-0.438***	-1.244***	-2.437**	-0.633***
	(0.116)	(0.143)	(0.0821)	(0.0665)	(0.101)	(0.0465)	(0.101)	(0.731)	(0.0551)
R^2	0.240	0.240	0.243	0.195	0.188	0.300	0.187	0.282	0.226
BIC	29589.1	4008.7	18670.0	43121.8	53391.4	17456.3	35448.2	23814.2	18516.0
N	9184	1460	7010	15473	18302	6943	12322	6496	7087
	IRE	ITA	POR	ROM	SER	SLO	SPA	SWE	UNI
lnempl	-0.148***	-0.0853***	-0.174***	-0.166***	-0.139***	-0.152***	-0.107***	-0.141***	-0.178***
	(0.0395)	(0.00680)	(0.0108)	(0.00970)	(0.0144)	(0.0136)	(0.0103)	(0.0108)	(0.00874)
cons	-0.885	-1.130***	-0.695***	-0.324***	-0.0604	-0.122	-0.828***	-1.124***	-0.579
	(0.597)	(0.140)	(0.0745)	(0.0347)	(0.0499)	(0.102)	(0.0382)	(0.0498)	(0.362)
R^2	0.180	0.196	0.226	0.174	0.189	0.249	0.243	0.150	0.219
BIC	5247.8	164016.2	202902.6	167416.9	17641.0	24143.2	348843.7	153813.4	54088.6
N	1694	58257	74963	65497	6423	8542	126246	54861	17594

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
FE: 4 Digit NAICS Code and NUTS 3 Region Code

Table 14. Results for Employment Size and Volatility for Second Data Set

Dependent Variable: ln(vol-opre), NAICS Code:4 Digit, Sectoral, Regional and Age Dummy Variables Included

	BEL	BOS	BUL	CRO	CZE	EST	FRA	GER	HUN
lnempl	-0.169***	-0.0922**	-0.182***	-0.156***	-0.178***	-0.153***	-0.0734***	-0.127**	-0.150***
	(0.0136)	(0.0305)	(0.0154)	(0.0157)	(0.0110)	(0.0184)	(0.0104)	(0.0391)	(0.0119)
cons	-3.200***	-0.800***	0.152	-0.636***	-0.706***	-0.349***	-0.984***	-2.387**	-0.535***
	(0.135)	(0.147)	(0.0800)	(0.0703)	(0.0997)	(0.0493)	(0.103)	(0.740)	(0.0610)
R^2	0.241	0.243	0.246	0.201	0.189	0.304	0.196	0.282	0.229
BIC	29590.2	4018.7	18657.5	43012.8	53392.6	17432.8	35324.6	23812.9	18513.4
N	9184	1460	7010	15473	18302	6943	12322	6496	7087
	IRE	ITA	POR	ROM	SER	SLO	SPA	SWE	UNI
nempl	-0.144***	-0.0746***	-0.154***	-0.150***	-0.131***	-0.147***	-0.0886***	-0.126***	-0.172***
	(0.0403)	(0.00685)	(0.0104)	(0.00991)	(0.0140)	(0.0139)	(0.0101)	(0.0108)	(0.00849)
cons	-0.774	-0.992***	-0.520***	-0.253***	0.0106	-0.0930	-0.679***	-0.893***	-0.402
	(0.609)	(0.141)	(0.0756)	(0.0346)	(0.0575)	(0.102)	(0.0399)	(0.0518)	(0.322)
R^2	0.182	0.199	0.232	0.179	0.191	0.249	0.249	0.158	0.225
BIC	5258.6	163841.9	202333.6	166991.9	17642.7	24158.2	347971.8	153307.7	53969.4
N	1694	58257	74963	65497	6423	8542	126246	54861	17594

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
FE: 4 Digit NAICS Code and NUTS 3 Region Code

Table 15. Results for Share of Employment Size in a Region and Volatility for Second Data Set

Dependent Variable: ln(vol-opre), NAICS Code:4 Digit, Sectoral Dummy Variables Included

	BEL	BOS	BUL	CRO	CZE	EST	FRA	GER	HUN
lnempl-re	-0.126***	-0.0843***	-0.104***	-0.119***	-0.143***	-0.0830***	-0.0881***	-0.120***	-0.106***
	(0.0111)	(0.0235)	(0.00981)	(0.0113)	(0.00918)	(0.00984)	(0.00865)	(0.0233)	(0.0102)
cons	-4.559***	-1.836***	-1.134***	-1.906***	-1.989***	-1.400***	-2.198***	-2.445***	-1.804***
	(0.0696)	(0.181)	(0.0618)	(0.0748)	(0.0661)	(0.0656)	(0.0624)	(0.0735)	(0.0707)
R^2	0.232	0.239	0.225	0.188	0.169	0.285	0.175	0.233	0.210
BIC	29306.4	4002.7	18598.3	43059.0	52860.6	17475.0	34761.1	22248.3	18500.0
N	9184	1460	7010	15473	18302	6943	12322	6496	7087
	IRE	ITA	POR	ROM	SER	SLO	SPA	SWE	UNI
lnempl-re	-0.0453***	-0.0430***	-0.0535***	-0.124***	-0.129***	-0.110***	-0.0486***	-0.0812***	-0.110***
	(0.0114)	(0.00466)	(0.00535)	(0.00636)	(0.0131)	(0.00984)	(0.00661)	(0.00609)	(0.00757)
cons	-1.999***	-1.993***	-1.207***	-1.481***	-1.605***	-1.153***	-1.304***	-2.053***	-1.830***
	(0.0846)	(0.0339)	(0.0302)	(0.0508)	(0.110)	(0.0496)	(0.0596)	(0.0561)	(0.0366)
R^2	0.145	0.181	0.205	0.164	0.189	0.235	0.231	0.144	0.150
BIC	5014.2	163900.1	202385.0	167755.8	17638.8	23592.1	350297.4	154001.4	53276.1
N	1694	58257	74963	65497	6423	8542	126246	54861	17594

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
FE: 4 Digit NAICS Code

Table 16. Results for Share of Employment Size in a Region and Volatility for Second Data Set

Dependent Variable: ln(vol-opre), NAICS Code:4 Digit, Sectoral and Age Dummy Variables Included

	BEL	BOS	BUL	CRO	CZE	EST	FRA	GER	HUN
lnempl-re	-0.123***	-0.0787**	-0.0942***	-0.113***	-0.136***	-0.0742***	-0.0731***	-0.118***	-0.0967***
	(0.0112)	(0.0239)	(0.00996)	(0.0114)	(0.00974)	(0.0101)	(0.00858)	(0.0237)	(0.0102)
cons	-4.436***	-1.629***	-0.908***	-1.669***	-1.889***	-1.174***	-1.795***	-2.405***	-1.584***
	(0.104)	(0.206)	(0.0749)	(0.0765)	(0.0729)	(0.0744)	(0.0714)	(0.114)	(0.0763)
R^2	0.234	0.242	0.231	0.196	0.171	0.293	0.185	0.233	0.214
BIC	29302.7	4012.4	18555.9	42933.8	52841.9	17415.2	34634.6	22263.8	18479.3
N	9184	1460	7010	15473	18302	6943	12322	6496	7087
	IRE	ITA	POR	ROM	SER	SLO	SPA	SWE	UNI
lnempl-re	-0.0446***	-0.0375***	-0.0506***	-0.113***	-0.121***	-0.105***	-0.0412***	-0.0741***	-0.106***
	(0.0107)	(0.00464)	(0.00461)	(0.00646)	(0.0127)	(0.0101)	(0.00641)	(0.00591)	(0.00736)
cons	-1.894***	-1.747***	-0.953***	-1.277***	-1.441***	-1.050***	-1.030***	-1.717***	-1.524***
	(0.0722)	(0.0385)	(0.0313)	(0.0519)	(0.113)	(0.0629)	(0.0558)	(0.0560)	(0.0517)
R^2	0.149	0.186	0.214	0.171	0.191	0.236	0.238	0.153	0.157
BIC	5022.1	163606.6	201501.0	167225.2	17639.6	23600.7	349082.3	153421.1	53141.6
N	1694	58257	74963	65497	6423	8542	126246	54861	17594

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
FE: 4 Digit NAICS Code

Table 17. Results for Employment Size and Volatility in a Particular Sized Region for Second Data Set

Dependent Variable: ln(vol-opre), NAICS Code:4 Digit, Sectoral Dummy Variables Included

	BEL	BOS	BUL	CRO	CZE	EST	FRA	GER	HUN
lnempl	-0.174***	-0.0996**	-0.197***	-0.162***	-0.185***	-0.173***	-0.101***	-0.134***	-0.160***
	(0.0134)	(0.0297)	(0.0144)	(0.0153)	(0.00990)	(0.0175)	(0.00954)	(0.0389)	(0.0119)
lnempl-r	0.0606***	0.0315	0.0241	0.0672***	0.0181	0.0347***	0.0736***	0.108***	0.0185
	(0.0178)	(0.0494)	(0.0129)	(0.0126)	(0.0124)	(0.00991)	(0.0120)	(0.0232)	(0.0129)
cons	-3.768***	-1.214*	-0.0817	-1.323***	-0.799***	-0.827***	-2.059***	-2.290***	-0.834***
	(0.175)	(0.563)	(0.129)	(0.109)	(0.105)	(0.0825)	(0.0987)	(0.228)	(0.118)
R^2	0.236	0.240	0.240	0.191	0.178	0.296	0.175	0.233	0.221
BIC	29265.2	4008.7	18464.2	43005.9	52686.8	17382.9	34764.3	22255.1	18402.6
N	9184	1460	7010	15473	18302	6943	12322	6496	7087
	IRE	ITA	POR	ROM	SER	SLO	SPA	SWE	UNI
lnempl	-0.152***	-0.0893***	-0.171***	-0.164***	-0.139***	-0.150***	-0.103***	-0.141***	-0.179***
	(0.0396)	(0.00687)	(0.0109)	(0.00973)	(0.0144)	(0.0133)	(0.0105)	(0.0108)	(0.00911)
lnempl-r	0.0122	0.00321	0.0113	0.0681***	0.0491	0.0235	0.0142*	0.0370***	0.0430***
	(0.0156)	(0.00604)	(0.00622)	(0.00759)	(0.0328)	(0.0166)	(0.00555)	(0.00674)	(0.00762)
cons	-1.482***	-1.490***	-0.721***	-0.845***	-0.661	-0.256	-0.839***	-1.514***	-0.935***
	(0.208)	(0.0609)	(0.0491)	(0.0782)	(0.378)	(0.157)	(0.0538)	(0.0717)	(0.0662)
R^2	0.165	0.186	0.217	0.168	0.189	0.240	0.235	0.148	0.164
BIC	4982.1	163579.3	201251.8	167433.1	17641.0	23544.6	349679.1	153734.3	52981.4
N	1694	58257	74963	65497	6423	8542	126246	54861	17594

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
FE: 4 Digit NAICS Code

Table 18. Results for Employment Size and Volatility in a Particular Sized Region for Second Data Set

Dependent Variable: ln(vol-opre), NAICS Code:4 Digit, Sectoral and Age Dummy Variables Included

	BEL	BOS	BUL	CRO	CZE	EST	FRA	GER	HUN
lnempl	-0.169***	-0.0922**	-0.181***	-0.153***	-0.178***	-0.152***	-0.0747***	-0.133***	-0.150***
	(0.0137)	(0.0305)	(0.0153)	(0.0156)	(0.0106)	(0.0186)	(0.00984)	(0.0397)	(0.0120)
lnempl-r	0.0607***	0.0303	0.0249	0.0644***	0.0193	0.0352***	0.0715***	0.107***	0.0187
	(0.0178)	(0.0510)	(0.0129)	(0.0121)	(0.0123)	(0.00995)	(0.0116)	(0.0233)	(0.0129)
cons	-3.698***	-1.072	-0.0186	-1.129***	-0.790***	-0.740***	-1.781***	-2.258***	-0.742***
	(0.179)	(0.562)	(0.129)	(0.103)	(0.105)	(0.0851)	(0.0989)	(0.212)	(0.116)
R^2	0.237	0.243	0.243	0.198	0.178	0.300	0.185	0.234	0.223
BIC	29266.3	4018.7	18451.6	42887.7	52689.2	17354.5	34643.9	22270.7	18400.2
N	9184	1460	7010	15473	18302	6943	12322	6496	7087
	IRE	ITA	POR	ROM	SER	SLO	SPA	SWE	UNI
lnempl	-0.147***	-0.0778***	-0.151***	-0.148***	-0.131***	-0.146***	-0.0834***	-0.125***	-0.173***
	(0.0406)	(0.00691)	(0.0103)	(0.00997)	(0.0140)	(0.0137)	(0.0103)	(0.0107)	(0.00876)
lnempl-r	0.0130	0.00447	0.0153**	0.0671***	0.0476	0.0243	0.0156**	0.0370***	0.0412***
	(0.0158)	(0.00603)	(0.00576)	(0.00766)	(0.0324)	(0.0165)	(0.00559)	(0.00660)	(0.00762)
cons	-1.435***	-1.355***	-0.586***	-0.763***	-0.572	-0.239	-0.699***	-1.281***	-0.672***
	(0.189)	(0.0606)	(0.0512)	(0.0782)	(0.375)	(0.157)	(0.0556)	(0.0725)	(0.0711)
R^2	0.166	0.189	0.223	0.174	0.191	0.241	0.241	0.156	0.171
BIC	4993.9	163384.6	200725.2	167003.7	17642.7	23560.0	348731.5	153232.3	52864.3
N	1694	58257	74963	65497	6423	8542	126246	54861	17594

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
FE: 4 Digit NAICS Code

5.3 Results for Second Data Set With 3 Digit and 2 Digit NAICS Code

In this section, I look at the relationship between agglomeration and volatility by expanding my sector code class from 4-digit to 3-digit and 2-digit using Second Data Set which is trimmed by 5 percent based on volatility. In all these estimations, I use age dummy variables.

Defining the sectors in different levels can change the meaning when fixing a sector variable. For instance, NAICS Code 3311 represents the ”Iron and Steel Mills and Ferroalloy Manufacturing” industry while NAICS Code 331 represents the ”Primary Metal Manufacturing” industry and 33 represents the ”Manufacturing” industry which the last two are more general comparing to 3311. By doing so, I strengthen the assumption that the workers can change jobs in the same sector. Hence, it gives more flexibility to workers and firms at these levels of agglomeration.

Although the elimination of the firms in the sector as monopoly according to the new sector definition changes the number of observations, it cannot be said that there are too significant changes in total observations in this sense. Only number of industries changed and decreased reasonably. The details are in Table 19 for 3-Digit and Table 20 for 2-Digit.

It can be seen from the Tables 21 and 22, for the new sectoral levels, volatility and the size of the firm is negatively correlated for the firms which are in same sector and region. The results are statistically significant.

Considering the Tables 23 and 24, for the new sectoral levels, results are statistically significant, the firms which are in same industry have higher volatility if their sizes are smaller comparing to the region they are in.

Considering the Tables 25 and 26, for the new sectoral levels, the results of the regressions of the volatility on level of employment and level of regional employment are given. The results are significant.

I also use a different approach to the concept of agglomeration by calculating the total number of employment in an industry-region pair and use it as a control variable. The results are given in Table 27 (for 3 Digit Sector Level) and Table 28 (for 2 Digit Sector Level). In here, by fixing the size of total employment level in an industry-region pair, I can control for regional dummy variables and also can show the same results as above. The results are only insignificant for Bosnia and Herzegnovia for 3 Digit code sector level, which has the smallest number of observations. The results are insignificant for Bosnia and Herzegnovia, Portugal, Romania and Spain for 2 Digit code sector level.

Table 19. Industry-Region Statistics

Country	Number of Firms	Total Number of Industries (3 Digit)	Total Number of Regions	Total Number of Region-Industry Intersections
BELGIUM	9198	85	43	1588
BOSNIA AND H.	1494	64	2	97
BULGARIA	7021	75	28	1019
CROATIA	15485	79	21	1202
CZECH R.	18314	85	98	3952
ESTONIA	6955	76	15	703
FRANCE	12329	80	93	2973
GERMANY	6514	88	392	3773
HUNGARY	7106	77	20	941
IRELAND	1722	66	44	414
ITALY	58265	90	109	5603
PORTUGAL	74968	83	307	9954
ROMANIA	65497	86	42	2753
SERBIA	6438	76	2	143
SLOVAKIA	8555	76	79	2457
SPAIN	1.26e+05	90	52	3557
SWEDEN	54863	83	21	1460
UNITED KINGDOM	17599	88	908	8242

Table 20. Industry-Region Statistics for Second Data Set

Country	Number of Firms	Total Number of Industries (2 Digit)	Total Number of Regions	Total Number of Region-Industry Intersections
BELGIUM	9201	24	43	731
BOSNIA AND H.	1499	22	2	35
BULGARIA	7026	23	28	423
CROATIA	15490	24	21	434
CZECH REP.	18316	24	98	1736
ESTONIA	6957	22	15	281
FRANCE	12331	23	93	1505
GERMANY	6516	24	392	2787
HUNGARY	7112	23	20	353
IRELAND	1734	24	44	302
ITALY	58265	24	109	2178
PORTUGAL	74969	24	307	4626
ROMANIA	65500	24	42	916
SERBIA	6441	23	2	45
SLOVAKIA	8561	24	79	1203
SPAIN	1.26e+05	24	52	1161
SWEDEN	54864	24	21	473
UNITED KINGDOM	17599	24	908	5922

Table 21. Results for Employment Size and Volatility for Second Data Set

Dependent Variable: ln(vol-opre), NAICS Code: 3 Digit, Sectoral, Regional and Age Dummy Variables Included

	BEL	BOS	BUL	CRO	CZE	EST	FRA	GER	HUN
lnempl	-0.179***	-0.0953**	-0.184***	-0.143***	-0.171***	-0.139***	-0.0695***	-0.143**	-0.148***
	(0.0189)	(0.0312)	(0.0153)	(0.0134)	(0.0138)	(0.0181)	(0.0133)	(0.0447)	(0.0114)
cons	-2.372***	-0.603***	0.163*	-0.586***	-0.735***	-0.387***	-1.326***	-2.694***	-0.508***
	(0.122)	(0.109)	(0.0802)	(0.0872)	(0.106)	(0.0549)	(0.105)	(0.733)	(0.0446)
R^2	0.197	0.196	0.203	0.141	0.148	0.252	0.156	0.244	0.190
BIC	30154.0	4202.7	19078.4	44191.9	54168.3	17956.8	35798.8	22974.3	18918.9
N	9198	1494	7021	15485	18314	6955	12329	6514	7106
	IRE	ITA	POR	ROM	SER	SLO	SPA	SWE	UNI
lnempl	-0.144***	-0.0753***	-0.138***	-0.141***	-0.136***	-0.143***	-0.0751***	-0.117***	-0.176***
	(0.0366)	(0.00854)	(0.0153)	(0.0113)	(0.0180)	(0.0147)	(0.0138)	(0.0149)	(0.0112)
cons	-0.323	-1.001***	-0.549***	-0.215***	-0.0447	-0.0761	-0.638***	-1.241***	-0.827*
	(0.564)	(0.130)	(0.0695)	(0.0362)	(0.0659)	(0.110)	(0.0500)	(0.0593)	(0.350)
R^2	0.151	0.171	0.190	0.151	0.146	0.202	0.208	0.130	0.202
BIC	5385.2	165643.9	204660.1	169204.9	18045.7	24660.7	354678.5	155128.6	53013.8
N	1722	58265	74968	65497	6438	8555	126247	54863	17599

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
FE: 3 Digit NAICS Code and NUTS 3 Region Code

Table 22. Results for Employment Size and Volatility for Second Data Set

Dependent Variable: ln(vol-opre), NAICS Code: 2 Digit, Sectoral, Regional and Age Dummy Variables Included

	BEL	BOS	BUL	CRO	CZE	EST	FRA	GER	HUN
lnempl	-0.177***	-0.0837*	-0.179***	-0.134***	-0.172***	-0.114**	-0.0676***	-0.138*	-0.143***
	(0.0189)	(0.0363)	(0.0167)	(0.0176)	(0.0199)	(0.0320)	(0.0176)	(0.0538)	(0.0116)
cons	-1.764***	-0.813***	0.192*	-0.595***	-0.938***	-0.228*	-1.492***	-2.666***	-0.631***
	(0.114)	(0.116)	(0.0775)	(0.0881)	(0.0879)	(0.0864)	(0.0932)	(0.681)	(0.0379)
R^2	0.169	0.164	0.173	0.122	0.127	0.183	0.133	0.212	0.162
BIC	30269.1	4276.9	19278.5	44527.4	54038.9	18584.8	35594.7	22693.8	19176.7
N	9201	1499	7026	15490	18316	6957	12331	6516	7112
	IRE	ITA	POR	ROM	SER	SLO	SPA	SWE	UNI
lnempl	-0.139***	-0.0646***	-0.105***	-0.122***	-0.129***	-0.122***	-0.0604**	-0.0985**	-0.174***
	(0.0356)	(0.0106)	(0.0227)	(0.0172)	(0.0226)	(0.0229)	(0.0179)	(0.0286)	(0.0129)
cons	-0.218	-1.012***	-0.610***	-0.164**	-0.0980	-0.375***	-0.837***	-1.314***	-0.861*
	(0.621)	(0.112)	(0.0758)	(0.0563)	(0.0919)	(0.0897)	(0.0678)	(0.0593)	(0.353)
R^2	0.102	0.130	0.151	0.130	0.121	0.159	0.164	0.100	0.187
BIC	5379.2	167701.8	207561.2	170606.7	18238.2	24665.7	361043.9	156953.9	52724.6
N	1734	58265	74969	65500	6441	8561	126248	54864	17599

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
FE: 2 Digit NAICS Code and NUTS 3 Region Code

Table 23. Results for Share of Employment Size in a Region and Volatility for Second Data Set

Dependent Variable: ln(vol-opre), NAICS Code: 3 Digit, Sectoral and Age Dummy Variables Included

	BEL	BOS	BUL	CRO	CZE	EST	FRA	GER	HUN
lnempl-re	-0.133***	-0.0825**	-0.0941***	-0.108***	-0.136***	-0.0703***	-0.0747***	-0.126***	-0.0908***
	(0.0167)	(0.0255)	(0.00869)	(0.0100)	(0.0109)	(0.0108)	(0.0109)	(0.0261)	(0.01000)
cons	-3.701***	-1.464***	-0.908***	-1.548***	-1.882***	-1.176***	-2.029***	-2.811***	-1.522***
	(0.125)	(0.227)	(0.0641)	(0.0631)	(0.0855)	(0.0801)	(0.0737)	(0.116)	(0.0646)
R^2	0.187	0.195	0.186	0.136	0.131	0.243	0.144	0.193	0.172
BIC	29879.7	4196.4	18988.0	44086.4	53748.1	17919.1	35254.5	22665.4	18900.9
N	9198	1494	7021	15485	18314	6955	12329	6514	7106
	IRE	ITA	POR	ROM	SER	SLO	SPA	SWE	UNI
lnempl-re	-0.0439***	-0.0395***	-0.0525***	-0.109***	-0.123***	-0.103***	-0.0373***	-0.0722***	-0.108***
	(0.0110)	(0.00575)	(0.00754)	(0.00879)	(0.0159)	(0.0101)	(0.00815)	(0.00914)	(0.00913)
cons	-1.527***	-1.776***	-1.026***	-1.209***	-1.504***	-1.009***	-0.975***	-2.056***	-1.897***
	(0.0816)	(0.0465)	(0.0415)	(0.0684)	(0.139)	(0.0560)	(0.0690)	(0.0809)	(0.0603)
R^2	0.116	0.157	0.174	0.143	0.144	0.189	0.198	0.125	0.130
BIC	5164.1	165634.8	205246.2	169380.3	18048.7	24152.9	355551.9	155200.2	53708.2
N	1722	58265	74968	65497	6438	8555	126247	54863	17599

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
FE: 3 Digit NAICS Code

Table 24. Results for Share of Employment Size in a Region and Volatility for Second Data Set

Dependent Variable: ln(vol-opre), NAICS Code: 2 Digit, Sectoral and Age Dummy Variables Included

	BEL	BOS	BUL	CRO	CZE	EST	FRA	GER	HUN
lnempl-re	-0.135***	-0.0775*	-0.0920***	-0.101***	-0.138***	-0.0593**	-0.0741***	-0.126***	-0.0870***
	(0.0163)	(0.0320)	(0.0122)	(0.0124)	(0.0145)	(0.0164)	(0.0147)	(0.0331)	(0.0103)
cons	-3.102***	-1.571***	-0.897***	-1.500***	-2.126***	-0.907***	-2.246***	-2.782***	-1.608***
	(0.106)	(0.259)	(0.0847)	(0.0803)	(0.0982)	(0.110)	(0.0801)	(0.132)	(0.0651)
R^2	0.159	0.163	0.156	0.118	0.109	0.175	0.121	0.160	0.145
BIC	30197.3	4269.8	19255.5	44412.1	54212.1	18525.7	35584.7	22937.0	19154.2
N	9201	1499	7026	15490	18316	6957	12331	6516	7112
	IRE	ITA	POR	ROM	SER	SLO	SPA	SWE	UNI
lnempl-re	-0.0428***	-0.0339***	-0.0416***	-0.0950***	-0.116***	-0.0886***	-0.0282*	-0.0602**	-0.109***
	(0.0109)	(0.00713)	(0.00982)	(0.0128)	(0.0208)	(0.0139)	(0.0127)	(0.0182)	(0.0112)
cons	-1.370***	-1.660***	-1.011***	-1.045***	-1.487***	-1.163***	-1.120***	-1.994***	-1.951***
	(0.0877)	(0.0540)	(0.0529)	(0.0975)	(0.166)	(0.0467)	(0.109)	(0.153)	(0.0642)
R^2	0.069	0.117	0.139	0.123	0.119	0.146	0.156	0.096	0.114
BIC	5293.0	168344.0	208406.4	170918.0	18241.1	24610.3	362089.4	156965.6	54042.3
N	1734	58265	74969	65500	6441	8561	126248	54864	17599

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
FE: 2 Digit NAICS Code

Table 25. Results for Employment Size and Volatility in a Particular Sized Region for Second Data Set

Dependent Variable: ln(vol-opre), NAICS Code: 3 Digit, Sectoral and Age Dummy Variables Included

	BEL	BOS	BUL	CRO	CZE	EST	FRA	GER	HUN
lnempl	-0.180***	-0.0953**	-0.183***	-0.141***	-0.172***	-0.138***	-0.0696***	-0.147**	-0.147***
	(0.0205)	(0.0312)	(0.0152)	(0.0133)	(0.0136)	(0.0184)	(0.0125)	(0.0455)	(0.0115)
lnempl-r	0.0697***	0.0360	0.0214	0.0678***	0.0286*	0.0356**	0.0803***	0.109***	0.00748
	(0.0190)	(0.0344)	(0.0115)	(0.0141)	(0.0122)	(0.0111)	(0.0158)	(0.0244)	(0.0104)
cons	-2.937***	-0.929*	0.0347	-1.096***	-0.876***	-0.783***	-2.084***	-2.599***	-0.614***
	(0.184)	(0.371)	(0.123)	(0.128)	(0.107)	(0.100)	(0.124)	(0.216)	(0.0889)
R^2	0.191	0.196	0.200	0.138	0.137	0.249	0.144	0.193	0.184
BIC	29842.4	4202.7	18876.5	44059.4	53627.7	17876.2	35263.0	22670.2	18808.8
N	9198	1494	7021	15485	18314	6955	12329	6514	7106
	IRE	ITA	POR	ROM	SER	SLO	SPA	SWE	UNI
lnempl	-0.146***	-0.0779***	-0.136***	-0.139***	-0.136***	-0.142***	-0.0704***	-0.117***	-0.177***
	(0.0371)	(0.00862)	(0.0160)	(0.0114)	(0.0180)	(0.0153)	(0.0142)	(0.0147)	(0.0122)
lnempl-r	0.0111	0.00733	0.0227	0.0683***	0.0167	0.0222	0.0169	0.0395***	0.0412***
	(0.0149)	(0.00730)	(0.0133)	(0.00998)	(0.0354)	(0.0182)	(0.00948)	(0.00793)	(0.00814)
cons	-0.965***	-1.396***	-0.689***	-0.751***	-0.249	-0.215	-0.699***	-1.669***	-1.000***
	(0.205)	(0.0700)	(0.106)	(0.0951)	(0.409)	(0.180)	(0.0927)	(0.0770)	(0.0570)
R^2	0.135	0.160	0.180	0.145	0.146	0.193	0.200	0.127	0.145
BIC	5134.6	165430.1	204714.8	169213.9	18045.7	24114.3	355341.9	155059.9	53411.4
N	1722	58265	74968	65497	6438	8555	126247	54863	17599

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
FE: 3 Digit NAICS Code

Table 26. Results for Employment Size and Volatility in a Particular Sized Region for Second Data Set

Dependent Variable: ln(vol-opre), NAICS Code: 2 Digit, Sectoral and Age Dummy Variables Included

	BEL	BOS	BUL	CRO	CZE	EST	FRA	GER	HUN
lnempl	-0.178***	-0.0837*	-0.178***	-0.132***	-0.173***	-0.114**	-0.0665***	-0.144*	-0.143***
	(0.0202)	(0.0363)	(0.0164)	(0.0173)	(0.0193)	(0.0324)	(0.0169)	(0.0530)	(0.0117)
lnempl-r	0.0774**	0.0543	0.0220	0.0622**	0.0286*	0.0313	0.0827***	0.111***	0.00279
	(0.0245)	(0.0315)	(0.0171)	(0.0174)	(0.0115)	(0.0166)	(0.0173)	(0.0284)	(0.0119)
cons	-2.437***	-1.306***	0.0261	-1.063***	-1.071***	-0.581***	-2.325***	-2.597***	-0.670***
	(0.228)	(0.291)	(0.170)	(0.158)	(0.106)	(0.137)	(0.116)	(0.233)	(0.109)
R^2	0.163	0.164	0.169	0.120	0.115	0.179	0.122	0.160	0.157
BIC	30168.0	4276.9	19152.3	44388.0	54091.0	18502.8	35591.9	22942.9	19059.3
N	9201	1499	7026	15490	18316	6957	12331	6516	7112
	IRE	ITA	POR	ROM	SER	SLO	SPA	SWE	UNI
lnempl	-0.141***	-0.0673***	-0.105***	-0.120***	-0.129***	-0.121***	-0.0566**	-0.0983**	-0.177***
	(0.0361)	(0.0102)	(0.0221)	(0.0171)	(0.0226)	(0.0230)	(0.0185)	(0.0281)	(0.0147)
lnempl-r	0.0111	0.00592	0.0182	0.0597***	0.0106	0.0199	0.0106	0.0319*	0.0425***
	(0.0138)	(0.0108)	(0.0143)	(0.0140)	(0.0352)	(0.0192)	(0.0147)	(0.0138)	(0.00891)
cons	-0.833***	-1.324***	-0.745***	-0.646***	-0.228	-0.493*	-0.884***	-1.662***	-1.101***
	(0.210)	(0.109)	(0.115)	(0.132)	(0.404)	(0.212)	(0.144)	(0.109)	(0.0562)
R^2	0.087	0.119	0.143	0.124	0.121	0.150	0.157	0.098	0.128
BIC	5266.1	168196.3	208101.6	170798.1	18238.2	24585.7	361941.7	156866.4	53754.6
N	1734	58265	74969	65500	6441	8561	126248	54864	17599

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
FE: 2 Digit NAICS Code

Table 27. Results for Employment Size and Volatility in a Particular Sized Industry-Region Pair for Second Data Set

Dependent Variable: ln(vol-opre), NAICS Code: 3 Digit, Regional and Age Dummy Variables Included

	BEL	BOS	BUL	CRO	CZE	EST	FRA	GER	HUN
lnempl	-0.150***	-0.0651	-0.116***	-0.0996***	-0.174***	-0.0821**	-0.0685***	-0.194**	-0.124***
	(0.0208)	(0.0440)	(0.0308)	(0.0210)	(0.0168)	(0.0276)	(0.0196)	(0.0573)	(0.0184)
lnempl-ir	0.0751***	-0.00668	0.0411	0.0650*	0.0745***	0.105**	0.101**	0.158***	0.0384
	(0.0212)	(0.0508)	(0.0327)	(0.0272)	(0.0185)	(0.0390)	(0.0347)	(0.0366)	(0.0288)
cons	-2.047***	-0.608	-0.261	-1.115***	-0.999***	-1.228***	-2.118***	-2.491***	-0.790***
	(0.180)	(0.362)	(0.201)	(0.162)	(0.151)	(0.292)	(0.190)	(0.565)	(0.176)
R^2	0.046	0.015	0.037	0.033	0.066	0.038	0.045	0.095	0.041
BIC	31751.8	4519.1	20422.5	46034.5	55868.7	19726.7	37329.0	24150.0	20130.6
N	9198	1494	7021	15485	18314	6955	12329	6514	7106
	IRE	ITA	POR	ROM	SER	SLO	SPA	SWE	UNI
lnempl	-0.0734**	-0.0628***	-0.0564*	-0.0612*	-0.0857***	-0.111***	-0.0364	-0.0837***	-0.192***
	(0.0232)	(0.0159)	(0.0247)	(0.0269)	(0.0249)	(0.0220)	(0.0211)	(0.0227)	(0.0151)
lnempl-ir	0.0273	0.115***	0.0657*	0.0350	0.0293	0.106***	0.0834	0.129***	0.0293*
	(0.0300)	(0.0252)	(0.0325)	(0.0384)	(0.0409)	(0.0234)	(0.0499)	(0.0236)	(0.0138)
cons	-1.178	-1.693***	-1.403***	-0.625**	-0.740*	-1.139***	-1.636***	-1.910***	-0.768
	(0.684)	(0.168)	(0.168)	(0.207)	(0.339)	(0.166)	(0.279)	(0.164)	(0.490)
R^2	0.034	0.035	0.031	0.037	0.017	0.031	0.024	0.044	0.129
BIC	5622.8	174444.9	218127.0	177461.0	18962.8	26323.9	381066.6	160304.0	54553.1
N	1722	58265	74968	65497	6438	8555	126247	54863	17599

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
FE NUTS 3 Region Code

Table 28. Results Employment Size and Volatility for in a Particular Sized Industry-Region Pair for Second Data Set

Dependent Variable: ln(vol-opre), NAICS Code: 2 Digit, Regional and Age Dummy Variables Included

	BEL	BOS	BUL	CRO	CZE	EST	FRA	GER	HUN
lnempl	-0.155***	-0.0653	-0.117**	-0.108***	-0.184***	-0.0905*	-0.0704**	-0.214***	-0.125***
	(0.0235)	(0.0592)	(0.0396)	(0.0271)	(0.0181)	(0.0372)	(0.0209)	(0.0485)	(0.0177)
lnempl-ir	0.118*	-0.0282	0.0464	0.140*	0.119***	0.193	0.150**	0.233***	0.0516
	(0.0433)	(0.0825)	(0.0633)	(0.0623)	(0.0256)	(0.0941)	(0.0440)	(0.0603)	(0.0553)
cons	-2.370***	-0.457	-0.341	-1.578***	-1.273***	-2.019*	-2.493***	-2.899***	-0.924*
	(0.260)	(0.605)	(0.434)	(0.352)	(0.198)	(0.762)	(0.289)	(0.624)	(0.410)
R^2	0.050	0.016	0.037	0.042	0.074	0.050	0.053	0.107	0.042
BIC	31505.1	4534.9	20350.0	45886.2	55105.3	19649.1	36693.1	23523.9	20128.4
N	9201	1499	7026	15490	18316	6957	12331	6516	7112
	IRE	ITA	POR	ROM	SER	SLO	SPA	SWE	UNI
lnempl	-0.0794**	-0.0692***	-0.0538	-0.0591	-0.0877*	-0.122***	-0.0438	-0.0886**	-0.193***
	(0.0242)	(0.0178)	(0.0342)	(0.0389)	(0.0313)	(0.0272)	(0.0233)	(0.0309)	(0.0154)
lnempl-ir	0.0668	0.150**	0.0681	0.00985	0.0156	0.159***	0.154	0.219***	0.0413*
	(0.0390)	(0.0434)	(0.0488)	(0.0682)	(0.0653)	(0.0304)	(0.0861)	(0.0524)	(0.0150)
cons	-1.302	-1.916***	-1.489***	-0.490	-0.635	-1.478***	-2.228***	-2.557***	-0.828
	(0.743)	(0.231)	(0.273)	(0.432)	(0.612)	(0.177)	(0.579)	(0.371)	(0.513)
R^2	0.035	0.042	0.030	0.036	0.017	0.044	0.032	0.052	0.130
BIC	5504.8	173287.9	217566.1	177323.4	18976.4	25759.8	379604.4	159797.1	53912.3
N	1734	58265	74969	65500	6441	8561	126248	54864	17599

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
FE NUTS 3 Region Code, Age

5.4 Results for Volatility of Wage and Employment

Volatility can be defined by using different firm specific features. If a firm's volatility of sales are high, one can expect that volatility of costs and employment levels are also high for that firm. In this section, I change my dependent variable from volatility of sales to volatility of cost of employees, i.e. wages. The same calculation is used and natural logarithm of volatility is considered. I use 4-Digit NAICS code as industry codes. In the regressions, I use industry-year clustering variable and age dummy variables. The results can be seen in Tables B1, B2 and B3. They are only insignificant for Germany.

I also try to define the volatility as voaltility of employment (Table B4, B5 and B6). In here also, the results are only insignificant for Germany. It may be because Germany has the highest rate for Large firms and this may imply a monopolistic behaviour for that firms.

CHAPTER 6

CONCLUSION

In this dissertation, I show how volatility of sales are associated with firm's employment size. While volatility is negatively related to firm size, it is positively related to regional labor stock considering the number of employers in a given region and sector. Especially the second relationship is interesting and not explored in the literature in detail. The smaller share of employment in a region, will find it easier to exchange labor with other firms in close proximity and can respond to demand or supply shocks more easily compared to larger firms. These specifications can be motivated by a model of worker heterogeneity with product differentiation in future research.

APPENDIX A

TABLES OF DESCRIPTIVE STATISTICS

Table A1. Descriptive Statistics for First Data Set

NAICS Code: 4 Digit

country	stats	ln(vol-opre)	Lijr	lnempl	lnempl-re	age	lnempl-r
BEL	count	10204	10204	10204	10204	10204	43
	mean	-2.131	84.757	3.543	-6.991	26.814	9213
	sd	1.730	159.168	1.311	1.730	19.014	1198
	min	-7.251	2	0.693	-11.234	2	7171
	max	3.372	1635	7.399	-0.850	186	11927
BOS	count	1624	1624	1624	1624	1624	2
	mean	-1.020	43.531	2.938	-7.928	11.283	10063
	sd	1.336	81.843	1.215	1.366	10.858	1370
	min	-5.374	2	0.693	-10.338	2	9094
	max	2.961	812	6.700	-2.681	144	11032
BUL	count	7789	7789	7789	7789	7789	28
	mean	-0.484	77.022	3.505	-7.401	11.986	9459
	sd	1.276	126.914	1.297	1.964	12.607	852
	min	-5.157	2	0.693	-11.546	2	8188
	max	3.106	1048	6.955	-1.628	174	12239
CRO	count	17196	17196	17196	17196	17196	21
	mean	-1.109	18.667	2.135	-8	11.301	9216
	sd	1.338	38.760	1.092	1.476	5.783	907
	min	-5.940	2	0.693	-10.667	2	7328
	max	2.914	394	5.976	-1.981	311	11360
CZE	count	20335	20335	20335	20335	20335	98
	mean	-1.031	44.116	2.600	-6.785	10.461	8887
	sd	1.401	98.765	1.433	1.635	5.316	711
	min	-6.822	3	1.099	-9.806	2	7154
	max	3.200	750	6.620	-0.562	69	10904
EST	count	7715	7715	7715	7715	7715	15
	mean	-0.859	14.249	2.091	-7.688	10.344	8195
	sd	1.248	21.337	0.972	1.641	6.385	1013
	min	-6.674	2	0.693	-10.271	2	6709
	max	2.795	194	5.268	-1.982	106	10965
FRA	count	13690	13690	13690	13690	13690	93
	mean	-2.130	33.913	2.544	-6.296	18.122	7925
	sd	1.402	76.304	1.255	1.593	13.171	1060
	min	-7.708	2	0.693	-10.246	2	5220
	max	3.314	861	6.758	-0.682	107	10939
GER	count	7225	7225	7225	7225	7225	395
	mean	-2.147	497.217	5.269	-4.346	33.522	8406
	sd	1.952	970.304	1.372	1.916	36.933	1189
	min	-8.313	6	1.792	-10.196	2	3296
	max	3.407	10307	9.241	-0.061	677	11988
HUN	count	7886	7886	7886	7886	7886	20
	mean	-1.059	58.243	3.096	-7.404	11.151	9657
	sd	1.266	114.134	1.333	1.682	4.823	774
	min	-5.497	2	0.693	-11.212	2	8239
	max	3.239	1112	7.014	-1.394	59	11905

country	stats	ln(vol-opre)	Lijr	lnempl	lnempl-re	age	lnempl-r
IRE	count	1891	1891	1891	1891	1891	45
	mean	-1.690	90.247	3.141	-6.877	15.951	5836
	sd	1.418	222.516	1.568	2.671	14.711	1776
	min	-5.892	2	0.693	-11.086	2	2485
	max	2.260	2607	7.866	-0.163	120	11779
ITA	count	64730	64730	64730	64730	64730	109
	mean	-1.593	36.579	2.655	-7.989	20.145	9175
	sd	1.401	77.127	1.257	1.761	14.623	1307
	min	-9.646	2	0.693	-12.089	2	4407
	max	3.395	818	6.707	-0.950	146	12782
POR	count	83291	83291	83291	83291	83291	308
	mean	-1.429	11.321	1.893	-7.072	15.314	6903
	sd	1.311	17.653	0.917	1.650	12.621	1512
	min	-8.650	2	0.693	-10.762	2	2565
	max	3.191	174	5.159	-0.110	142	11456
ROM	count	72771	72771	72771	72771	72771	42
	mean	-0.588	18.176	2.121	-8.523	9.635	10085
	sd	1.181	36.338	1.091	1.390	5.073	676
	min	-6.097	2	0.693	-11.664	2	8802
	max	3.023	370	5.914	-2.979	18	12357
SER	count	7141	7141	7141	7141	7141	2
	mean	-0.863	47.851	2.984	-9.153	12.752	11963
	sd	1.305	92.173	1.250	1.318	9.778	594
	min	-6.243	2	0.693	-11.690	2	11543
	max	2.927	862	6.759	-4.794	156	12383
SLO	count	9493	9493	9493	9493	9493	79
	mean	-1.031	46.629	2.953	-6	10.256	8215
	sd	1.386	96.613	1.221	1.442	6.045	1001
	min	-6.891	2	0.693	-9.618	2	5533
	max	2.860	750	6.620	-0.555	59	10311
SPA	count	1.40e+05	1.40e+05	1.40e+05	1.40e+05	1.40e+05	52
	mean	-1.421	18.964	2.277	-9.104	14.724	10170
	sd	1.395	35.368	1.028	1.535	9.805	1158
	min	-10.410	2	0.693	-12.364	2	7018
	max	3.276	388	5.961	-1.598	166	13057
SWE	count	60956	60956	60956	60956	60956	21
	mean	-1.565	10.887	1.809	-9.028	17.278	9891
	sd	1.375	18.556	0.939	1.403	13.533	884
	min	-8.139	2	0.693	-11.421	2	8078
	max	3.391	199	5.293	-3.387	111	12114
UNI	count	19570	19570	19570	19570	19570	935
	mean	-1.613	310.592	4.501	-4.887	24.380	7532
	sd	1.500	765.692	1.546	2.066	22.095	1676
	min	-7.666	3	1.099	-10.670	2	2303
	max	3.189	8968	9.101	-0.007	152	11769

Table A2. Industry Classification Statistics for First Data Set

NAICS Code: 4 Digit

Industry Code	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent
	BEL		BOS		BUL		CRO	
11	38	0.37	44	2.71	303	3.89	54	0.31
21	35	0.34	11	0.68	49	0.63	126	0.73
22	44	0.43	52	3.20	76	0.98	1,571	9.14
23	679	6.65	129	7.94	682	8.76	524	3.05
31	455	4.46	98	6.03	666	8.55	795	4.62
32	695	6.81	174	10.71	509	6.53	1,346	7.83
33	808	7.92	130	8.00	773	9.92	3,468	20.17
42	2,309	22.63	458	28.20	1,959	25.15	1,022	5.94
44	362	3.55	137	8.44	570	7.32	735	4.27
45	80	0.78	69	4.25	181	2.32	786	4.57
48	642	6.29	79	4.86	462	5.93	16	0.09
49	88	0.86	2	0.12	24	0.31	353	2.05
51	204	2.00	25	1.54	109	1.40	102	0.59
52	101	0.99	8	0.49	30	0.39	346	2.01
53	261	2.56	6	0.37	278	3.57	2,809	16.34
54	840	8.23	84	5.17	323	4.15	12	0.07
55	247	2.42	-	-	34	0.44	624	3.63
56	466	4.57	22	1.35	173	2.22	305	1.77
61	274	2.69	-	-	6	0.08	266	1.55
62	1,036	10.15	52	3.20	122	1.57	142	0.83
71	115	1.13	-	-	49	0.63	820	4.77
72	113	1.11	17	1.05	328	4.21	644	3.75
81	299	2.93	27	1.66	83	1.07	2	0.01
92	13	0.13 1	-	-	-	-	17,196	
Total	10,204		1,624		7,789		24,412	
	CZE		EST		FRA		GER	
11	782	3.85	384	4.98	171	1.25	31	0.43
21	53	0.26	34	0.44	52	0.38	27	0.37
22	225	1.11	69	0.89	24	0.18	513	7.10
23	2,254	11.08	821	10.64	2,254	16.46	147	2.03
31	612	3.01	262	3.40	467	3.41	216	2.99
32	1,189	5.85	343	4.45	572	4.18	493	6.82
33	2,754	13.54	659	8.54	961	7.02	1,027	14.21
42	3,594	17.67	933	12.09	2,101	15.35	1,045	14.46
44	987	4.85	602	7.80	1,268	9.26	318	4.40
45	364	1.79	261	3.38	329	2.40	39	0.54
48	728	3.58	729	9.45	657	4.80	305	4.22
49	28	0.14	23	0.30	42	0.31	23	0.32
51	290	1.43	104	1.35	294	2.15	126	1.74
52	65	0.32	27	0.35	132	0.96	36	0.50
53	1,110	5.46	344	4.46	394	2.88	397	5.49
54	2,733	13.44	734	9.51	1,170	8.55	499	6.91
55	33	0.16	267	3.46	278	2.03	722	9.99
56	707	3.48	71	0.92	595	4.35	266	3.68
61	225	1.11	280	3.63	104	0.76	48	0.66
62	264	1.30	48	0.62	227	1.66	663	9.18
71	182	0.90	343	4.45	129	0.94	93	1.29
72	564	2.77	377	4.89	808	5.90	52	0.72
81	592	2.91	625	5.49	661	4.83	113	1.56
92	-	-	-	-	-	-	26	0.36
Total	20,335		7,715		13,690		7,225	

Industry Code	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent
	HUN		IRE		ITA		POR	
11	335	4.25	10	0.53	853	1.32	2,297	2.76
21	37	0.47	4	0.21	334	0.52	297	0.36
22	79	1.00	7	0.37	478	0.74	98	0.12
23	782	9.92	32	1.69	5,980	9.24	8,635	10.37
31	412	5.22	14	0.74	4,724	7.30	5,643	6.78
32	669	8.48	39	2.06	5,654	8.73	3,686	4.43
33	1,271	16.12	62	3.28	12,850	19.85	6,797	8.16
42	1,831	23.22	98	5.18	10,579	16.34	10,315	12.38
44	494	6.26	30	1.59	3,154	4.87	10,071	12.09
45	123	1.56	16	0.85	652	1.01	3,014	3.62
48	654	8.29	39	2.06	2,733	4.22	3,722	4.47
49	45	0.57	6	0.32	191	0.30	78	0.09
51	112	1.42	51	2.70	1,770	2.73	639	0.77
52	22	0.28	85	4.49	438	0.68	611	0.73
53	187	2.37	57	3.01	1,434	2.22	1,593	1.91
54	394	5.00	120	6.35	4,170	6.44	6,727	8.08
55	22	0.28	64	3.38	418	0.65	67	0.08
56	215	2.73	197	10.42	2,505	3.87	1,892	2.27
61	9	0.11	67	3.54	301	0.47	1,263	1.52
62	28	0.36	318	16.82	1,604	2.48	2,685	3.22
71	16	0.20	121	6.40	529	0.82	434	0.52
72	63	0.80	19	1.00	2,106	3.25	8,157	9.79
81	86	1.09	381	20.15	1,271	1.96	4,562	5.48
92	-	-	54	2.86	2	0.00	8	0.01
Total	7,886		1,891		64,730		83,291	
	ROM		SER		SLO		SPA	
11	3,143	4.32	382	5.35	704	7.42	3,521	2.51
21	252	0.35	28	0.39	39	0.41	599	0.43
22	151	0.21	129	1.81	126	1.33	496	0.35
23	6,300	8.66	597	8.36	836	8.81	18,121	12.92
31	4,490	6.17	622	8.71	350	3.69	7,843	5.59
32	3,483	4.79	556	7.79	569	5.99	8,205	5.85
33	4,845	6.66	748	10.47	1,238	13.04	12,779	9.11
42	8,352	11.48	2,008	28.12	1,794	18.90	24,091	17.17
44	13,916	19.12	374	5.24	505	5.32	11,459	8.17
45	3,552	4.88	112	1.57	353	3.72	3,070	2.19
48	4,580	6.29	417	5.84	373	3.93	6,602	4.71
49	112	0.15	19	0.27	21	0.22	484	0.35
51	1,110	1.53	174	2.44	123	1.30	1,699	1.21
52	292	0.40	8	0.11	7	0.07	924	0.66
53	1,489	2.05	40	0.56	388	4.09	4,239	3.02
54	5,960	8.19	426	5.97	807	8.50	10,878	7.75
55	26	0.04	12	0.17	3	0.03	411	0.29
56	2,076	2.85	206	2.88	374	3.94	4,035	2.88
61	418	0.57	14	0.20	23	0.24	1,479	1.05
62	1,074	1.48	19	0.27	323	3.40	2,092	1.49
71	417	0.57	42	0.59	81	0.85	1,760	1.25
72	3,610	4.96	115	1.61	260	2.74	8,515	6.07
81	3,109	4.27	93	1.30	194	2.04	6,931	4.94
92	14	0.02	-	-	2	0.02	39	0.03
Total	72,771		7,141		9,493		140,272	

Industry Code	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent
	SWEDEN		UNITED KING					
	Freq.	Percent	Freq.	Percent				
11	2,172	3.56	159	0.81				
21	119	0.20	190	0.97				
22	244	0.40	116	0.59				
23	9,208	15.11	1,316	6.72				
31	1,069	1.75	551	2.82				
32	2,176	3.57	1,134	5.79				
33	5,617	9.21	2,491	12.73				
42	7,152	11.73	2,559	13.08				
44	4,124	6.77	368	1.88				
45	1,736	2.85	289	1.48				
48	4,138	6.79	778	3.98				
49	75	0.12	101	0.52				
51	1,103	1.81	840	4.29				
52	450	0.74	922	4.71				
53	1,976	3.24	737	3.77				
54	8,235	13.51	2,039	10.42				
55	476	0.78	700	3.58				
56	2,090	3.43	1,848	9.44				
61	922	1.51	150	0.77				
62	1,371	2.25	437	2.23				
71	916	1.50	414	2.12				
72	2,856	4.69	662	3.38				
81	2,728	4.48	734	3.75				
92	3	-	35	0.18				
Total	60,956		19,570					

11 Agriculture, Forestry, Fishing and Hunting
21 Mining, Quarrying, and Oil and Gas Extraction
22 Utilities
23 Construction
31 Manufacturing
32 Manufacturing
33 Manufacturing
42 Wholesale Trade
44 Retail Trade
45 Retail Trade
48 Transportation and Warehousing
49 Transportation and Warehousing
51 Information
52 Finance and Insurance
53 Real Estate and Rental and Leasing
54 Professional, Scientific, and Technical Services
55 Management of Companies and Enterprises
56 Administrative and Support and Waste Management and Remediation Services 61 Educational Services
62 Health Care and Social Assistance
71 Arts, Entertainment, and Recreation
72 Accommodation and Food Services
81 Other Services (except Public Administration)
92 Public Administration

Table A3. Descriptive Statistics for Second Data Set

NAICS Code: 4 Digit

country	stats	ln(vol-opre)	Lijr	lnempl	lnempl-re	age	lnempl-r
BEL	count	9.184	9.184	9.184	9.184	9.184	43
	mean	-2.146	81.740	3.541	-6.847	26.550	9.058
	sd	1.361	153	1.281	1.719	18.583	1.195
	min	-5.031	2	693	-11.119	2	7.113
	max	732	1.619	7.390	-812	186	11.812
BOS	count	1.460	1.460	1.460	1.460	1.460	2
	mean	-1.023	41.675	2.899	-7.801	11.157	9.943
	sd	1.090	79.319	1.204	1.354	10.876	1.312
	min	-3.171	2	693	-10.178	2	9.015
	max	1.218	808	6.695	-2.602	144	10.871
BUL	count	7.010	7.010	7.010	7.010	7.010	28
	mean	-476	72.176	3.477	-7.255	11.777	9.258
	sd	1.035	117.103	1.267	1.946	12.103	882
	min	-2.556	2	693	-11.390	2	7.886
	max	1.603	1.032	6.939	-1.326	127	12.083
CRO	count	15473	15473	15473	15473	15473	21
	mean	-1.102	17.981	2.122	-7.869	11.307	9.074
	sd	1.079	36.830	1.076	1.464	5.626	902
	min	-3.330	2	693	-10.528	2	7.251
	max	1.071	394	5.976	-1.904	311	11.221
CZE	count	18302	18302	18302	18302	18302	98
	mean	-1.026	43.444	2.616	-6.649	10.453	8.764
	sd	1.125	95.994	1.420	1.623	5.282	710
	min	-3.322	3	1.099	-9.704	2	6.976
	max	1.308	750	6.620	-490	63	10.802
EST	count	6.943	6.943	6.943	6.943	6.943	15
	mean	-847	14.451	2.107	-7.575	10.304	8.108
	sd	1.007	21.427	973	1.641	5.955	1.008
	min	-2.976	2	693	-10.177	2	6.687
	max	1.116	194	5.268	-1.960	106	10.870
FRA	count	12322	12322	12322	12322	12322	93
	mean	-2.148	32.691	2.529	-6.151	18.003	7.775
	sd	1.091	73.604	1.238	1.562	13.043	1.090
	min	-4.372	2	693	-10.085	2	5.069
	max	221	861	6.758	-687	103	10.778
GER	count	6.496	6.496	6.496	6.496	6.496	392
	mean	-2.187	455.440	5.237	-4.175	33.522	8.253
	sd	1.531	874.354	1.328	1.862	37.067	1.137
	min	-5.216	6	1.792	-9.928	2	3.296
	max	1.573	10307	9.241	-47	677	11.719
HUN	count	7.087	7.087	7.087	7.087	7.087	20
	mean	-1.057	55.197	3.066	-7.252	11.096	9.502
	sd	1.003	108.838	1.309	1.645	4.824	787
	min	-3.137	2	693	-11.003	2	7.991
	max	1.056	1.112	7.014	-1.146	59	11.697

country	stats	ln(vol-opre)	Lijr	lnempl	lnempl-re	age	lnempl-r
IRE	count	1.694	1.694	1.694	1.694	1.694	44
	mean	-1.693	84.383	3.117	-6.705	15.900	5.680
	sd	1.147	197.789	1.546	2.661	14.682	1.780
	min	-3.942	2	693	-10.915	2	2.485
	max	708	2.041	7.621	-145	120	11.608
ITAL	count	58257	58257	58257	58257	58257	109
	mean	-1.594	34.856	2.633	-7.856	19.938	9.015
	sd	1.092	73.489	1.237	1.742	14.202	1.318
	min	-3.904	2	693	-11.934	2	4.304
	max	707	818	6.707	-926	146	12.627
POR	count	74963	74963	74963	74963	74963	307
	mean	-1.438	11.278	1.890	-6.963	15.220	6.788
	sd	1.047	17.605	915	1.641	12.555	1.515
	min	-3.512	2	693	-10.621	2	2.565
	max	806	174	5.159	-110	136	11.314
ROM	count	65497	65497	65497	65497	65497	42
	mean	-584	17.770	2.109	-8.401	9.603	9.964
	sd	952	35.477	1.082	1.376	5.060	664
	min	-2.534	2	693	-11.530	2	8.746
	max	1.363	370	5.914	-2.923	18	12.223
SER	count	6.423	6.423	6.423	6.423	6.423	2
	mean	-862	45.537	2.954	-9.028	12.609	11.803
	sd	1.060	88.126	1.229	1.299	9.703	608
	min	-2.986	2	693	-11.540	2	11.374
	max	1.319	862	6.759	-4.755	156	12.233
SLO	count	8.542	8.542	8.542	8.542	8.542	79
	mean	-1.005	44.678	2.950	-5.851	10.257	8.069
	sd	1.100	90.461	1.200	1.416	5.938	1.004
	min	-3.450	2	693	-9.429	2	5.533
	max	1.142	750	6.620	-594	59	10.123
SPA	count	1.26e+05	1.26e+05	1.26e+05	1.26e+05	1.26e+05	52
	mean	-1.425	18.533	2.267	-8.983	14.612	10.041
	sd	1.105	34.343	1.018	1.523	9.618	1.169
	min	-3.699	2	693	-12.236	2	6.619
	max	893	388	5.961	-1.628	166	12.929
SWE	count	54861	54861	54861	54861	54861	21
	mean	-1.566	10.583	1.802	-8.891	17.159	9.768
	sd	1.064	17.706	924	1.381	13.356	885
	min	-3.830	2	693	-11.254	2	7.877
	max	646	198	5.288	-3.204	111	11.947
UNI	count	17594	17594	17594	17594	17594	908
	mean	-1.614	300.818	4.513	-4.734	24.399	7.469
	sd	1.192	742.688	1.512	2.031	21.859	1.639
	min	-4.067	3	1.099	-10.540	2	2.303
	max	916	8.968	9.101	-7	152	11.639

APPENDIX B

ANOTHER DEFINITIONS OF VOLATILITY

Table B1. Results for Employment Size and Volatility of Wages

Dependent Variable: ln(vol-wage), NAICS Code: 4 Digit, Sectoral, Regional and Age Dummy Variables Included

	BEL	BOS	BUL	CRO	CZE	EST	FRA	GER	HUN
lnempl	-0.274***	-0.187***	-0.185***	-0.213***	-0.306***	-0.186***	-0.201***	0.00577	-0.234***
	(0.0209)	(0.0316)	(0.0203)	(0.0167)	(0.0145)	(0.0182)	(0.0229)	(0.0622)	(0.0141)
cons	-2.327***	-1.040***	-0.523***	-1.130***	-0.818***	-0.331***	-1.520***	-6.131***	-0.929***
	(0.146)	(0.143)	(0.0937)	(0.0872)	(0.153)	(0.0459)	(0.124)	(0.352)	(0.0651)
R^2	0.253	0.213	0.212	0.121	0.196	0.242	0.155	0.204	0.172
BIC	36373.1	4468.6	23589.1	54724.4	70192.8	22517.5	45602.2	31072.8	24442.1
N	10204	1624	7789	17196	20336	7715	13690	7225	7886
	IRE	ITA	POR	ROM	SER	SLO	SPA	SWE	UNI
lnempl	-0.180***	-0.178***	-0.231***	-0.211***	-0.190***	-0.244***	-0.125***	-0.312***	-0.198***
	(0.0439)	(0.00977)	(0.0162)	(0.0113)	(0.0167)	(0.0165)	(0.0168)	(0.0119)	(0.00910)
cons	-1.355	-0.755***	-1.237***	-0.489***	-0.588***	-1.159***	-1.236***	-1.027***	-0.240
	(1.305)	(0.176)	(0.0926)	(0.0391)	(0.0651)	(0.142)	(0.0523)	(0.0527)	(0.532)
R^2	0.170	0.155	0.130	0.141	0.155	0.196	0.141	0.127	0.231
BIC	6595.2	221212.8	264003.1	210094.9	21706.1	30622.2	451522.9	203604.0	67368.4
N	1891	64730	83292	72771	7141	9493	140242	60957	19570

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
FE: 4 Digit NAICS Code and NUTS 3 Region Code

Table B2. Results for Employment Size in a Region and Volatility of Wages

Dependent Variable: ln(vol-wage), NAICS Code: 4 Digit, Sectoral and Age Dummy Variables Included

	BEL	BOS	BUL	CRO	CZE	EST	FRA	GER	HUN
lnempl-re	-0.193***	-0.127***	-0.114***	-0.151***	-0.241***	-0.0922***	-0.159***	-0.0743	-0.161***
	(0.0158)	(0.0278)	(0.0126)	(0.0128)	(0.0129)	(0.00896)	(0.0115)	(0.0437)	(0.0113)
cons	-4.356***	-2.734***	-1.812***	-2.559***	-2.777***	-1.356***	-2.976***	-4.191***	-2.766***
	(0.145)	(0.235)	(0.0952)	(0.0872)	(0.0990)	(0.0688)	(0.101)	(0.205)	(0.0942)
R^2	0.241	0.202	0.203	0.112	0.174	0.232	0.140	0.150	0.156
BIC	36151.3	4483.6	23432.3	54705.3	69771.4	22490.9	44967.8	29498.4	24431.3
N	10204	1624	7789	17196	20336	7715	13690	7225	7886
	IRE	ITA	POR	ROM	SER	SLO	SPA	SWE	UNI
lnempl-re	-0.0548***	-0.0809***	-0.0873***	-0.131***	-0.173***	-0.165***	-0.0646***	-0.166***	-0.132***
	(0.0121)	(0.00735)	(0.00742)	(0.00820)	(0.0165)	(0.0143)	(0.00960)	(0.00712)	(0.00821)
cons	-3.238***	-2.145***	-1.949***	-1.777***	-2.667***	-3.021***	-1.805***	-2.783***	-1.840***
	(0.130)	(0.0660)	(0.0466)	(0.0763)	(0.152)	(0.0872)	(0.0918)	(0.0734)	(0.0714)
R^2	0.134	0.118	0.107	0.122	0.153	0.174	0.127	0.107	0.162
BIC	6357.3	222767.0	263574.5	211230.1	21713.7	30163.3	453162.2	204758.4	66699.8
N	1891	64730	83292	72771	7141	9493	140242	60957	19570

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
FE: 4 Digit NAICS Code

Table B3. Results for Employment Size in a Particular Sized Region and Volatility of Wages

Dependent Variable: ln(vol-wage), NAICS Code: 4 Digit, Sectoral and Age Dummy Variables Included

	BEL	BOS	BUL	CRO	CZE	EST	FRA	GER	HUN
lnempl	-0.272***	-0.187***	-0.185***	-0.210***	-0.306***	-0.186***	-0.208***	-0.00787	-0.233***
	(0.0208)	(0.0316)	(0.0205)	(0.0167)	(0.0145)	(0.0185)	(0.0229)	(0.0700)	(0.0143)
lnempl-r	0.0769***	-0.0833	0.0537***	0.0762***	0.0551***	0.0451***	0.108***	0.131***	0.0538***
	(0.0188)	(0.0580)	(0.0157)	(0.0157)	(0.0158)	(0.00943)	(0.0161)	(0.0331)	(0.0156)
cons	-2.986***	-0.282	-1.037***	-1.726***	-1.011***	-0.830***	-2.496***	-4.909***	-1.601***
	(0.184)	(0.618)	(0.163)	(0.142)	(0.136)	(0.0928)	(0.169)	(0.183)	(0.164)
R^2	0.249	0.213	0.210	0.117	0.185	0.240	0.144	0.153	0.168
BIC	36044.5	4468.6	23379.7	54619.7	69522.1	22425.3	44918.5	29481.5	24323.3
N	10204	1624	7789	17196	20336	7715	13690	7225	7886
	IRE	ITA	POR	ROM	SER	SLO	SPA	SWE	UNI
lnempl	-0.180***	-0.185***	-0.230***	-0.209***	-0.190***	-0.242***	-0.119***	-0.312***	-0.201***
	(0.0420)	(0.00975)	(0.0164)	(0.0118)	(0.0167)	(0.0160)	(0.0176)	(0.0118)	(0.00892)
lnempl-r	0.0133	-0.00725	0.0365***	0.0276***	0.0322	0.0173	0.0312***	0.0598***	0.0634***
	(0.0146)	(0.00923)	(0.00647)	(0.00752)	(0.0385)	(0.0221)	(0.00637)	(0.00752)	(0.00978)
cons	-2.647***	-1.077***	-1.414***	-0.608***	-0.987*	-1.503***	-1.369***	-1.524***	-0.931***
	(0.209)	(0.0978)	(0.0512)	(0.0716)	(0.437)	(0.192)	(0.0598)	(0.0856)	(0.109)
R^2	0.154	0.131	0.119	0.133	0.155	0.186	0.129	0.123	0.173
BIC	6322.1	221806.4	262481.3	210301.1	21706.1	30041.1	452747.4	203702.4	66466.0
N	1891	64730	83292	72771	7141	9493	140242	60957	19570

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
FE: 4 Digit NAICS Code

Table B4. Results for Employment Size and Volatility of Employment

Dependent Variable: ln(vol-empl), NAICS Code: 4 Digit, Sectoral, Regional and Age Dummy Variables Included

	BEL	BOS	BUL	CRO	CZE	EST	FRA	GER	HUN
lnempl	-0.406***	-0.343***	-0.323***	-0.384***	-0.204***	-0.299***	-0.384***	-0.0381	-0.349***
	(0.0273)	(0.0435)	(0.0244)	(0.0146)	(0.0131)	(0.0250)	(0.0240)	(0.0508)	(0.0156)
cons	-1.584***	-1.010***	-0.302**	-0.612***	0.328*	-0.757***	-0.205	-5.256***	-0.583***
	(0.156)	(0.248)	(0.0973)	(0.0759)	(0.156)	(0.0556)	(0.133)	(0.697)	(0.0649)
R^2	0.240	0.300	0.265	0.187	0.159	0.182	0.228	0.148	0.234
BIC	36843.6	5321.4	24213.2	50187.7	30653.9	21749.7	43927.4	32365.2	24612.1
N	10116	1609	7781	16327	12373	7273	13212	7223	7867
	IRE	ITA	POR	ROM	SER	SLO	SPA	SWE	UNI
lnempl	-0.302***	-0.416***	-0.409***	-0.318***	-0.261***	-0.277***	-0.326***	-0.307***	-0.184***
	(0.0396)	(0.0130)	(0.0214)	(0.0154)	(0.0232)	(0.0148)	(0.0220)	(0.0156)	(0.00979)
cons	-0.156	1.587***	-0.434***	-0.539***	-0.871***	0.803***	-0.399***	-1.197***	-1.690***
	(0.485)	(0.159)	(0.101)	(0.0445)	(0.0878)	(0.102)	(0.0607)	(0.0498)	(0.280)
R^2	0.206	0.249	0.210	0.161	0.193	0.222	0.162	0.135	0.184
BIC	6315.7	224615.3	223441.8	209342.3	23665.6	20021.9	420970.2	161290.1	68566.8
N	1828	63920	76108	71138	7093	8398	134838	52770	19496

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
FE: 4 Digit NAICS Code and NUTS 3 Region Code

Table B5. Results for Employment Size in a Region and Volatility of Employment

Dependent Variable: ln(vol-empl), NAICS Code: 4 Digit, Sectoral and Age Dummy Variables Included

	BEL	BOS	BUL	CRO	CZE	EST	FRA	GER	HUN
lnempl-re	-0.252***	-0.272***	-0.162***	-0.225***	-0.145***	-0.117***	-0.230***	-0.0776	-0.214***
	(0.0180)	(0.0309)	(0.0134)	(0.0117)	(0.0104)	(0.0112)	(0.0124)	(0.0402)	(0.0119)
cons	-4.449***	-4.116***	-2.217***	-3.022***	-0.934***	-2.070***	-2.442***	-3.652***	-2.852***
	(0.163)	(0.261)	(0.102)	(0.0805)	(0.0722)	(0.0791)	(0.0985)	(0.181)	(0.0969)
R^2	0.208	0.292	0.234	0.149	0.130	0.153	0.180	0.097	0.193
BIC	36864.1	5331.3	24296.5	50734.4	30152.8	21877.4	43858.0	30735.2	24851.7
N	10116	1609	7781	16327	12373	7273	13212	7223	7867
	IRE	ITA	POR	ROM	SER	SLO	SPA	SWE	UNI
lnempl-re	-0.0764***	-0.174***	-0.114***	-0.175***	-0.242***	-0.181***	-0.128***	-0.150***	-0.120***
	(0.0190)	(0.0101)	(0.00858)	(0.0106)	(0.0226)	(0.0116)	(0.0113)	(0.00765)	(0.00706)
cons	-3.168***	-0.912***	-1.478***	-2.412***	-3.792***	-1.131***	-1.768***	-2.864***	-2.859***
	(0.193)	(0.0806)	(0.0494)	(0.0933)	(0.202)	(0.0665)	(0.104)	(0.0774)	(0.0672)
R^2	0.129	0.178	0.142	0.121	0.191	0.171	0.115	0.108	0.126
BIC	6176.7	229168.4	227153.9	212202.0	23672.0	19853.6	427767.2	162683.3	67566.4
N	1828	63920	76108	71138	7093	8398	134838	52770	19496

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
FE: 4 Digit NAICS Code

Table B6. Results for Employment Size in a Particular Sized Region and Volatility of Employment

Dependent Variable: ln(vol-empl), NAICS Code: 4 Digit, Sectoral and Age Dummy Variables Included

	BEL	BOS	BUL	CRO	CZE	EST	FRA	GER	HUN
lnempl	-0.405***	-0.343***	-0.323***	-0.382***	-0.204***	-0.298***	-0.394***	-0.0457	-0.348***
	(0.0271)	(0.0435)	(0.0244)	(0.0148)	(0.0131)	(0.0250)	(0.0242)	(0.0551)	(0.0154)
lnempl-r	0.0349	0.0288	0.0260	0.0308*	0.000415	0.0300*	0.0586***	0.105**	0.0180
	(0.0182)	(0.0729)	(0.0142)	(0.0133)	(0.00958)	(0.0116)	(0.0164)	(0.0353)	(0.0151)
cons	-1.867***	-1.272	-0.466**	-0.846***	0.437***	-1.084***	-0.859***	-3.997***	-0.713***
	(0.183)	(0.867)	(0.149)	(0.122)	(0.0834)	(0.107)	(0.167)	(0.179)	(0.153)
R^2	0.237	0.300	0.261	0.184	0.151	0.179	0.217	0.098	0.231
BIC	36500.4	5321.4	24021.8	50069.6	29869.3	21657.3	43250.4	30739.0	24484.3
N	10116	1609	7781	16327	12373	7273	13212	7223	7867
	IRE	ITA	POR	ROM	SER	SLO	SPA	SWE	UNI
lnempl	-0.302***	-0.420***	-0.406***	-0.316***	-0.261***	-0.279***	-0.320***	-0.308***	-0.186***
	(0.0378)	(0.0130)	(0.0218)	(0.0156)	(0.0232)	(0.0148)	(0.0230)	(0.0157)	(0.00954)
lnempl-r	0.00558	-0.0322***	0.0115	-0.0112	0.0842	-0.00937	0.0120*	0.0398***	0.0563***
	(0.0186)	(0.00832)	(0.00587)	(0.00885)	(0.0473)	(0.0124)	(0.00560)	(0.00737)	(0.00924)
cons	-2.145***	1.593***	-0.374***	-0.305***	-1.913***	0.783***	-0.245***	-1.526***	-2.004***
	(0.234)	(0.0851)	(0.0492)	(0.0811)	(0.537)	(0.120)	(0.0463)	(0.0844)	(0.120)
R^2	0.187	0.236	0.198	0.155	0.193	0.213	0.150	0.131	0.135
BIC	6057.7	224451.8	222071.9	209418.2	23665.6	19427.8	422377.0	161324.2	67374.4
N	1828	63920	76108	71138	7093	8398	134838	52770	19496

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
FE: 4 Digit NAICS Code

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