Labour turnover and the spatial distribution of unemployment. A panel data analysis using employment registry data

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Abstract

This paper aims to study whether the local variation in unemployment rates is related to labour turnover and what is the sign of such relationship. In addition, the paper aims to assess the relative impact of inflow and outflow from unemployment on the dynamics of the local unemployment rate. The empirical analysis is based on a newly available unique dataset from the employment registry of a transition economy (Poland), encompassing nine years of monthly data (from 2000 to 2008) at a county (*poviat*) level. We find that turnover, as well as inflows and outflows separately, are *ceteris paribus* positively related to the unemployment level. This general conclusion is robust to sub-sampling that addresses potential heterogeneity of the analysed local labour markets. It is also robust to the use of different panel estimators, such as fixed effect and alternative GMM specifications. Nonetheless, point estimators differ, reflecting the diverse adjustment patterns. We also find that elasticity is larger in the case of the inflow rate than for the outflow rate. Finally, we demonstrate that the effect is stronger in low unemployment regions.

Keywords: Regional Unemployment; Labour Turnover; Panel Data; Poland
JEL Classification: C33; J63; P25; P52; R23

Introduction

Based on theoretical reasoning (Aghion and Blanchard, 1994), the relationship between labour market turnover and the unemployment rate can be of different nature. There could be either a positive relationship or no relationship. Intuitively, in the former case, large turnover is an indication of massive layoffs, thus leading to a (possibly temporary) unemployment increase. In fact, industrial restructuring causing sectoral shifts could explain the high degree of turnover of high unemployment regions. Alternatively, large labour market flows might be the sign of greater labour market flexibility, which is usually associated with efficient labour markets and thus relatively lower unemployment.

The aim of this paper is to empirically discriminate between these alternative theoretical hypotheses exploiting the geographical differentiation of labour turnover and unemployment. By exploring the *ceteris paribus* variation in the labour market turnover and the unemployment rate, we seek to provide evidence of an empirical pattern. Ferragina and Pastore (2008) suggest that in fact these theories constitute a "screening device" allowing to distinguish the case when unemployment is due to labour market rigidities and when it is due instead to some region-specific shock (namely when the high degree of labour turnover in high unemployment regions is caused by industrial restructuring). Note that the policy implications of these alternative hypotheses are partly different, because a low job finding rate in high unemployment regions essentially indicates the need for supply side policies, whereas a positive relationship between labour market turnover and unemployment necessitates interventions on the demand side as well.

We use local level data encompassing nearly ten years of monthly observations (from 2000 to 2008) relative to 380 *poviats* (i.e. counties classified in the EU as LAU1 units) of a transition economy (Poland). To our knowledge, few other countries have similar data, which makes this study the first one to implement a systematic analysis of the relationship between the geographical pattern of unemployment and that of the labour market dynamics. The length of the period that the data covers allows us to consider both times of considerable unemployment growth (2001-2003) and of subsequent decrease (2005 onwards).

The estimates provide evidence of a positive coefficient on turnover, much larger for the inflow than for the outflow. Estimations are robust to the inclusion of a number of control variables, several stratifications and different types of estimation techniques. To adequately tackle the dynamic component of the data, we employ both fixed effect GLS panel data estimation with time controls and the alternative specifications of GMM.

In addition, the paper attempts to disentangle market driven from administrative flows, on the ground that the former might be correlated to structural change and the latter to institutional features of the labour market. The former flow includes those who register for the first time and those who find a job, whereas the latter also includes the re-registrations and those of are de-listed because of administrative reasons or because they are attending labour market programmes.

Furthermore, to verify the robustness of the results we also isolate the *poviats* where industrial restructuring has been more intense. We introduce a classification based on the share of private employment, employment in services and of investment. We end up with four different clusters of *poviats*: a) "laggards" are the *poviats* included in the bottom 25th percentiles of the distribution of the aforementioned variables; b) "in transition" are intermediate cases of *poviats* with a high share of both rural and service share in employment; while c) "privatized industrial" are those with high private ownership and high industry contribution. We find that that the correlation between labour turnover and unemployment is universal across the clusters, but quantitatively the strongest in the most industrialized clusters of *poviats*.

As a final check, the estimates are run for *poviats* at different deciles of the unemployment distribution. The estimates show that the elasticity of unemployment to labour turnover, inflow and outflow rates, which is positive in all groups of *poviats*, is much higher than average in low unemployment *poviats*, where the rate of structural change is supposedly greater.

The paper is structured as follows. In the next section motivation is briefly discussed, with some insights into the interplay between geography and unemployment in transition economies. Section 2 discusses the relevant theoretical foundations in detail as well as some available empirical evidence. Subsequently, we describe the dataset (Section 3) and the methodology (Section 4). Section 5 presents the analysis of the results as well as the graphical illustration of the findings. Concluding remarks and emerging policy implications are included in the final section.

1. Motivation

Transition from a centrally planned to a market economy typically involves massive layoffs and economic slowdown inhibiting vivid job creation. The situation in the early 1990s in Poland was no different, with unemployment rate increasing to the thresholds of above 10% in just two years and since then never falling below this level (Figure 1). Professional and geographic mobility is very low, while transitory migration of approximately 1 million Poles to Ireland, Sweden, Norway, Germany, UK and other EU countries concerns predominantly those aged under 30 years old (80%) and with relatively high skills (17% with a university degree). Long term unemployment rate is the highest in EU (currently app. 10%, EU average falls short of 4%). Employment in agriculture still exceeds 17%, which is extremely high by European standards, while half of the registered unemployed live in the rural areas. In addition, forecasts concerning the agricultural sector at large suggest, that due to increasing productivity, hidden over-employment in this sector will soon transform to de facto unemployment and/or premature labour market exits. Thus, low skills, low mobility and excessive employment in the agriculture are the main structural traits of the labour market problems in Poland.

[Figure 1 about here]

Since the beginning of transition from plan to market, unemployment has taken a strong geographic dimension. However, the differentiation at a regional level is surprisingly low (usually ranging between 3-5pp), while within regional variation reached even 11-fold thresholds. As also the early literature on geographical differences in Poland has shown (Gorzelak, 1996), despite the very high degree of dispersion in the local unemployment rate and its persistence over the post-transition period, there has never been any obvious geographical pattern of the unemployment rate across *voivodships* or *poviats*. In other words, different from the UK or Italy, just to mention some of the best-known examples of high regional unemployment in the EU, there is not a North-South or an East-West divide. Figure 2 shows the geographical distribution of unemployment rates across *poviats*. It confirms that no obvious geographical divide existed also in 2008. Generally speaking the high unemployment *poviats* locate in the North-West, in the West and in the South-East. Moreover, some highest unemployment local labour markets are neighbouring the ones with relatively lowest unemployment rates.

[Figure 2 about here]

This fact has encouraged the literature of the early 1990s to elaborate different classifications of Polish *voivodships* aimed at testing the impact of the industry structure inherited from the past communist era on the spatial distribution of unemployment. The industry was proxied by an index of industrial concentration - and the current level of development - as proxied, among others, by the share of employment in services, the level of

infrastructure and of human capital (Gòra and Lehmann, 1995; Scarpetta, 1995; and Scarpetta and Huber, 1995; Lehmann and Walsh, 1999; Walsh, 2003). However, as argued by Newell and Pastore (2006), none of these classifications actually captures the distribution of flows, which makes them only marginally informational about the distribution in the unemployment rate.

2. A survey of the literature

Before presenting the methodology and data adopted, this section attempts to define the main hypotheses to test and puts them into a theoretical framework. The first section focuses on the link between local worker reallocation and unemployment, showing that no a priori relationship exists among them and brings to the fore two alternative hypothesis to test. The section also summarises the main empirical contributions that support either of the two hypotheses. The ensuing section argues that the empirical literature has attempted to disentangle three possible sources of differences in labour reallocation across regions, namely sectoral shifts, aggregate disturbances and job-to-job moves. The last section highlights temporary and permanent weaknesses of high unemployment regions.

2.1. The link between local worker reallocation and unemployment

The Aghion and Blanchard (1994) model can be used as a framework to study the way labour market dynamics affects the regional distribution of unemployment. Assume that the hiring rate is a bell-shaped function of unemployment. This non-linearity depends on the double effect of unemployment on hiring: on the one hand, unemployment reduces wages, and therefore fosters private sector growth, since with unemployment increasing there is greater competition for jobs and downward pressure on wages; on the other hand, though, unemployment increases the level of taxes per worker, to pay unemployment benefits, thus reducing profits. Assume also that the separation rate is a control variable and is therefore independent of unemployment. When the separation rate is above (below) the hiring rate, unemployment increases (reduces).

As Ferragina and Pastore (2008) argue, although thought to explain national unemployment, this framework might apply also to local labour markets, provided that they are separated from each other due to low migration / commuting. Then, two alternative hypotheses are in order:

H_1: worker reallocation correlates positively with regional unemployment;
H_0: worker reallocation is independent of regional unemployment.

According to H_1, in high unemployment regions more jobs are destroyed and created at the same time. In the spirit of the Aghion and Blanchard model, this happens because each region has a specific rate of structural change, but other hypotheses are also possible, as later discussion shows. According to H_0, instead, the same aggregate shock has yielded different effects in different regions. High unemployment regions have experienced an unsuccessful process of structural change in the past, with a too high separation rate at the beginning, so that the unemployment rate exceeds its equilibrium level. Only at a later stage separation rates converge across regions.

Ferragina and Pastore (2008) suggest that the above hypotheses configure an empirical law to detect the case when unemployment is due to some region-specific shock (H_1) and when it is due to labour market rigidities (H_0). The policy implications of these alternative hypotheses are partly different. Whilst a low job finding rate essentially indicates the need for supply side policies in favour of the long-term unemployed, namely increasing labour market flexibility and/or educational reforms and active labour market policy on a large scale, H_1 also requires

interventions on the demand side. For instance, assuming that the government is able to do so, it should reduce the rate of separation and/or increase the life expectancy of private businesses in the high unemployment regions. This might in turn require removing the sources of structural change in high unemployment regions.

The empirical evidence available in the literature is neither large nor unambiguous. The main reason is the limited availability of suitable longitudinal data to measure labour market dynamics at a local level. In addition, the sign of the relation under consideration might change over time.

Robson (2001) finds no correlation between the worker reallocation and unemployment across the UK macro-regions in the decade 1984-1994. In the case of transition countries, some authors (such as Boeri and Scarpetta 1996; Boeri 2000; the World Bank 2001; Rutkowski 2003) interpret the low rate of monthly labour turnover based on employment registry data of high unemployment regions as a consequence of low labour market dynamism. Other studies find evidence that high unemployment regions are those where the degree of worker turnover is higher. For the UK, Armstrong and Taylor (1985) use male monthly inflow data from unemployment registry data and find that they positively correlate to local unemployment rates. Newell and Pastore (2006) use labour force survey measures of annual gross worker flows and find a correlation coefficient between the job separation rate and the unemployment rate of 0.76, significant at the one-percent level, during the period 1994-1997. In the case of Italy, Contini and Trivellato (2006) find that the traditionally high unemployment regions in the South have a higher (not a lower) degree of worker turnover as compared to low unemployment regions in the North. Naticchioni, Rustichelli and Scialà (2006) find similar evidence that would support H_1 using the ISFOL panel based on ISTAT Labour Force Survey data.

An explanation of H_0 is sometimes found in the well-known Krugman (1994) hypothesis. It states that the higher the degree of labour reallocation experienced in a country (region), the lower the unemployment rate: greater labour reallocation means, in fact, lower frictional and long-term unemployment. The rate of reallocation should be, hence, higher in low unemployment, boosting regions. In high unemployment regions, there are more workers with a higher probability of losing their job due to the spatially asymmetric impact of rigid labour market institutions. Extensive literature highlights, among other things, the role of rigid wages and legislation protecting employment, non-employment subsidies and early retirement schemes (see, among others, Boeri 2000; World Bank 2001; Rutkowski and Przybila 2002; Funck and Pizzati 2002; 2003). Garonna and Sica (2000) find a negative association between the Lilien index of structural change and the unemployment rate in Italy: in particular, sectoral and interregional reallocations in Italy would reduce unemployment, rather than increasing it. Böckerman (2003) takes the same result for Finland as evidence of Schumpeterian "creative destruction".

A related issue is whether it is the inflow or the outflow rate to affect unemployment over time. Blanchard and Summers (1986) claim that a higher degree of cyclicality of the hiring rate is behind fluctuations in US unemployment. Burda and Wyplosz (1994) note that European countries differ in terms of the degree of cyclicality of hiring and firing rates. While some EU countries follow US trends, others, instead, have a cyclical firing rate. Layard, Nickell and Jackman (1991) summarise this research partly confirming the hypothesis that a low job finding rate is behind high unemployment rates, due to the increase in long-term unemployment and its persistent impact on average unemployment. Shimer (2007), demonstrates that flows into unemployment do not reproduce the dynamic patterns observed in the unemployment rate, while the only flow that contributes to unemployment growth is the evolution of the job creation (finding) rate[1].

[1] A number of studies have replicated Shimer's findings for other countries: Strawinski (2008) for Poland.

2.2. The sources of worker reallocation

If H_1 holds true, what are the sources of the reallocation and why are they different across regions? Several hypotheses have been raised in the literature:

H_{13}: different sectoral shifts across regions (Lilien hypothesis);

H_{12}: aggregate disturbances with spatially asymmetric effects (Abraham and Katz hypotheses);

H_{11}: a crowding out of employed job seekers in low unemployment regions (Burgess hypothesis);

According to H_{13}, some sectors/regions experience a permanent reduction in labour demand that causes local unemployment. Lilien (1982) found a strong positive correlation over time between the aggregate unemployment rate and the cross-industry dispersion of employment growth rates in the US[2]. Most studies use some variation of the Lilien index[3]. However, Abraham and Katz (1986) and a number of related studies (such as Neelin, 1987; Fortin and Araar, 1997) argue against the underlying assumption that sectoral shifts can take place independent of aggregate labour demand reductions.

To overcome these criticisms, the ensuing research in the field has pursued the objective of finding empirical ways of disentangling sectoral shifts and aggregate disturbances. Several approaches have been developed. First, Neumann and Topel (1991) develop a macroeconomic model where the equilibrium level of unemployment in a region depends on its exposure to the risk of within-industry employment shocks and on their degree of industrial diversity. Their approach has stimulated further research (see, for instance, Chiarini and Piselli 2000; and Robson 2009)[4]. Second, Hyclak (1996, p. 655) proposed another approach based on gross job flows at an establishment level data. He reports estimates relative to a sample of 200 US metropolitan areas over the years 1976-1984 and finds a negative correlation of -0.72 between sectoral shifts and net job growth. Third, Holzer (1991) proposes an alternative measure of sectoral shifts, namely the sales growth rates, used to disentangle shifts *between* and *within* local markets. The econometric analysis shows that the former have a much greater impact than the latter.

According to Burgess (1993), the greater worker reallocation in high unemployment regions is due to the lower job opportunities for unemployed job seekers in low unemployment regions. In these regions, in fact, the unemployed are crowded out by employed job seekers who are encouraged to search for better jobs. Consequently, one would observe a higher worker turnover in high unemployment regions simply because in these regions the unemployed who find jobs are a larger relative number with respect to their peers in low unemployment regions.

A number of studies have tested the Burgess hypothesis. Van Ours (1995) finds only partial evidence of competition between employed and unemployed job seekers in the Netherlands. Broersma (1997) finds similar evidence in the flexible UK and rigid Netherlands. For the UK, Robson (2001) finds evidence of employed job seekers crowding out the unemployed especially in low unemployment regions. Burgess and Profit (2001) find that high unemployment levels in neighbouring areas raise the number of local vacancies but lower the local outflow from unemployment. Eriksson and Lagerström (2006) study the Swedish Applicant Database and find evidence that unemployed seekers face a lower contact probability than employed job seekers.

[2] Lehmann and Walsh (1999) suggest an alternative explanation of why sectoral shifts are associated with higher unemployment: where human capital is interchangeable, workers do not oppose restructuring, which takes place generating unemployment, but also fast output recovery.

[3] Among the available studies, it is worth mentioning Samson (1985) for Canada; Berg (1994), Barbone, Marchetti and Paternostro (1999), Newell and Pastore (2006) for Poland; Krajnyàk and Sommer (2004) for the Czech Republic; Robson (2009, p. 282) for the UK.

4 The above discussion shows the existence of a clear link between Lilien's argument and Simon (1988) and Simon and Nardinelli's (1992) hypothesis of a portfolio effect in the labour market (see for surveys Elhorst 2003, p. 735; and Ferragina and Pastore 2008, p. 91).

In conclusion of this section, it should be noted that no study compares the above hypotheses in the same theoretical framework. Most studies provide instead evidence of only one source or, in several cases, they contrast two hypotheses.

2.3. The weakness of backward regions

The next obvious question arises as to why some regions experience shocks more frequently or with greater intensity than others. There are sources of structural change that tend to be transitory and others that are permanent. The former include the opening up to international trade of new competitors and the introduction of new technologies causing some productions to go out of market.

Due to their specialisation in low-skill intensive productions, high unemployment regions tend to be much more exposed than average to international competition arising from the opening up to international trade of emerging market economies with similar product specialisation. In addition, due to the lower degree of product diversification of backward regions, technical change is likely to generate more unemployment, due to the portfolio effect.

Considering these sources of structural change transitory does not mean that they happen only for a short period of time. For instance, the economic integration of CEECs productions on EU markets began in the late 1980s and is still ongoing; the same also applies to the European integration of the so-called Chindia. In turn, this means that the actual impact of transitory sources of structural change depends ultimately on specific structural and permanent 'weaknesses' of high unemployment regions, namely their low competitiveness and low local attractiveness to investment from abroad due to:

a) Low human and social capital endowment;
b) High (organised) crime rate;
c) Reduction in migration as an adjustment mechanism;
d) Economic dependence on more developed regions;
e) Poverty traps.

The above discussion has helped defining a number of hypotheses to test in the empirical analysis. Naturally, these hypotheses have both the time and the cross-sectional dimension. Namely, some processes are usually categorised as the so-called slow-moving changes (e.g. migration, human capital formation, etc.), whereas some of the processes have instantly observable consequences (e.g. industrial restructuring). For the former type, the cross-sectional analyses tackling adequately the dynamic component seem particularly relevant. Moreover, cross-sectional analysis should be pursued at a policy relevant level. Our subsequent analysis in the next sections follows these recommendations.

3. Data

This paper employs data from three main sources: a) reporting of stocks and flows of registered unemployed by local labour offices (LLOs) for the Ministry of Labour and Social Affairs (ML&SA); b) the unemployment rate from the Central Statistical Office; and c) control variables from the Bank of Regional Data.

The first source provides the bulk of the data bank. It is very rich, as it refers to 380 *poviats* (i.e. counties classified in the EU as LAU1 units - 314 land counties and 65 city counties)[5] over the period from January 2000

5 A poviat is the second-level unit of the local government and administration in Poland, equivalent to a county or a district (LAU1 in the EU classification, formerly NUTS4). A *poviat* is part of a larger unit or province called a *voivodship* (NUTS2 in the UE classification). In turn a *poviat* is usually subdivided into *gminas* (i.e. municipalities or communes). However the more important towns and cities function as separate counties in their own right, with no subdivision into *gminas* (the so-called city counties). There are 314 land counties and 65 city counties. Public employment services have *poviat* coverage with no separate service centres existing at a *gmina* level.

(2000M1) to December 2008 (2008M12). The length of the period that the data covers allows us to consider both times of considerable unemployment growth (2001-2003) and of subsequent decrease (2005 onwards).

The data yields an overall number of 40,201 observations. This large number of observations is crucial at least for two reasons: first, it cannot be obtained from any other source of data at a local level; second, it guarantees high statistical efficiency of the estimates. The *poviat* (not the individual unemployed) is the unit of observation. In other words, each LLO reports monthly aggregate measures of the indices of interest to the ML&SA. Therefore, this dataset does not permit individual level analysis.

Despite this shortcoming, the dataset used in this paper is a unique source of information for the level of detail it reaches, since no other statistical source on labour market dynamics is available at this level of aggregation in the country (and also elsewhere). The labour force survey does have a quasi-panel dimension, which allows computing (quarterly and annual) labour market flows, but it does so only at the NUTS2 level (Pastore and Socha, 2005). The latter include 16 *voivodships* since the administrative reform of 1999. However, there are two main reasons why a *voivodship* level analysis may not be satisfactory. First, the information content of the regional aggregates is low (Tyrowicz and Wójcik, 2010). Second, it is exactly at the local level that decisions regarding labour market policy are taken today in the country.

A shortcoming of working with *poviat* data, though, is that only few control variables are available. Nonetheless, using the stock of unemployed obtained from ML&SA data and the unemployment rate from CSO data, we were able to compute the labour force size of *poviats*. The latter we use as a denominator to normalise stock and flow variables and hence make them quantitatively comparable. In addition, information was also collected about such other variables as the employment composition by broad sectors, namely agriculture, industry and services, as well as the investment intensity and the wealth of *poviats*. The data on employment composition is available only annually from 2003. The private ownership share in employment is available for the same years. Moreover, annual data relative to private per capita fixed capital formation is available since 2002. Finally, we obtained the annual data on personal income tax revenues in *poviats* for the period covering 1999-2008 period. Rescaling personal tax revenues by the size of the local labour force yields a proxy for GDP per capita, which is not available. Other potentially relevant data is reported only at the *voivodship* level.

3.1. Inflows and outflows

The registry data includes information on two types of flows into the registry and three types of flows out of the registry. The former allows the separation into a group that is registering for the first time (FT), and a group that is re-registering (RR). The data on the outflow permits to observe separately those who find a job (JF), those who are de-listed from the registry for administrative reasons (AD) and those who are temporarily attending active labour market schemes (AS). The total inflow rate is defined hence as a sum of all inflows over the labour force:

$$Inflow = \frac{FT + RR}{LF}, \tag{1}$$

whereas the total outflow rate is defined as a sum of all outflows over the labour force:

$$Outflow = \frac{JF + AD + AS}{LF}. \tag{2}$$

Finally, the unemployment rate is

$$Urate = \frac{registered\ unemployed}{LF} \tag{3}$$

Turnover rate is then defined as a sum of inflows and outflows. This is a typical approach in the literature (cfr. review in Ferragina and Pastore, 2008). While it captures well the absolute dynamics in the labour market – as opposed to net flows – such measure is also "blind" to whether these are the inflows or the outflows that differ across units. To inquire which of the flows has a dominant contribution to the variation in the unemployment rate, we estimate the model both for the turnover as a whole and with separation of the inflows and the outflows.

Nonetheless, these overall flows might not be entirely related to the labour market dynamics, but to the administrative reasons as well. To see why, consider that there are three main reasons why individuals register with the LLOs: access to job offers, to unemployment benefit and to health insurance (covering all dependent family members). Only the unemployment benefit is temporary (usually 12 months, never exceeding 18 months) and some of the registered unemployed are not entitled to it at the time of their first registration[6]. Individuals ineligible for the unemployment benefit may apply to the social assistance institutions, which provide means tested benefits. Moreover, registration with the social assistance provides health insurance as well. Consequently, in fact, only weak incentives exist to maintain registration with the LLOs.

On the other hand, under the Polish legislation, an unemployed person is obliged to demonstrate "willingness to undertake employment". There is no strict definition of what exactly is expected of the unemployed, but local internal regulations in the LLOs permit their representatives to remove individuals from the registry on various grounds. As a matter of fact, LLOs draft independently internal regulations, which serve as "interpretations" of the country-wide legislation. For instance, in some *poviats*, the registered unemployed may be removed from the registry if they refuse to accept a job offer coming from an institution known for it has violated the labour code – which in other *poviats* would not be allowed to place a vacancy with the public brokering system. In addition, some of the LLOs are temporarily or permanently subjected to incentives to abuse the discretionary "de-listing" for fiscal and organisational reasons.

These incentives originate from the conflict between different financing schemes. On one hand, the higher is the number of registered unemployed, the larger is the state-level financing for "activation" policies. On the other hand, local authorities – who supervise public employment services and are obliged to bear all the payroll and institutional expenses – occasionally exert pressure to decrease headcount in the respective LLO as well as the number of registered unemployed for both financial and political reasons. Either of these effects is likely to dominate temporarily in a particular *poviat*. Consequently, there is considerable heterogeneity relative to how the legislation is being implemented.

These movements into and out of the registry can be called "administratively driven flows" and might affect the results. To take into account this possible source of bias, the analysis will distinguish turnover due to "market driven flows" (outflows to employment, JF, and first-time registrations, FT) from turnover due to "administratively driven flows" (de-listings for administrative reasons, AD, individuals participating in the activisation schemes, AS, and the re-registrations, RR). Also the unemployment rate has been adjusted to:

$$urate^{A} = \frac{(unemployed - AD)}{LF - AD}, \tag{4}$$

6 These groups include the youth without prior employment experience, individuals returning to the labour market after a prolonged period of inactivity and the handicapped.

In fact, the administratively driven flow is of considerable size and might therefore affect changes in the local unemployment rate in a way that is not related to the theoretical underpinnings of this study, Table 1. The hypothesis underlying empirical testing certainly concerns market driven adjustment, rather than administrative factors. Consequently, we pay particular attention in the estimations to disentangling these two effects, to the extent that data quality permits it.

[Table 1 about here]

There are two main limitations of these robustness checks. First, the categories of flows that are available do not allow identifying in a clear way the reason of delisting and re-registrations. Only some of them are due to administrative reasons. That is why, it is not possible to simply compute the importance of this flows and subtract them from the market driven flows, which would be the best strategy. The only way to address the importance of administrative factors is checking whether they affect the results of the econometric analysis.

Second, administratively generated flows may affect the findings in a way that is not possible to predict a priori. Two possible hypotheses are in order: on the one hand, some offices might wish to de-list unemployed from the register to show that their policy against unemployment was successful; on the other hand, other offices might wish to keep the unemployed in the register or re-register them to justify the request of funds from the higher levels of government. In turn, these differences might be related in some way to the local unemployment rate. On the one hand, local labour markets with higher unemployment rates tend to have also a higher incidence of long-term unemployed, who are more frequently "de-listed". At the same time, though, the majority of the individuals who are removed from the registry for administrative reasons re-register after a period which has fluctuated over the last ten years from one to three months[7]. Which of these tendencies is prevailing is a matter of empirical testing.

3.2. Clusters of poviats

In order to verify the robustness of the results to outliers or to specific clusters of *poviats* sharing similar structural characteristics, a stratification strategy has been pursued. Due to the data limitations at a *poviat* level, we cannot replicate the classifications of Gòra and Lehmann (1995); Scarpetta (1995); Scarpetta and Huber (1995); Lehmann and Walsh (1999) or Walsh (2003). In fact, they are all based on early 1990s data and use an administrative division of the country that does not exist anymore. We thus resort to a new type of subsampling that is possible with the data actually available.

The rationale behind the stratification adopted is to distillate those local labour markets of whom it may be expected that either relatively larger or relatively more contained structural change has occurred. For example, *poviats* which ranked among the lowest in service employment in 2003 and among the highest in 2008 must have undergone significant structural changes. On the other hand, *poviats* with the lowest share of private ownership, the lowest investment rates and the highest employment share in the agriculture can be identified as relatively resistant to transition forces. For the reasons of data availability, the stratification is thus based on four variables: the share of private firms in employment, the share of services and agriculture in employment and the investment intensity. The following groups of *poviats* have been identified:

a) LAGGARDS - [44 *poviats*] with low private ownership (bottom 25%), high share of rural employment (top 25%) and low investment rate (bottom 25%)
b) IN TRANSITION – [74 *poviats*] with both high rural and service share in employment (top 25% in both)

7 The correlation coefficient between re-registrations and de-listings is of roughly 0.74 and highly significant from a statistical point of view.

c) PRIVATISED INDUSTRIAL – [66 *poviats*] with high private ownership (top 25%) and high industry contribution (top 25%)

Naturally, *poviats* "travel" across the quarters of variables distribution, while this migration is also endogenous to the labour market turnovers. Thus, we use the earliest available data (2003 for employment shares, 2002 for investment) which partially addresses the problem of the mutual reinforcing between the structural change and the turnover. In addition, these classifications are not mutually exclusive in a sense that the same *poviat* may belong to more than one groups, while some *poviats* may appear in none of the groups. The purpose of this grouping, however, has not been to classify all the *poviats*, but rather to distillate those, who are more likely to expect larger (INDUSTRIAL, IN TRANSITION) or smaller (LAGGARDS) structural change.

To corroborate the adopted typology we have also computed the Lilien Index for the available years. While employing the index directly in the computations would reduce the sample to just two years of data (2004-2005), we can test if indeed the selected stratification of *poviats* is characterised by more industrial change, as suggested above. The results of this simple analysis are presented in Table 2. In all of the cases where relatively larger industrial restructuring is expected (IN TRANSITION, INDUSTRIAL), the Lilien Index is larger than average in a statistically significant way. Moreover, for the LAGGARDS group it is also smaller in a statistically significant way. Consequently, the adopted stratification seems to reflect well the concept of the industrial restructuring.

[Table 2 about here]

The final source of information used as a control variable is personal income tax revenues. Since PIT is proportional to individual income, it is a reliable proxy for the unavailable measure of GDP per capita. However, it is not available for city *poviats* for the whole analysed time span. Moreover, this information is provided only at an annual frequency. Moreover, since 2004 there has been a considerable increase in the proportion of PIT revenues assigned to the local authorities. Consequently, to address this data inconsistency and avoid the nominal character of the data, we standardise this variable year-wise. This approach still permits to explore the regional variation.

4. Methodology

This paper aims to study whether the regional variation in unemployment rates is related to labour turnover and what is the direction of such relationship. In addition, the paper aims to assess the relative impact of inflow and outflow from unemployment on the dynamics of the local unemployment rate. Large turnover is consistent with more flexibility, thus implying that it could be associated with lower unemployment (frictional unemployment gets reduced faster). On the other hand, large turnover is also consistent with more structural change, suggesting that larger turnover could also be associated with higher unemployment (structural unemployment is larger). These two competing explanations need to be disentangled empirically. However, these processes are likely to co-exist at a given time (some local labour markets following the former hypothesis and others the latter) or over time (one labour market behaving according to the latter hypothesis in downturns and according to the former in upturns). Thus, without the necessary controls, the estimated coefficient would only signify quantitative dominance of one of the hypotheses, but not necessarily prove any of the theories

With reference to inflows and outflows from the unemployment pool, little analysis has been done so far at a local level, mainly due to the data shortages. The importance of inflows and outflow rates for the determination of local unemployment rates and their convergence cannot be overstated, while it has also been recognised in the literature. For example, Newell and Pastore (2006) argue that it is the hazard of job loss differentiating for

employees with longer tenure that drives the regional differences over the period of 1995-1999. Unfortunately, they use data for the pre-reform administrative structure.

The theoretical predictions, as discussed in the previous section, suggest the following formulation of the model:

$$urate_{i,t} = \alpha_i + \beta_i TURNOVER_{i,t} + \nu_t + \varepsilon_{i,t} \quad (4a)$$

and, alternatively,

$$urate_{i,t} = \alpha_i + \beta_i^I INFLOWS_{i,t} + \beta_i^O OUTFLOWS_{i,t} + \nu_t + \varepsilon_{i,t} \quad (4b)$$

The key aspect of the analysis concerns the elaboration of the cross-sectional dimension of the data. The time dimension – nearly a decade of monthly observations – contribute to the richness of this dataset, but also posits a technical challenge in the estimations, due to the natural autocorrelation in the unemployment rate. One way to tackle this problem would be to apply a robust fixed effect panel data estimator with time controls. However, the model is a single equation, one with autoregressive dynamics and explanatory variables that are not strictly exogenous. We are also facing heteroscedasticity of unknown form. There are several ways to handle dynamic panel bias, but LSDV does not address the potential endogeneity of other regressands[8]. Hence the Generalized Method of Moments (GMM) applies in this context[9]. More specifically, Anderson-Hsiao levels estimator is consistent, given our assumptions and this is the specification we treat as benchmark.

Consequently, as the best strategy, we obtain the classic Arellano-Bond (1991) Difference GMM estimator, which uses moment conditions in which lags of the dependent variable and first differences of the exogenous variables are instruments for the first differenced equation. We also use the Huber-White sandwich estimator of variance by specifying robust standard errors. The moment conditions of this type of GMM estimator are only valid if serial correlation is not present in the idiosyncratic errors. But the first difference of white noise can be autocorrelated, so the second and higher autocorrelations should receive more attention. In our results, there is no evidence of serial correlation in the first-differenced errors at order 2, so the moment conditions used are valid.

Subsequently, we proceed to the implementation of GMM. Panel GLS with robust standard errors (including the within and between groups estimators) yields consistent estimator of the range. The estimation of the one-step and two-step GMM Difference estimator as well as GMM System estimator should yield the point estimators within this range (Blundell and Bond 1998; Doornik, Arellano, and Bond 2002). The results are reported for robust fixed effect GLS panel estimator, between effects estimator as well as both GMM-Difference and GMM System estimators. In order to verify the extent to which the estimators are immune to the time-driven heterogeneity, in addition to the monthly data, we also report annual averages. Specific results are discussed in the next section.

The final attempt to tackle the consequences of endogeneity and the time dimension of the data consists of a very simplistic approach, possible due to the richness of the dataset. Namely, we resort to using only 2000 annual averages for the right-hand side variables (turnover as well as inflows and outflows) and 2008 annual averages for the dependant variable (unemployment rate). In addition, both RHS and LHS variables have been standardised to assume N(0,1) distribution. This way the absolute level of unemployment is no longer relevant in the estimations, neither are the absolute values of turnover, inflows and outflows. This way we may explore a cross-sectional

[8] Comprehensive surveys of these estimators can be found for instance in Arellano and Honore (2001) or Blundell, Bond and Windmeijer (2000)

[9] In order to adequately establish the structure of the GMM estimation, we first estimate a simple dynamic model. This allows to understand better the dynamics of the process, thus yielding the boundaries for the structure of the estimation. As expected, the first lag of the dependent variable in the OLS regression is correlated with the fixed effects in the error term, creating dynamic panel bias (Nickel 1981). After accounting for the fixed effects in the model, the initial naive GLS regression demonstrates that the lagged dependent variable is positively correlated with the error, biasing its coefficient estimate upwards, and for the within groups, the opposite effect is observed.

dimension, without running the risk of endogeneity (LHS variables precede RHS by 8 years, while the level of absolute unemployment rate in 2000 and in 2008 were roughly comparable, compare Figure 1). This last analysis serves the purpose of enhancing the robustness of the findings.

5. Results

The results section first presents descriptive statistics and then the results of the estimates for the overall sample. This will allow us to bring to the fore the main thesis of the paper. The rest of the section discusses the results of several robustness checks.

5.1. Data properties

Table 3 supplies descriptive statistics of the variables used in the econometric analysis. All numbers in the table represent averages over the entire period.. "Industrial" *poviats* follow in the ranking of the most densely populated (and - by definition - urbanised). As expected, the *poviats* lagging behind and included in the other two groups include some of the least densely populated regions and also those with the highest unemployment rate. Note that the average unemployment rate in the sample is lower than the average unemployment rate in each group of *poviats*. This can be understood considering that the groups of regions defined in the previous section are not mutually exclusive.

[Table 3 about here]

Figure 3, Panel (a) provides scatters of inflow and outflow rates by year for all the *poviats* in the sample. Both components of labour turnover present a high degree of variation, over time and across units. Nonetheless, they positively correlate with each other in every year of the period considered. This depends on the nature itself of labour market dynamics, which always tends to fluctuate around some equilibrium unemployment level. Nonetheless, at a careful glance, it appears that the slope of the scatters tends to be flatter (steeper) when the unemployment rate is increasing (reducing). Overall, this is as if it was not the gap in inflow or outflow rate, but the gap in both flows, namely the gap in the overall turnover rate, as suggested in the theoretical hypotheses defined in section two, that correlates with the gap in unemployment rates. Panel (b) of Figure 3 shows the same variables as Figure 3, but by *voivodship*. Again, the correlation is positively sloped for all *voivodships*, although in some of them the slope is obviously steeper than in others, due to the variation in unemployment rates across *voivodships*.

[Figure 3 about here]

This is confirmed by inspection of Figure 4 which reports the average levels of monthly inflow, outflow and unemployment rates by *voivodship*. The former two are measured on the left-side, while the latter is measured on the right-side. Clearly, the data shows that the unemployment rate is reducing when the inflow overcomes the outflow from it; and vice versa. However, in addition to the time dimension, visual inspection reveals that there is also a high correlation in the rates of inflow, outflow and unemployment across regions. In fact, while the time effects are a natural phenomenon, it is the cross-sectional dimension that could possibly allow testing the theoretical hypothesis discussed in the opening of this paper. Thus, exploring the cross-sectional variation lies at the core of the analysis in the reminder of this paper.

[Figure 4 about here]

5.2. Results of the estimations

Results are reported separately for four types of estimations. In the first estimation, we use raw and adjusted data and report estimated elasticities. There are two preferred model specifications with two ways to disentangle the turnover: (i) to inflows and outflows and (ii) to turnovers due to the labour market processes (JF, AS and FT[10]) and to the part attributable to the administrative flows (AD and RR). Second estimation consists of the two preferred specifications for the comparison across the stratification groups, as discussed earlier. The third estimation employs GMM approach, with system and difference GMM. All these three specifications use monthly data. In the last estimations annual averages are reported, where we re-estimate the original model in logs as well as the GMM.

Table 4 reports the results of the estimation in logarithms. We used fixed effect panel GLS estimator with robust standard errors, additionally including the monthly and annual dummies. Estimations were performed on raw as well as adjusted data. As described in section 3, the former are the originally reported unemployment rate as well as the turnover rate, whereas the adjusted data do not take into account those who are administratively de-listed, equation (3a) and (3b). Results demonstrate a consistent positive and significant estimator. The size of the estimated elasticity is consistent across the specifications, but slightly lower in the case of adjusted data. This last finding suggests that administratively driven outflows are considerable and contribute negatively to the unemployment rate. This is confirmed upon the inspection of elasticity by the AD variable – across all specifications on the raw data it is negative and statistically significant.

[Table 4 about here]

Also inflows and outflows separately are statistically significant. The coefficients are considerably larger for the aggregated inflows than for the outflows, but this differential is partly reduced when we move from raw data to the adjusted data. In fact, larger responsiveness of the unemployment rate towards inflows may stem from two sources. Firstly, the number of periods when the unemployment increased dominates in the sample, while such circumstances are also associated with the larger contributions of inflows to the aggregate changes in the unemployment rate. Secondly, as already discussed earlier, *poviats* with higher unemployment rate are typically those with larger share of the long-term unemployed, who tend to drop out of the registry and re-register more frequently than other unemployed.

This last assertion is corroborated by the analysis of five flows separately. There is naturally a consistently negative contribution from the administrative de-listing (AD) and – quantitatively minor – from the flows into activisation (AS). However, market driven flows of job finding (JF) and first time registrations (FT) have both positive contribution and a comparable size of the elasticity estimate. This finding remains essentially the same for the adjusted unemployment rate and flows, with the size of the elasticity estimates nearly the same. Consequently, it seems that indeed markets with larger market-driven turnover are the ones with higher unemployment rates, which provides empirical support to the Aghion and Blanchard (1994) hypothesis. Also re-registrations have a positive contribution, though, this is a natural effect.

As to the control factors, including the share of employment in services or investment rate does not change quantitatively the findings. The *poviats* experiencing increase in capital availability relative to the rest of the country tend to also decrease their unemployment rate. On the other hand, service sector seems to provide less stable jobs than industry or agriculture, thus yielding higher turnover and unemployment rate. The relative wealth, as proxied by the standardised tax revenues, seems to be associated with higher unemployment rates, *ceteris paribus*. However, the change in the point estimators for the turnover, inflows and outflows is a not a consequence

[10] Note that FT serves as a proxy for job destructions.

of including these control factors, but rather the fact that tax data are unavailable for the city *poviats*, so they are dropped from the estimation.

Although the findings seem stable and consistent across specifications, with the autocorrelation and heteroscetasticity as well as with the risk of endogeneity, GLS estimator with time dummies may result in inconsistent estimators. To evaluate empirically the severity of its consequences, we also employ alternative specifications of the GMM estimation. Naturally, GMM focuses more on the "within" or time-dimension, but it also provides a reliable estimate of how the GLS estimators may be biased vis-à-vis this dimension. Table 5 reports the results for the alternative GMM specifications.

[Table 5 about here]

In fact, GMM estimators differ considerably in size and in sign. Namely, turnover coefficient as well as the outflows coefficient are both significant and negative, while inflow remains positive. However, the lowering of the estimator sizes raises doubts in the reliability of these estimates. Namely, it seems that instruments have low power, in capturing the cross-sectional dimension. Thus, it seems that GMM – both system and difference specifications – tackle well the autocorrelation, but not necessarily the heteroscedasticity. What follows, is that the negative consequences of the autocorrelation induced by the time dimension of the data are effectively reduced – if not removed – due to the large size of our sample, whereas heteroscedasticity is better tackled by the robust GLS estimator than the GMM. Nonetheless, we find again that the estimator of the inflows coefficient is much larger than the one of the outflows, which further corroborates the findings discussed earlier.

The lack of GMM reliability is confirmed when annual data are analysed, Table 6. Namely, the Andersen-Hsiao estimator is no longer statistically significant, while the two-step GMM estimator reports extremely low values of the estimated coefficients. By contrast, the annual data reveal larger coefficients in the panel GLS estimation. Moreover, the between effects estimator – which is exceptionally immune to time-driven effects – is actually even larger than the fixed effect estimator. Here too, the elasticity towards the inflows is larger than towards the outflows.

[Table 6 about here]

Summarising, these results demonstrate – mainly by exploring the cross-sectional dimension of the data – that both inflows and outflows are positively correlated to the unemployment rate. Leaving aside the ambiguous question of causality, this relationship is robust to the inclusion of other control variables as well as measure of labour market flows and unemployment rate. In fact, correction for the administratively driven flows, albeit imperfect, changes the size of the estimators, but not the main conclusion. Furthermore, the analysis demonstrates that the elasticity vis-à-vis inflows is considerably larger than in the case of outflows. Since this effect virtually disappears if only market driven flows and adjusted unemployment rate are analysed, it points to the relevance of the administratively driven flows – especially the re-registrations – in determining in the unemployment rate disparities observed in Poland. In the reminder of this section we verify if these results may be attributed to some "special cases" of *poviats*, or are they indeed general.

5.3 Robustness checks

Two types of the robustness checks were performed: stratification and the analysis along the distribution. Since the data set is so rich, stratification or grouping does not hazard the statistical quality of the findings. At the same time it permits exploring further the cross-sectional variation. Finally, in order to verify the robustness of the results, one more attempt was made to "exogenise" the potentially endogenous variables as much as possible. We

have plotted the variables of interest (i.e. turnover, inflows and outflows) as recorder in the beginning of the time span (i.e. annual averages for 2000) against the unemployment rate at the end of the time span available for the analysis (i.e. the annual averages for 2008). In fact, the aggregate unemployment level in 2000 and in 2008 were fairly similar, but doubled in between these time boundaries.

First, we have distilled *poviats*, where the industrial restructuring processes have been intense. These are the groups characterised as INDUSTRIAL and TRANSITION. On the other hand, LAGGARDS are the *poviats* were industrial restructuring has been less intense, relative to the rest of the country. The robustness consists of inspecting the differences in the estimated point coefficients across these groups. Table 7 reports the results of stratification analysis for the two preferred specifications.

[Table 7 about here]

The stratification analysis reveals that in fact elasticity estimators are consistent and of the same sign irrespectively of the grouping – the differences concern only the size of the estimator. More specifically, estimators are the largest in the INDUSTRIAL cluster, i. e. the ones where industrial restructuring can be expected to be the highest. Naturally, we also find no statistical significance by the service sector employment variable. In addition, we also find that the difference between the estimators of the inflows and the outflows elasticities is no longer as large as in the case of the total sample or the INDUSTRIAL cluster. Finally, it seems that "active de-listing" seems to be particularly at play in this group of *poviats*, since this is the only estimation where institutional turnover exhibits a negative elasticity towards the unemployment rate.

The second robustness check – the distributional analysis – consisted of estimating the coefficients on turnover, inflows and outflows in deciles of poviats along the distribution of unemployment rate at the beginning of the analysed period. In fact, *poviats* rarely change these decimal groups, while most of the mobility is found in the middle of the distribution, which suggests that (i) grouping based on the initial unemployment rate is valid for the whole period of analysis, Tyrowicz and Wójcik (2009).

[Figure 5a, 5b and 5c about here]

Panel (a) of Figure 5 displays the estimated elasticity and confidence interval on the turnover, while panels (b) and (c) contain the same results for inflows and outflows, respectively. Clearly, all the coefficients are statistically significant and of the same – positive – sign. However, the effect is much stronger among the *poviats* with the lowest unemployment rate and the difference in the size of the estimated coefficient is statistically significant between the lowest unemployment decimal group and the rest of the sample for all the estimators. This finding is in a sense intuitive – in the low unemployment regions the current changes in the labour creation and labour destruction have more decisive contribution to the current situation. In the regions with higher unemployment rate the accumulated stock of the unemployed is actually large enough to make the flows quantitatively less important for determining the unemployment rate. Thus, although the strength of the effect is visibly different along the distribution of the unemployment, it is also consistently of the same sign and statistical significant for all deciles.

The last attempt to corroborate the findings discussed above consists of a graphical analysis. Figure 6 displays the scatter plots of the unemployment rate in 2008 on the vertical axis against the turnover (panel a), inflows (panel b) and outflows (panel c). Each of the graphs is consistent with the statistical findings reported earlier. Namely, *poviats* with relatively larger turnover, inflow and outflow in 2000 are characterised by relatively larger unemployment rate in 2008. This finding also further undermines the reliability of the GMM estimates – the negative sign of the outflows and turnover estimators seems to find little justification in the graphical analysis of the data.

Concluding remarks

When inquiring the link between the local labour market dynamics – proxied by the turnover – and the unemployment rate, many ambiguous hypotheses may be formed. In fact, the theoretical foundations give prediction for both positive, negative and virtually no relationship between these variables. In this paper an attempt was made to quantitatively verify the empirical pattern linking the labour market turnover and the unemployment rate using a rich dataset encompassing nearly 10 years of monthly data. We resort to a policy relevant level of a *poviat* (county). We find a statistically significant and economically large positive estimator on turnover as a whole as well as its components: inflows and outflows.

The empirical analysis of this paper builds on a theoretical model by Aghion and Blanchard (1994). Leaving aside the question of the causality direction, we have focused on exploring the cross-sectional dimension of the data. There is no clear spatial pattern of the unemployment rate in Poland, while unemployment rate differentials are extremely high and persistent. The empirical findings lend support to the assertion that the larger the flows in the local labour markets, the higher the unemployment rate. This finding may also be interpreted as evidence of the inefficiency of the labour market institutions, whose role would be to smoothen the job-to-job as well as unemployment-to-job flows.

The policy implications of our findings are far reaching. In fact, providing empirical evidence in support of the Aghion and Blanchard (1994) model suggests that the key to reducing the unemployment rate lies in the supply side policies. This implies that instruments addressing the needs of the long-term unemployed, educational reforms and active labour market policy on a large scale are necessary for actually combating the unemployment rate differentials – so far persistent and extremely high – across Polish *poviats*.

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Appendix of Tables and Figures

Table 1.Inflow and outflow components of the turnover

Flow	Share in		
	inflows	outlows	turnover
Administrative de-listing (AD)		0.411	0.119
Job finding (JF)		0.527	0.152
Re-registration (RR)	0.806		0.573
First-time registration (FT)	0.194		0.138
Activisation schemes (AS)		0.063	0.018

Source: Own elaboration on ML&SA data.

Table 2. The Lilien Index by the stratification groups

Group	Mean	Max	Min	% of poviats above mean	T-test
Total sample	.055	.286	.002	-	-
Laggards	.062	.099	.022	27%	***
Transition	.068	.240	.013	41%	***
Industrial	.078	.197	.009	67%	***

Source: Own elaboration on ML&SA and CSO data. T-test for the equality of means reported, *** denote statistical significance at 1% level.

Table 3. Descriptive statistics by group of *poviat*

Variable	Full sample	Laggards	Transition	Industrial
Unemployed registering	566.68	394.69	379.90	862.22
(flow)	[422.4129]	[269.7165]	[229.1238]	[661.5636]
Unemployed who got employed this month - JF	268.74	181.59	176.28	375.77
(flow)	[210.3583]	[141.8534]	[123.2595]	[321.1451]
No of unemployed	6 922.39	5 684.82	5 405.76	9 763.32
(stock)	[5227.872]	[3834.46]	[3277.776]	[8229.325]
No of unemployed, previously registered - RR	416.61	296.33	283.90	614.86
(flow)	[293.3067]	[214.3105]	[183.5827]	[434.9242]
No of delisted unemployed - AD	192.20	127.15	125.61	328.05
(flow)	[179.4544]	[97.5701]	[89.2682]	[268.931]
No of unemployed, first time registered - FT	150.07	98.36	96.00	247.37
(flow)	[168.9209]	[77.7356]	[68.6223]	[275.4883]
No of unemployed, in activisation schemes - AS	102.08	80.40	78.10	134.16
(flow)	[104.6981]	[78.3089]	[71.6473]	[147.5468]
Labour force [computed]	43 218	33 797	32 941	73 396
(stock)	[58286.38]	[18196.74]	[15952.96]	[71876.52]
Service share in employment	0.403	0.220	0.229	0.586
(stock, % of working population)	[.1459]	[.0413]	[.0395]	[.1328]
Fixed capital formation per capita	- 0.000	- 0.642	- 0.463	0.589
(standardised)	[.9992]	[.0702]	[.4442]	[1.243]
Per capita tax revenues	- 0.000	-0.879	- 0.743	1.376
(standardised)	[.9992]	[0.2641]	[0.3681]	[0.7718]
Unemployment rate [%]	18.66	16.60	16.49	15.49
	[7.5397]	[5.424]	[5.4607]	[6.068]
Adjusted unemployment rate [%]	18.26	16.29	16.17	15.05
	[7.51]	[5.41]	[5.43]	[6.04]
Inflows (FT+RR/LF) [%]	1.540	1.180	1.190	1.380
	[.0069]	[.0048]	[.0048]	[.005]
Outflows (JF+AS+AD/LF) [%]	1.560	1.180	1.210	1.350
	[.0083]	[.0059]	[.006]	[.0058]
Turnover (inflows + outflows) [%]	3.100	2.360	2.390	2.730
	[.0138]	[.0093]	[.0095]	[.0099]
Adjusted outflows (JF/LF) [%]	1.060	0.810	0.820	0.830
	[.0065]	[.0048]	[.0048]	[.0041]
Adjusted inflows (FT/LF) [%]	0.380	0.290	0.300	0.360
	[.0019]	[.0014]	[.0014]	[.0017]
Adjuted turnover	1.440	1.100	1.120	1.200
(adjusted inflows + adjusted outflows) [%]	[.0072]	[.0052]	[.0053]	[.0046]
Number of observations	40 202	4 663	7 843	6 993

Notes: Standard deviations in brackets. Each observation is an average computed on the entire sample period.

Source: Own elaboration on ML&SA and CSO data.

Table 4. Estimations results, unemployment rate (raw and adjusted) as determined variable

	Raw data							Adjusted data						
Variable	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
Turnover	0.2898***			0.2675***				0.1820***			0.1588***			
	[0.0049]			[0.0052]				[0.0036]			[0.0037]			
Inflows		0.2470***			0.2316***				0.1365***			0.1173***		
		[0.0042]			[0.0046]				[0.0028]			[0.0029]		
Outflows		0.0772***			0.0698***				0.1020***			0.0942***		
		[0.0030]			[0.0031]				[0.0025]			[0.0027]		
AD			-0.013***			-0.014***								
			[0.0016]			[0.0017]								
JF			0.0998***			0.0891***				0.0912***			0.0800***	
			[0.0032]			[0.0033]				[0.0035]			[0.0034]	
FT			0.0954***			0.0780***				0.0978***			0.0785***	
			[0.0028]			[0.0028]				[0.0030]			[0.0030]	
RR			0.0898***			0.0860***								
			[0.0039]			[0.0041]								
AS			-0.006***			-0.006***								
			[0.0008]			[0.0008]								
Institutional turnover							0.00814***							0.107***
							[0.000616]							[0.00425]
Market turnover							0.0261***							0.213***
							[0.000551]							[0.00403]
Tax revenues				0.0171***	0.0154***	0.0573***	-0.00584***				0.0287***	0.0194***	0.0603***	0.00462
				[0.0059]	[0.0058]	[0.0046]	[0.000645]				[0.0064]	[0.0063]	[0.0077]	[0.00578]
Investment				-0.071***	-0.069***	-0.103***	-0.0114***				-0.083***	-0.080***	-0.106***	-0.0692***
				[0.0095]	[0.0096]	[0.0145]	[0.00166]				[0.0109]	[0.0109]	[0.0153]	[0.00967]
Services				0.6476***	0.5923***	0.4816***	0.211***				0.7675***	0.7433***	0.4517***	0.578***
				[0.0826]	[0.0831]	[0.1191]	[0.0158]				[0.0939]	[0.0926]	[0.1312]	[0.0871]
Constant	-0.511***	-0.235***	-3.310***	-1.363***	-1.047***	-3.454***	0.247***	-0.746***	-0.346***	-3.109***	-1.135***	-1.212***	-3.044***	-0.675***
	[0.0181]	[0.0207]	[0.0330]	[0.0369]	[0.0395]	[0.0528]	[0.00670]	[0.0162]	[0.0224]	[0.0382]	[0.0403]	[0.0419]	[0.0611]	[0.0424]
No. of observations	39838	39838	33090	39838	39838	32527	33090	39838	39838	39838	33090	33090	33090	33090
R2 between	0.806	0.795	0.0002	0.523	0.560	0.105	0.374	0.764	0.645	0.0005	0.303	0.316	0.0929	0.528
R2 within	0.751	0.759	0.744	0.748	0.755	0.745	0.748	0.738	0.749	0.736	0.736	0.746	0.738	0.764

Note: Monthly data, annual and monthly dummies included. Fixed effect panel GLS estimator with robust standard errors. Tax data only available for land *poviats*,

Table 5. Estimation results, unemployment rate as a determined variable, monthly data

	SYS-GMM						Diff-GMM		
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Turnover	-0.00485***	-0.00483***					-0.00332***		
	[0.000201]	[0.000196]					[0.00000]		
Inflows			0.0111***	0.0110***				0.00148***	
			[0.000119]	[0.000265]				[0.000129]	
Outflows			-0.0101***	-0.0100***				-0.00388***	
			[0.000873]	[0.000220]				[0.000104]	
Market turnover					-0.00739***	-0.00738***			-0.00600***
					[0.000235]	[0.000264]			[0.000186]
Institutional turnover					0.00474***	0.00472***			0.00131***
					[0.000184]	[0.000228]			[0.000137]
Constant	-0.0109***	-0.0110***	0.00666***	0.00663***	-0.00828***	-0.00833***	-0.00134***	-0.00131***	-0.00137***
	[0.000791]	[0.000652]	[0.000680]	[0.000543]	[0.00127]	[0.000147]	[0.000330]	[0.000324]	[0.000326]
No of observations	25104	25104	25104	25104	25104	25104	26237	26237	26237
Model	One-step	Two-step	One-step	Two-step	One-step	Two-step	Anderson-Hsiao	Anderson-Hsiao	Anderson-Hsiao

Note: Annual dummies included

Table 6. Estimation results, unemployment rate as a determined variable, yearly data

	Panel GLS				GMM					
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
Turnover	0.7473***	0.9513***			-0.0333***			-0.00340		
	[0.0222]	[0.0234]			[0.00511]			[0.00295]		
Inflows			0.5664***			0.0938***			0.0352***	
			[0.0352]			[0.00844]			[0.00376]	
Outflows			0.1923***			-0.100***			-0.0297***	
			[0.0293]			[0.00678]			[0.00295]	
Institutional turnover				0.4239***			0.0825***			0.00500***
				[0.0215]			[0.00244]			[0.00160]
Market turnover				0.2624***			-0.0189***			-0.00845***
				[0.0136]			[0.00305]			[0.00253]
Services	0.1715*	-0.3806***	0.1423	0.2761***						
	[0.0969]	[0.0578]	[0.0983]	[0.0977]						
Investment	-0.0257**	-0.0279***	-0.0261**	-0.0277***						
	[0.0100]	[0.0087]	[0.0102]	[0.0093]						
Tax revenues	-0.0474***		-0.0492***	-0.0618***						
	[0.0096]		[0.0099]	[0.0089]						
Constant	1.0076***	1.7492***	1.1788***	0.9935***	-0.105***	-0.0292	0.311***	-0.00906***	-0.00806***	-0.00848***
	[0.0935]	[0.1009]	[0.1102]	[0.1130]	[0.0225]	[0.0249]	[0.0203]	[0.000296]	[0.000305]	[0.000316]
No of observations	2 810	3 384	2 810	2 810	2 250	2 250	2 250	2 628	2 628	2 628
R2 within	0.832	-	0.835	0.816	-	-	-	0.719	0.731	0.721
R2 between	0.839	0.839	0.836	0.833	-	-	-	-	-	-
Model	FE	BE	FE	FE	Two-step	Two-step	Two-step	Anderson-Hsiao	Anderson-Hsiao	Anderson-Hsiao

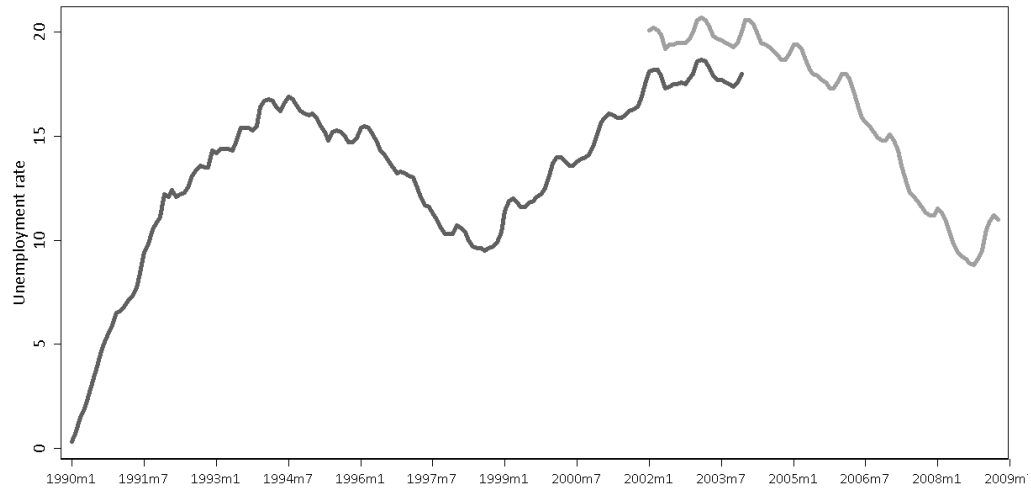
***Notes*:** Annual dummies included

Table 7. Estimation results, stratification, unemployment rate as determined variable

Variables	Laggards			Transition			Industrial		
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Turnover	0.1263***			0.1401***			0.2433***		
	[0.0078]			[0.0068]			[0.0152]		
Inflows		0.1304***			0.1410***			0.1703***	
		[0.0073]			[0.0063]			[0.0131]	
Outflows		0.0212***			0.0270***			0.0912***	
		[0.0052]			[0.0044]			[0.0088]	
Market turnover			0.0995***			0.1097***			0.2821***
			[0.0063]			[0.0054]			[0.0100]
Institutional turnover			0.0785***			0.0763***			0.0855***
			[0.0068]			[0.0056]			[0.0109]
Services	1.4861***	1.4527***	1.5483***	1.4688***	1.4285***	1.5087***	-0.1931	-0.1900	-0.1806
	[0.5326]	[0.5404]	[0.5692]	[0.4352]	[0.4392]	[0.4982]	[0.1449]	[0.1473]	[0.1520]
Investment	-0.1311	-0.1266	-0.1546	-0.1318***	-0.1284***	-0.1224***	-0.0559***	-0.0545***	-0.0436***
	[0.2879]	[0.2927]	[0.3116]	[0.0304]	[0.0302]	[0.0368]	[0.0128]	[0.0130]	[0.0145]
Constant	-1.9918***	-1.5071***	-1.4558***	-1.9568***	-1.4138***	-1.3869***	-1.4072***	-0.4977***	-0.2323**
	[0.2352]	[0.2387]	[0.2509]	[0.1076]	[0.1088]	[0.1223]	[0.1035]	[0.1138]	[0.1091]
No of observations	4663	4663	4663	7843	7843	7843	6969	6969	6969
R2 between	0.356	0.422	0.499	0.352	0.404	0.431	0.532	0.556	0.637
R2 within	0.744	0.751	0.755	0.745	0.752	0.757	0.811	0.812	0.838

Note: Monthly data, annual and monthly dummies included. Fixed effect panel GLS estimator with robust standard errors. Tax data only available for land *poviats*,

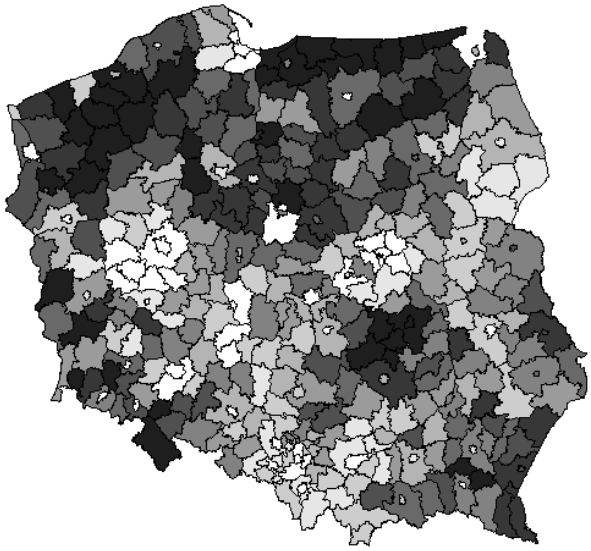
Figure 1. Unemployment rate evolution in Poland, 1990-2009.



Source: CSO

Note: In January 2004 new census data yielding a lower size of the population and thus higher unemployment rate (by roughly 3.2 percentage points). The data has not been recalculated backwards, but we control for this effect in the further analyses, filtering the data.

Figure 2. The regional distribution of the unemployment rates in Poland (December 2008)

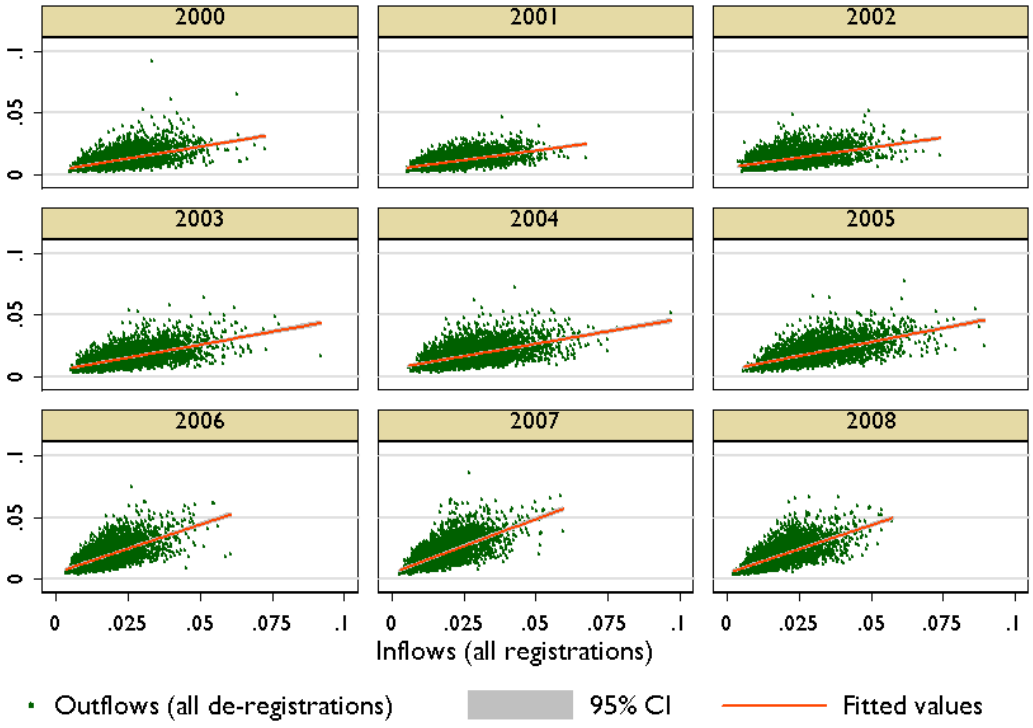


Source: CSO

Note: The darker the shade, the higher the unemployment rate.

Figure 3. Scatter of monthly inflow and outflow rates by year and *voivodship*

Panel (a)



Panel (b)

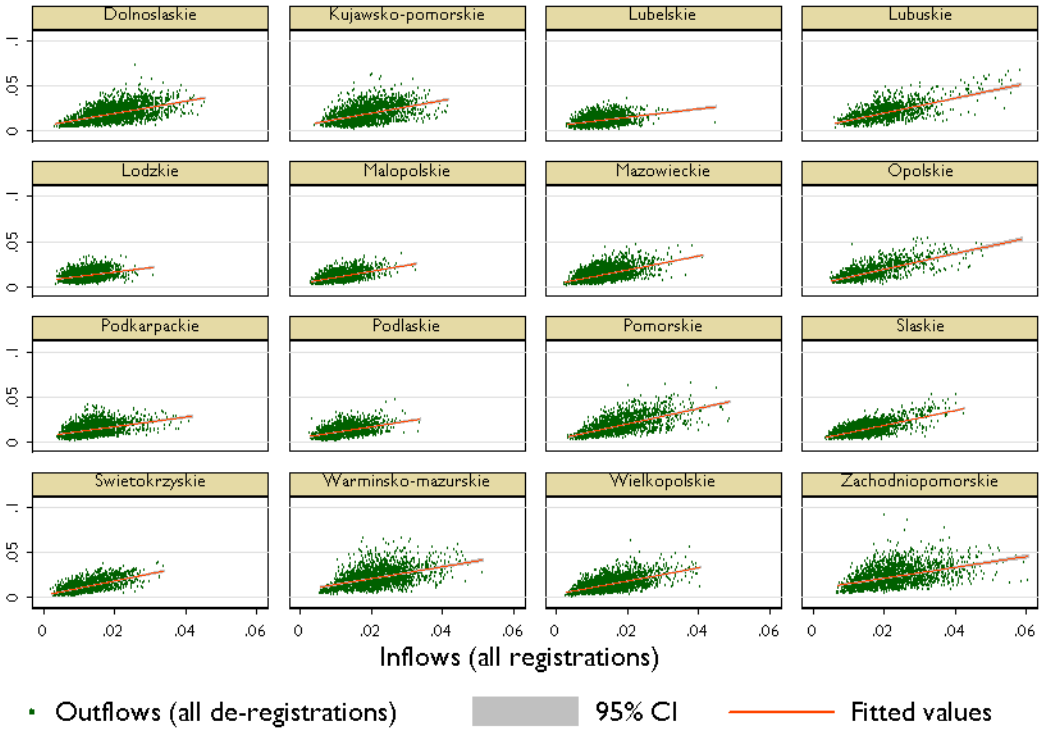


Figure 4. Unemployment, inflow and outflow rates by region (*voivodship*)

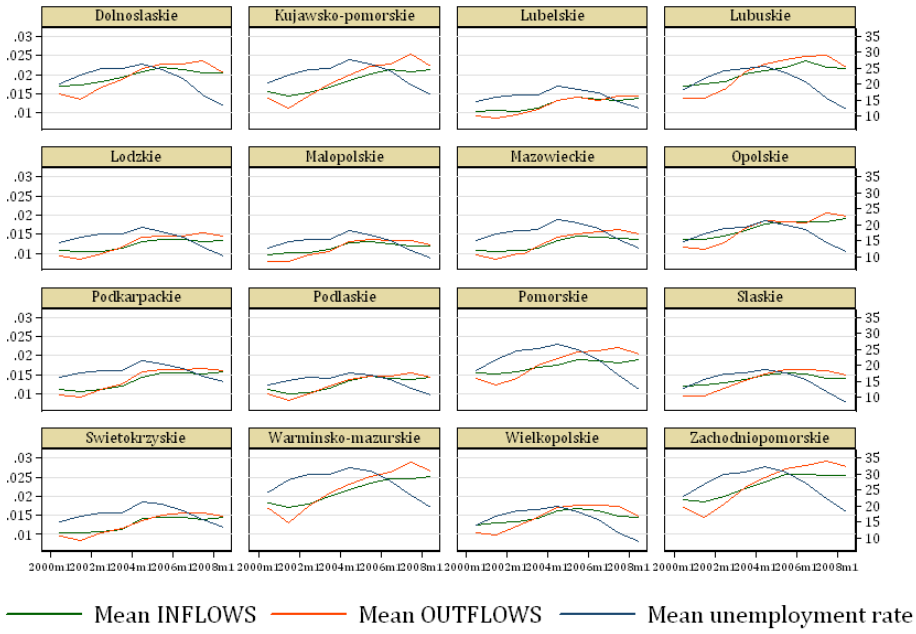
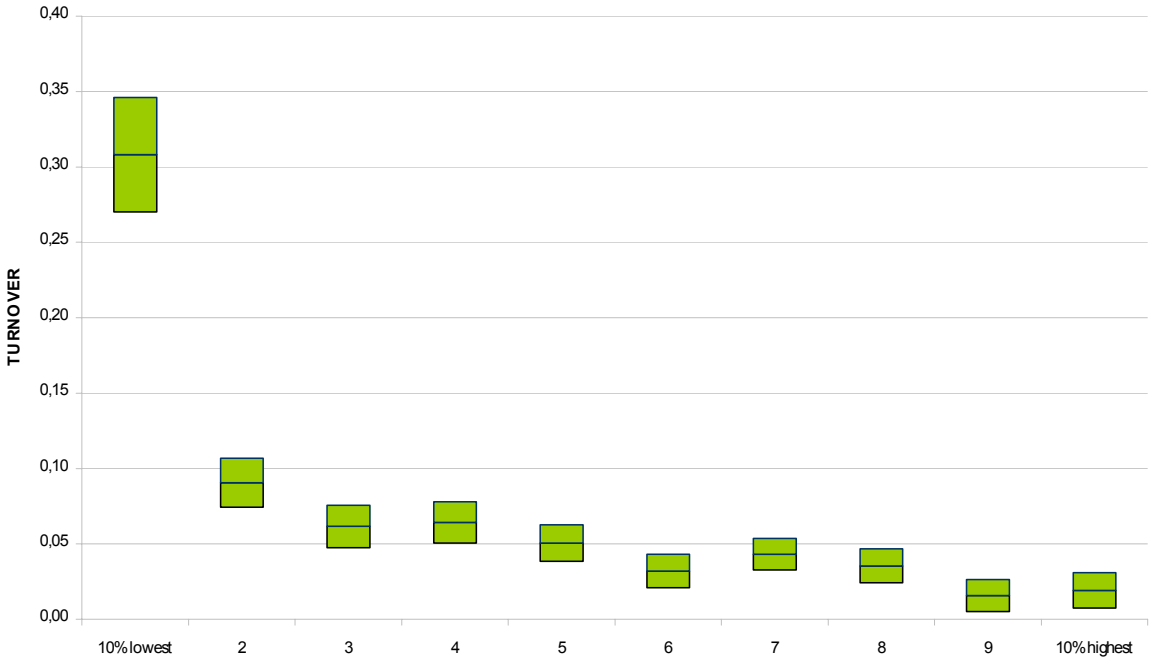
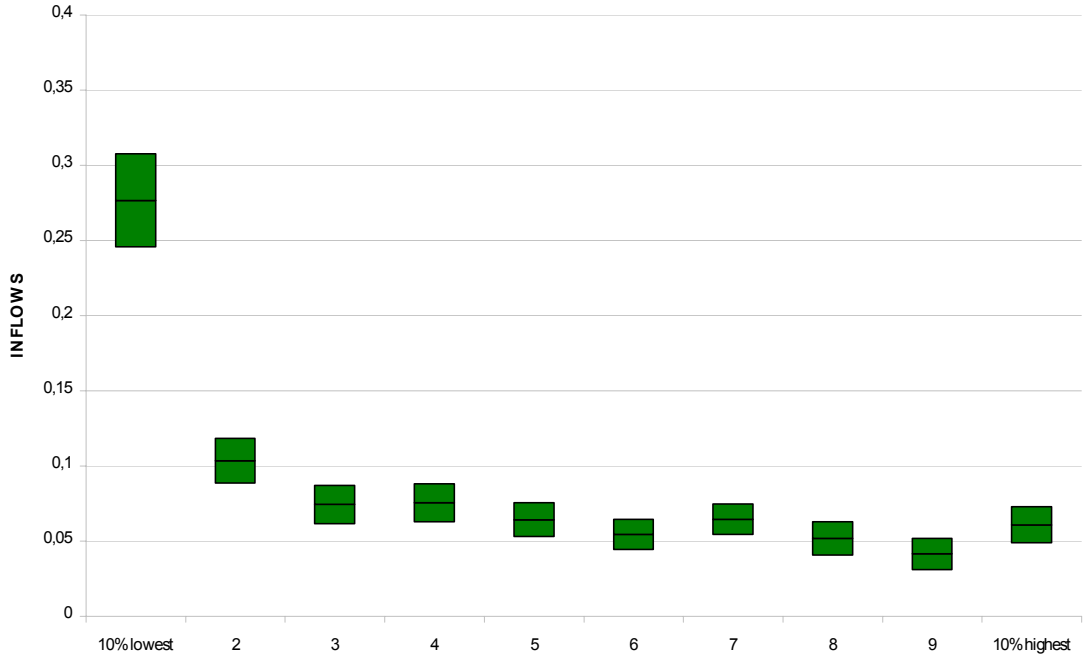


Figure 5. Point estimators (elasticities) by the decimal groups

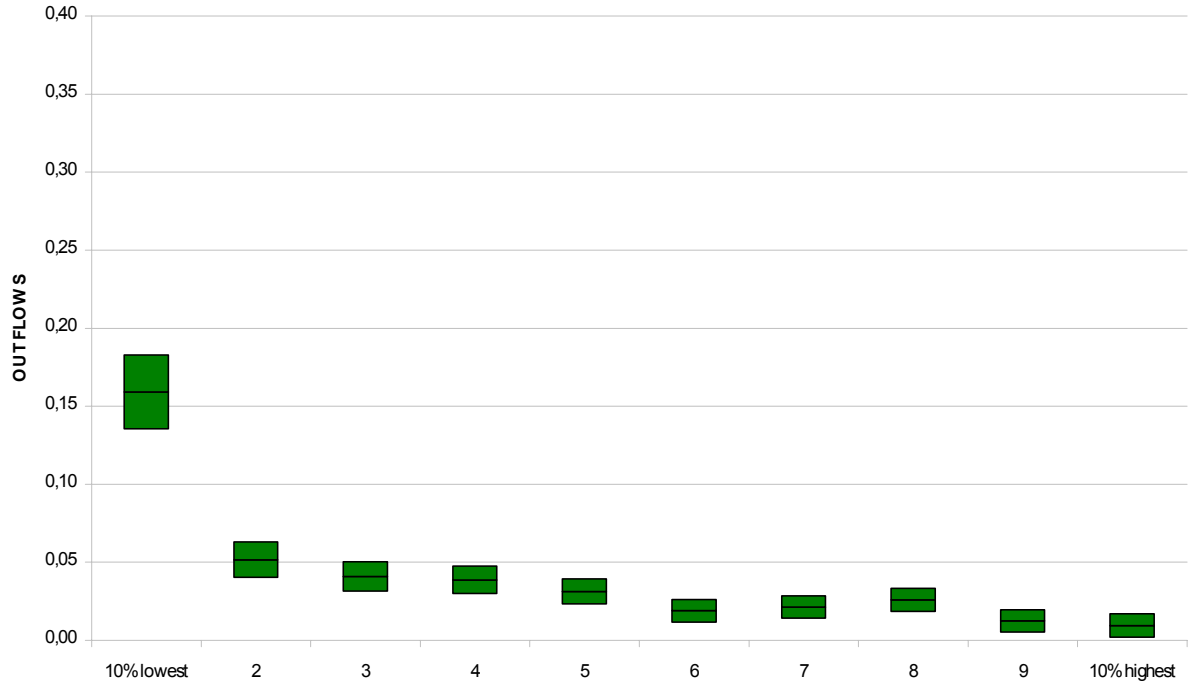
Panel (a)



Panel (b)

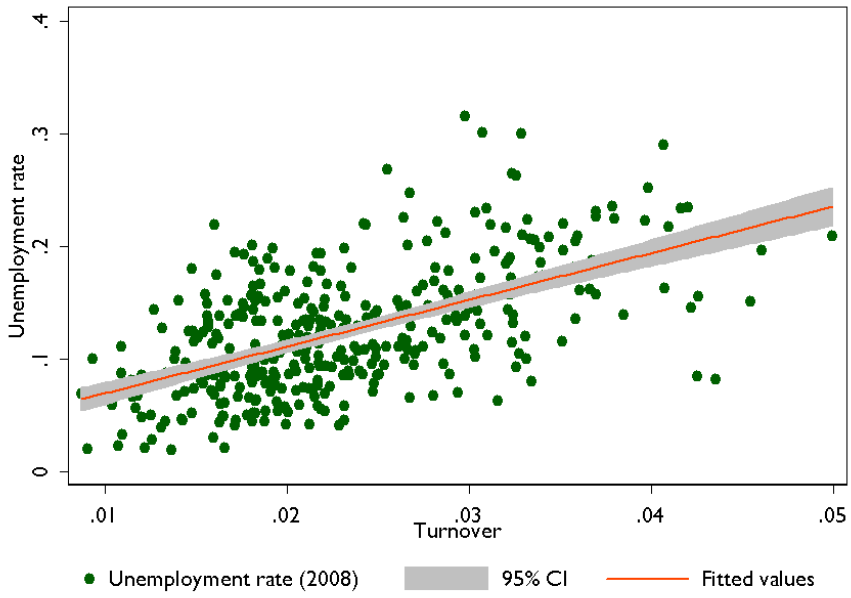


Panel (c)

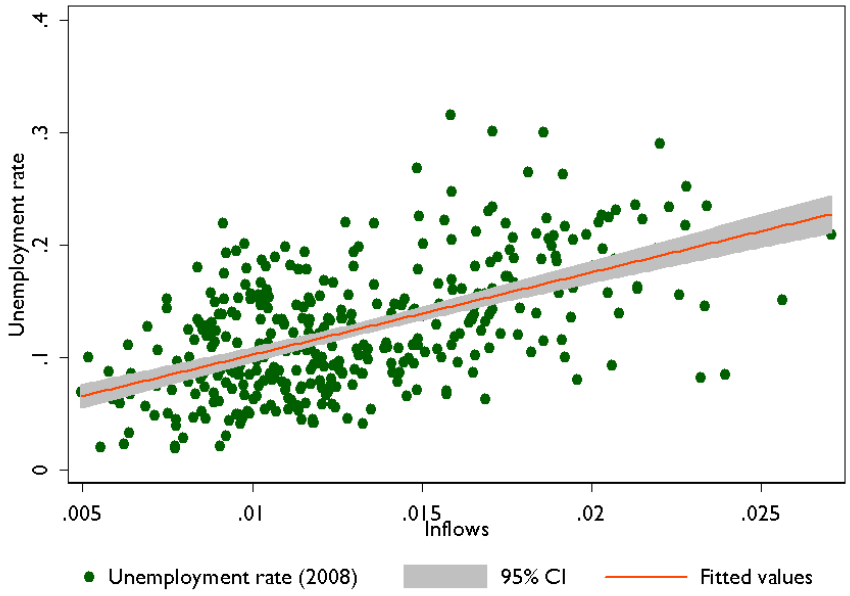


Note: Point estimators were obtained for decimal groups in separate estimations for each group. The values are obtained from estimation like the one presented in column 2 of Table 4.
Source: Own elaboration.

Figure 6. Scatter plot of turnover, inflows and outflows in 2000 against the unemployment rate in 2008
Panel (a)



Panel (b)



Panel (c)

Note: Figure displays the scatter plots of the unemployment rate in 2008 on the vertical axis against the turnover (panel a), inflows (panel b) and outflows (panel c) in 2000; annual averages.