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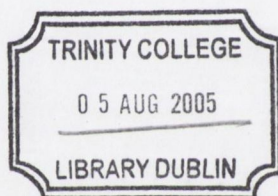
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**Industrial Structures And Labour
Market Outcomes:
An Examination Of Poland In
Transition.**

Christopher W. Sibley

Thesis submitted to the University of Dublin, Trinity College,
in fulfilment of the requirements for the degree of Ph.D.

May 2005



THESIS

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DECLARATION

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Summary

This Thesis presents three papers. In our first paper we estimate the impact of transition on earnings inequality using data across Polish regions 1994-1997. Our central result is that earnings inequality is higher in regions that are more advanced in restructuring (higher labour productivity/job reallocation rates), controlling for unobservable regional fixed effects. At the national level rapid growth does not seem to be associated with earnings inequality. This aggregate relationship is shown to be misleading. The positive relationship between earnings inequality and the stage of transition across regions remains when we apply an infrastructure-deficit based instrumental variable approach to allow for reverse causality.

Our second paper uses regional industry skill premia and industry dynamics to show considerable regional specific effects in Poland's labour market. We show that industry skill premia are driven by the relative supply of skilled labour. Skill premia are negatively related to the supply of skilled labour within a region, those regions with a larger supply of skilled labour will have a lower price of skilled to unskilled labour. We find that regions that have bigger differences in relative wages, share fewer common industries or industrial structure. Industry location and skill premia respond systematically to persistent relative wage differences over time. Regions with lower skill premia experience greater increases in their share of skill intensive industry employment and low skill premia regions also experience greater increases in the intensity with which skilled workers are used within industries. All leading to the suggestion that firm's move faster than labour and that development of skilled labour pools may lead to a greater share of skilled industry. This has stark consequences for Poland and transition economies in general, with large pools of skilled labour and ever increasing FDI flows.

Our third and final paper looks at persistent gaps in Polish regional mean earnings. We model wage behaviour in regional labour markets as an outcome of the speed of transition. While individual characteristics, such as education, determine participation rates and where one is on the wage distribution within regions, the pace of local annual (excessive) layoffs and hiring rates are shown to dictate the mean wage disparities across regions.

Acknowledgements

To my supervisor, Dr Patrick Paul Walsh, my guide through this challenging venture. You always looked out for your students, we always appreciated this. He has not only led us through this long and worthwhile learning experience, but he has also been a good friend.

To my wife, Lorraine Sibley, who didn't quite know what she was letting herself in for when I started this research five years ago. Thank-you for making a life with me even while I carried this burden over the last five years. Thanks for your support through thick and thin and for always being there to keep me working when times got tough.

To my parents, Brian and Pauline Sibley, and my brother and sister, Jason and Sandra Sibley, it's been a long nine years in college, sorry for the burden and thanks for putting me through it.

To all the staff in the Department of Economics, Trinity College Dublin, particularly Professor P.J. Drudy and Professor Frances Ruane, both of whom I had the pleasure of working for.

To Professor John O'Hagan, for encouraging me to come to Trinity in 1999, and for supporting me with my research into the economics of art markets - my hobby over the years.

To all the support staff in the Department over the five years, particularly, Orla, Mary, Pamela and Olive, you gave the Department its character, and I owe an awful lot to you for all the assistance in helping me work in the Department over the years.

To Professor Jozef Konings, who harboured me for my stay in LICOS at K.U. Leuven, Belgium. LICOS is a wonderful research centre, and a tremendous asset for Trinity graduate students to visit, in order to further their knowledge on Transition Economies.

Thanks to my Transition Economics Class of 2002-2003 and to all the guest speakers at our seminar series who enabled me to put all this learning into practice.

To all the Post Graduates in the Economics Department, you made the experience one I will never forget. Great friendships were made and I hope will last for many years to come, no matter how far away we live.

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“Transition is history in the making and will sooner or later become a subfield of economic history. At the same time, transition can be seen as a subfield of development economics with specific initial conditions, compared to other development contexts: generalised state ownership and strong state power, over industrialisation, a relatively high level of human capital and of economic development, and low initial income inequality.”

Gerard Roland

‘Transition and Economics: Markets, Politics and Firms’ (2000)

Chapter One

1.1 Introduction

Transition Economies of Eastern Europe during the 1990's saw large scale structural change across all markets, product, capital, but especially labour markets. We use Poland as our prime example of this transition, from a socialist planned economy, to an economy largely driven by market forces. Poland saw rapid change through the early 1990's and only begun to recover from it's 'big bang' approach to transition in 1994. This large scale structural reform provides us with a quasi natural experiment to test economic theory, while noting features specific to transition economies.

My thesis benefits from work undertaken as part of Trinity College's, Department of Economics, Transition Group. This group set up to study Economies of Eastern Europe, post socialism, has had several members over the last ten years. This thesis hopes to add to the body of research undertaken by those members.

This thesis draws on a common theme of ‘winners and losers’ in transition. Those who had the right set of initial endowments, pre-reform, in order to benefit most, post-reform. Other studies (Repkine and Walsh, 1999) have shown that those regions of Poland close, geographically, to Western Europe had substantial pre-existing trade links, manufacturing western quality goods. These trade links remained post reform in the market era, while the mainly eastern regions of Poland had their trade demand and supply line collapse to the old Soviet empire.

Throughout our papers we find a central role of education and skills in determining market success. Many reforms were induced by whether extremely heterogeneous regions had the right set of initial endowments, for example, those industries whose workers had market relevant skills we more likely to be privatised first. Hence these regions, participated at a faster rate in transition, with higher worker and job reallocation rates (Faggio and Konings 2003). Evidence of this feature of transition is shown throughout this thesis.

This thesis draws on a series of three papers to explore aspects of Poland’s labour market. All three aim to understand the evolutionary impact of transition on wages. Rising inequality in productive regions, increasing returns to skilled labour and the key importance of education are central themes.

In our first paper, Chapter Two, we estimate the impact of transition on earnings inequality using data across Polish regions 1994-1997. We take regional earnings data from the Polish Labour Force Survey, which is used to create our measure of earnings inequality. We then match that against corresponding regional productivity and job

reallocation rates, created from firm level information from our Amadeus data set. Our central question is whether earnings inequality is higher in regions that are more advanced in restructuring, we test this using higher labour productivity and job reallocation rates as measures for transition. At the national level rapid growth does not seem to be associated with earnings inequality. This aggregate relationship is thought to be misleading, hence we investigate this at a regional level. The test whether this positive relationship between earnings inequality and the stage of transition across regions remains when we apply an infrastructure-deficit based instrumental variable approach to allow for reverse causality. This chapter looks at initial endowments from a macroeconomic regional analysis point of view. We show that inequality does not drive growth, but vice versa, that the causal link runs from initial endowments which drive reallocation of labour from the state owned sector to the private sector. This new private owned higher productivity sector then is shown to have higher earnings inequality. The causal link in both cases runs from higher reallocation and higher productivity, to higher earnings inequality.

Our second paper, Chapter Three, uses regional industry skill premia and industry dynamics to show considerable regional specific effects in Poland's labour market. We investigate whether industry skill premia are driven by the relative supply of skilled labour. These measures are constructed from regional Polish Labour Force Survey data on skills, relative earnings and numbers reporting in those categories by NACE sector. Skill premia seem to be negatively related to the supply of skilled labour within a region, we look to see if those regions with a larger supply of skilled labour will have a lower price of skilled to unskilled labour. We find that regions that have bigger differences in relative wages, share fewer common industries or industrial

structure. Hence having the right set of market matched skills, and being a skill abundant region, produces lower skill premia. This in turn induces increased use of skilled labour over time, as such a demand effect from industry.

Industry location and skill premia respond systematically to persistent relative wage differences over time. Regions with lower skill premia experience greater increases in their share of skill intensive industry employment and low skill premia regions also experience greater increases in the intensity with which skilled workers are used within industries. All leading to the suggestion that firm's move faster than labour and that development of skilled labour pools may lead to a greater share of skilled industry. This has stark consequences for Poland and transition economies in general, with large pools of skilled labour and ever increasing FDI flows.

Our third and final paper, Chapter Four, looks at persistent gaps in Polish regional mean earnings. It emphasises the importance of having the right skill set, or market relevant educational attainment, in order to 'select oneself' into the job market. We model wage behaviour in regional labour markets as an outcome of the speed of transition. This data again comes from the Polish Labour Force Survey, where we take the earnings data and construct regional hiring and firing rates. While individual characteristics, such as education, determine participation rates and where one is on the wage distribution within regions, the pace of local annual (excessive) layoffs and hiring rates are shown to dictate the mean wage disparities across regions.

Chapter Four uses educational attainment levels that are shown as highly significant in order to select, or supply, participants from the unemployment pool into

employment. Again the right market relevant skills are shown here to determine participation, highlighting the importance of initial endowments. Which it is important to remember are decisions made exogenously under socialist planning, in that no knowledge was predetermined as to market reward for high wage occupations or jobs during planning. Selection effects of education are not so important in the western literature, but here are crucial. Many forms of technical education were pre-transition job and region specific, a consequence of socialist planning, and in the free market post reform era are no longer useful. On the other hand, general university education comes out best post reform, in terms of its market reward. We show that this exogenous decision on education is very important for labour market employment selection effects during transition.

We deal with Poland as 49 distinct labour markets, with the assumption of no worker or job mobility, as found respectively in Boeri and Scarpetta (1996) and Faggio and Konings (2003). This is in part due to the specialised nature of planning, with industry concentration within regions. We illustrate this in Table 4.1 where we show industry concentration ratios, for our 49 regions. The data is taken from the average of the three middle years of our data set and ratios are shown for the top one, two, five and ten 2-digit industries share of employment. Again it is important to stress that with such dependence on a small number of industries, that industries collapse has obvious effects. It is then that whether that industries workforce has a market relevant skill set comes into play. All too often a workforce with technical training for specific, non-market relevant industry, either blocks restructuring or creates a large unemployment pool in that region.

In Chapter Two we instrument for productivity and excess job reallocation rates using regional social capital, or an infrastructural ranking measure. Some previous studies have developed regional labour market taxonomies of Poland, for example, Huber and Scarpetta (1994) and Góra and Lehmann (1995). We use data from the regional yearbooks to rank voivodships (polish regions) by four infrastructure indicators. Using a Borda electoral scheme, the sum of the best four rankings establishes the overall score for each region. The regions are then sorted in ascending order. Large discrete breaks in the score of voivodships determined the hiatus between our six regional groupings, leading to a regional taxonomy that we use to summarise our data. The full ranking is used when we apply an infrastructure-deficit based instrumental variable approach to allow for reverse causality in the inequality and speed of transition relationship in Chapter Two. The taxonomy in Table 2.1 reflects a systematic ranking of regions by their infrastructure development that persists during the transition period. With the exception of Warsaw and Lodz, eastern regions mainly inherited poor infrastructure, while western regions inherited superior infrastructure, as illustrated in Figure 1.1.

We discuss our motivation and themes of transition underlying our analysis, along with the Polish Labour Force Survey, the Amadeus data set and some descriptive statistics in next part of this chapter. The first paper, a macroeconomic view of Polish regions, looking at inequality, productivity and the speed of transition, is presented in Chapter Two. The second paper, which takes a labour demand view, looks at skill abundant regions and industry skill premia and is presented in Chapter Three. The last paper, looking at labour supply, educational factors and the speed of transition, is presented in Chapter Four. Finally we conclude in Chapter Five.

1.2.1 Our Data Set, The Polish Labour Force Survey.

The Polish Labour Force Survey is conducted and processed by the Polish Central Statistical Office, Labour Statistics Division, this quarterly survey is the primary source for information on Poland's labour market. The survey covers all persons aged 15 years and over, who are members of private households selected for the survey. This includes members absent from the household for less than two months abroad for such reasons as travelling for business. The survey also includes those absent for more than two months such as sailors and fishermen. Those excluded are persons living in collective households (e.g., workers' and students' hostels, boarding schools, army barracks, old age pensioners homes, etc.), inmates of penal and mental institutions, members of private households staying for more than two months abroad, temporary guests staying for less than two month in a given household and foreigners. The LFS methodology is based on definitions recommended by the International Labour Office and Eurostat.

The basic criterion for division of population from the point of view of economic activity is work, into the employed, the unemployed and the economically inactive, i.e. performing, having or seeking a job in the reference week.

We use a series of this data covering a period central to the transition process, 1992 – 1997. This quarterly household survey is carried out in February, May, August and November each year, our data starts in May 1992. The Polish LFS does not differ from the usual western survey. It contains more than 50 questions. The total number of observations in each survey is approx 50,000. For each observation we use a record

of regional location (voivodship), wage/net earnings in the previous month from a main job measured in polish zloty, age, sex, type of completed education, sector attachment in the reference week (NACE 2-digit), tenure of current job, years of work experience, marital status, type of ownership of the firm respondent works in and no. of employees in that firm.

The PLFS uses each dwelling as a sampling unit, with each quarterly survey covering approximately 24,400 dwellings. The total quarterly elementary sample consists of four independent 'e-samples'.

The overall sampling fraction is approximately 1/2000 registered dwellings for urban areas and 1/1818 for rural areas. The sample frame is derived from the Polish CSO Register of geographical statistical units, enumeration districts (EDs), groups of EDs or census clusters and housing units from the national census. This register is updated annually, taking into consideration information about dwellings newly built, demolished or converted into non-residential one as at the 1st of January each year.

Four rotation groups called elementary samples (e-samples) are used in a given quarter, the sample comprises two e-samples surveyed in the previous quarter, one new e-sample introduced into the survey for the first time and one e-sample introduced in the corresponding quarter of the previous year. The quarterly four e-samples rotate according to a 2-(2)-2 scheme, i.e. a housing unit remains two consecutive quarters in a sample, leaves it for two quarters and returns again for another two consecutive quarters before leaving the sample definitively. Hence 50 per cent of units remain in the sample for two consecutive survey rounds, and a maximum

of four interviews per sample unit. Therefore every five quarters there is a complete renewal of the sample.

Interviews are carried out on a personal basis or by telephone interviews, both using paper and pencil. Each sample area covers 1880 dwellings. The survey is carried out by permanent survey staff of approximately 300. There is a non-response rate of 11.6 per cent, which an adjustment is made for. Adjustments are also made for areas and population not covered.

In Table 4.3 we show the regional disparities in mean wages, with their proportion relative to Warsaw in each case. This is compared to the published Polish Regional Yearbook statistics to show the reliability of our data. Our Polish LFS data is systematically lower, but the regional disparities are of similar magnitude on both sources. This is shown by comparing the proportion relative to Warsaw between the two sources. We use the earnings variable, by region, from the Polish Labour Force Survey to calculate our earnings inequality measure in Chapter 2. In Chapter 3, we use earnings information by regional industry classifications. We also use educational attainment to determine skilled and unskilled workers.

In Chapter 4 we use several variables from the Polish Labour Force Survey, to run our wage equations. Educational level attained is an important one of those. We compute some simple statistics, to highlight issues raised by this data. Caution must be given here to the heterogeneous nature of our data across regions, and that these are simple descriptive statistics. In Figure 1.2 we show mean monthly wages by educational attainment level, in a given year 1995. This is to highlight the market returns to general education qualifications, high school and university. In Figure 1.3 we show

the distribution of employment across education levels. This is also done for those in unemployment. This graph may be interpreted as showing that employed people are generally likely to be technically trained, or from high school. While the unemployed are likely to have only primary education or be technically trained. The technically trained groups appear here as important to both employment and unemployment, this properly reflects the nature of labour market restructuring in transition.

We can use Figure 1.4 to draw inference for each education level, whether on average one is likely to be employed or not. Although no causal relationship is drawn here, one can see that those with university level qualifications are more likely to be employed, as are technical college graduates. Those in high school are borderline, while technical training and technical high school graduates are less likely to be employed. Finally those with primary education and those without primary education are quite likely to be unemployed.

In the annex to Chapter 5 we include the categories from the PLFS data sets NACE coding. This approximates to a standard 2-digit level and is available for each respondent. In Chapter Three we restrict our analysis to just manufacturing codes, in order to look at a more homogenous data set, following the work of Bernard et al (2003).

1.2.2 The Amadeus Data Set

AMADEUS is a comprehensive, pan-European database containing financial information on 7 million public and private companies in 38 European countries. It

combines data from over 35 information providers. This is a commercial database collected by “Bureau Van Dijck” (BvD) which is a quoted software and consulting company on the (Euronext) stock market and is sold under the name of ‘Amadeus’. The data consists of all companies that have to report full company accounts to the national statistical offices for which at least one of the following criteria is satisfied: total turnover of at least 8 million USD, total assets of at least 16 million USD or total employment of at least 100. This data covers both manufacturing and non-manufacturing sectors and covers all countries in the European Union plus Central and Eastern European countries. BvD identifies the best source of information in each country and applies strict inclusion criteria to prevent any bias in coverage. A standard company report includes: 22 balance sheet items, 25 profit and loss account items and 26 ratios, descriptive information including trade description and activity codes (NACE 1, NAICS or US SIC can be used across the database), ownership information which is researched by BvD’s own team of consultants. In addition to their national industry codes, the companies have been allocated NACE, US SIC and NAICS codes as additional options for cross-border searching. BvD has developed an accurate cross-referencing matrix between these codes that gives reliable results. Consolidated statements are provided when available. Up to 10 years of information is provided per company.

Amadeus data includes an official national identity number, address, telephone and fax numbers, URL and e-mail addresses, legal form, year of incorporation, quoted/unquoted indicator, main exchange, details of peer group, trade description plus primary and secondary industry codes in national code plus NACE, US SIC and

NAICS codes, number of employees, board members and officers, auditors, shareholders, subsidiaries.

BvD supplements this company accounts data set with unique data including shareholders information with their percentage of interest, shareholdings and subsidiaries for both public and private companies, direct and indirect ownership details and ultimate ownership information.

We have extensively used this data by BvD in Chapter 2. There we use our firm level Polish data to compute regional job reallocation rates and real output per worker. This firm level data is then aggregated using that firm's employment share as a weight to form the regional variables.

Figure 1.1: Polish Regions Shown By Infrastructural Ranking

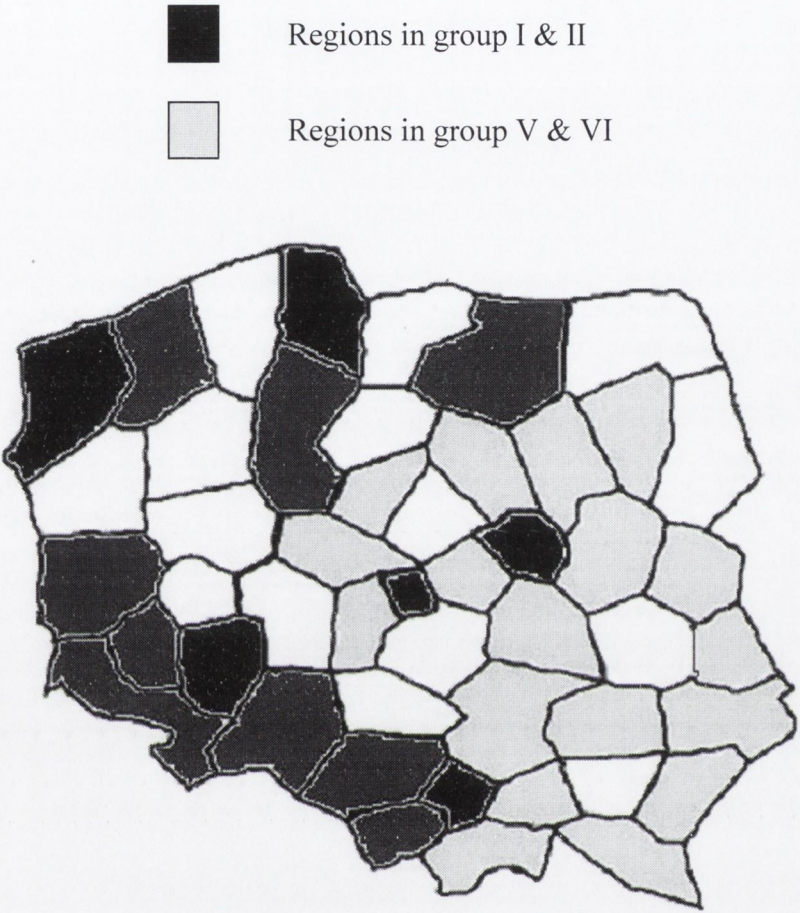


Figure 1.2: Mean Monthly Wages by Educational Attainment level, in 1995

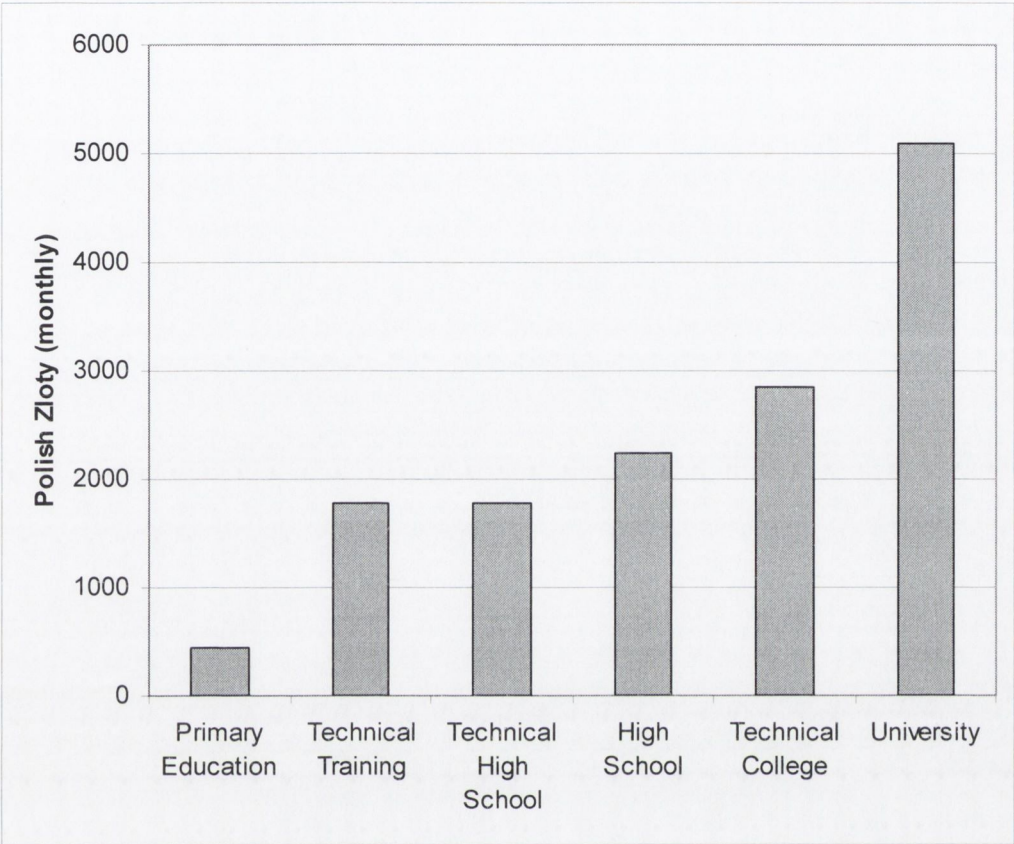


Figure 1.3: Distribution Of Employed And Unemployed Persons, By Educational Attainment, (Average Proportion 1993 – 1997).

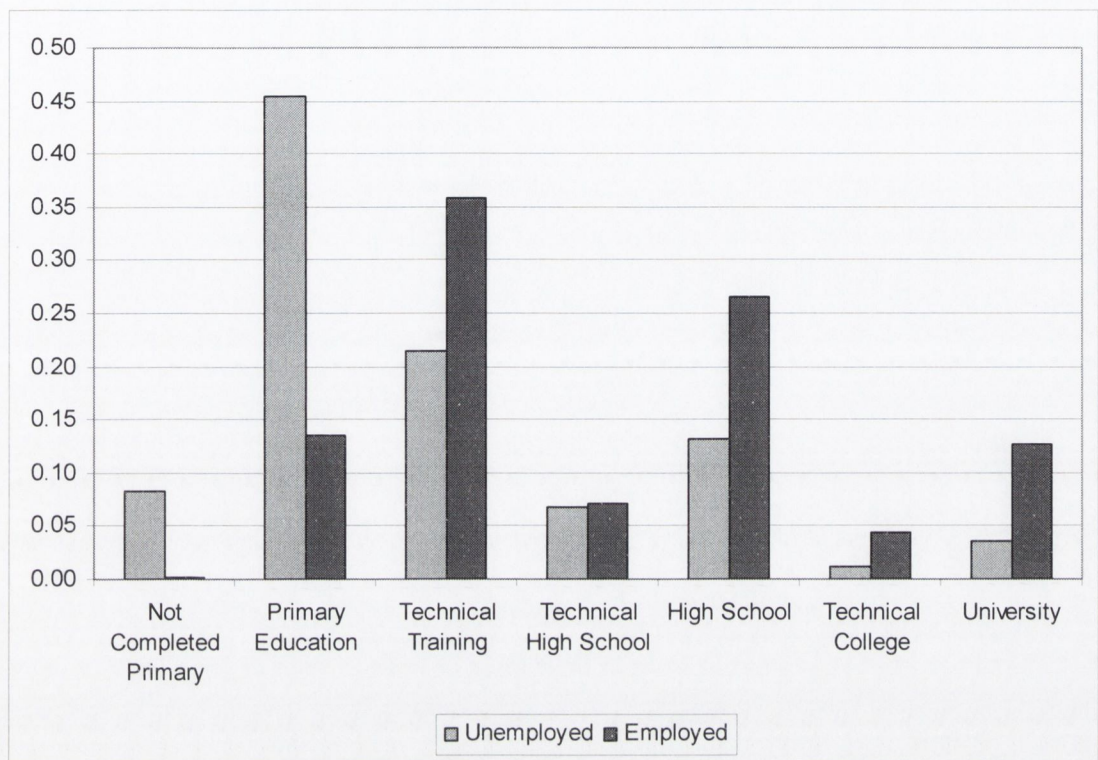
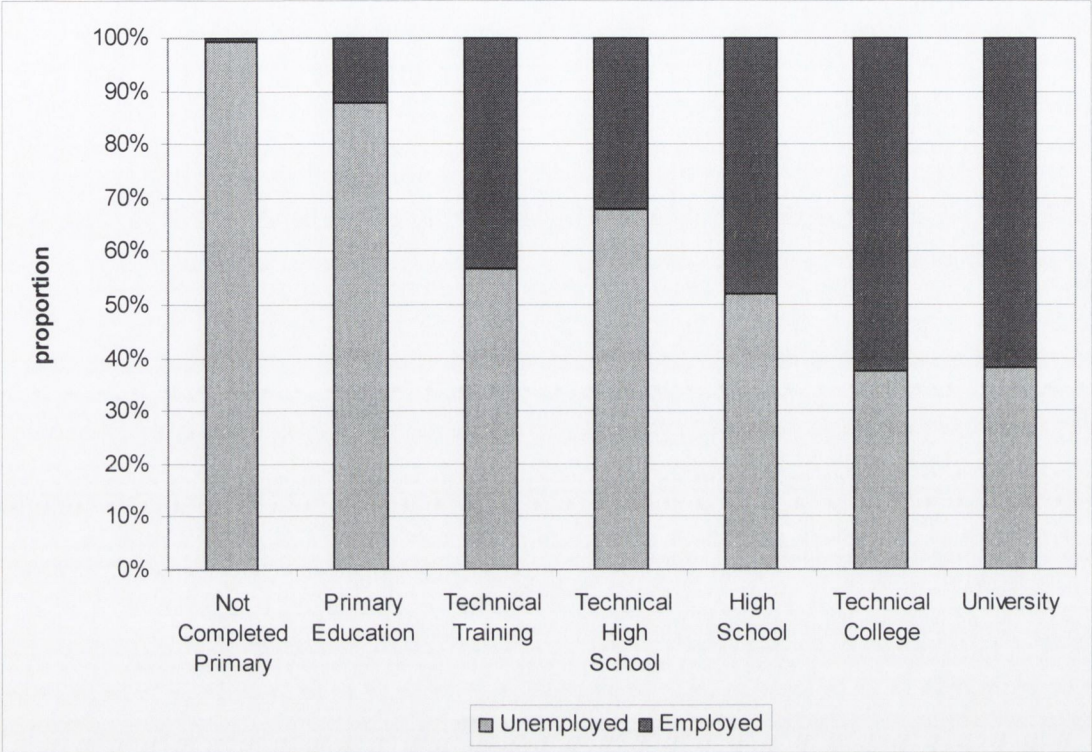


Figure 1.4: Shares Of Employed And Unemployed Persons, By Educational Attainment.



Chapter Two

Earnings Inequality and Transition: A Regional Analysis of Poland.

2.1 Introduction

This paper is in the same spirit as Wei and Wu (2001) who model the relationship between urban and rural income inequality and trade openness across a hundred Chinese cities during the period 1988-1993. They argue that an in-depth case study of a particular country's experience across regions can be useful. Analysis based on cross-country studies can suffer major shortcomings. Atkinson and Brandolini (2001) worry about the compatibility of data across countries. Use of dummy variables for pooled cross sections for data differences in each country may not be sufficient. In addition the comparability of living standards across countries in real terms using purchasing-power-parity adjustment cannot be done easily. Finally, to control for differences in legal and other institutions across countries can be very difficult. The use of fixed effects may not be enough as the impact of explanatory variables on measures of inequality may interact with such unobserved country specific effects.

Srinivasan and Bhagwati (1999) suggest that within a given country and over a relatively short time period, the culture, the legal system or other institutions can more plausibly be held constant. Furthermore, the comparability of data definition and collection method is, in principle, also higher within a single country than across multiple countries. In this paper we set out to estimate the impact of transition (using Amadeus Company Accounts data) on earnings inequality (using the Labour Force Survey) across Polish regions 1994-1997.

As in Wei and Wu (2001) we see that inferences based solely on national aggregate figures can be misleading. They find that cities more open to trade tend to have a lower urban-rural income inequality. At the national level urban-rural inequality and trade openness seem to have risen dramatically. Research at the national level in Poland suggests that income inequality has remained relatively constant during transition. Evidence reported by Roland (2000) for Poland suggests that overall inequality has not risen during transition, reporting Gini figures of 0.26 in 1989 and 0.28 in 1997. Keane and Prasad (2000) report Gini estimates of earnings inequality, based on Household Budget Data, to be 0.292 in 1994 and 0.298 in 1997. Overall income inequality is documented at 0.262 and 0.276, respectively, for the same years. Real GDP increased, on average, by 6.3 per cent per annum (ERBD 2000) over the period 1994-1997. Is it not surprising that this period of growth in Poland did not generate earnings inequality?

Kattuman and Redmond (2001) study income inequality in Hungary over the period 1987-1996. Coming from planning where incomes were compressed, they argue one should expect inequality would rise with progress in transition. The development path

in countries coming from the planning era is fundamentally different to that described in the development literature. Kuznets (1955) seminal contribution to development and income inequality deals with a process of Industrialisation coming from an Agrarian society. Initial conditions in transition economies reflect, amongst other factors, over-sized Industry and Agriculture, inefficiency and specialisation across regions. This was also true of the associated human capital structures. Certain firms and workers would adapt to the market economy and others would not. Liberalisation of markets was expected to induce winners and losers and a spread in realised earnings¹. Why did inequality not increase during transition in Poland? Are the aggregate figures misleading?

Poland provides us with a “quasi” natural experiment. Polish regions inherited idiosyncratic industry and physical infrastructure coming out of the planning era. Huber and Scarpetta (1995) explain the growing polarisation in performance across Polish regions as an outcome of such. In addition, inter-regional job and worker flows (adjustments) have been virtually absent during transition (see Faggio and Konings, 1999, and Boeri and Scarpetta 1996) allowing independent developments across regions to persist over-time. While institutions and data sets are compatible across regions, the speed of transition and the evolution of earnings inequality could be expected to vary differently across the regions of Poland. Gora and Urszula (1999) identify a group of highly developed regions that have markedly higher earnings

¹ In Industrial Organisation price dispersion can be modelled to be an outcome of competition in the market when individual consumers having different switching abilities. Borenstein and Rose (1994) provide empirical evidence for such in the US Airline Industry and Walsh and Whelan (1999) in the Irish Grocery Market. Liberalisation in the presence of firms and workers with different abilities to adapt to the market economy should be expected to induce dispersion in earnings.

inequality, namely Warsaw, Katowice, Gdansk, Poznan and Krakow, when compared to the other 44 regions.

We document persistent and large differences in earnings inequality across regions. In addition, persistent and large differences in labour productivity, job reallocation rates and physical infrastructure deficits across the regions of Poland are documented. Our central result is that earnings inequality is higher in regions that are more advanced in restructuring (higher labour productivity/job reallocation rates) during the period 1994-1997².

We apply an instrumental variable approach to allow for reverse causality issues emphasised in Barro (1999). The instrumental variable approach is similar to that used in Wei and Wu (2001) and Frankel and Romer (1999). They use a geography-based instrumental variable to control for possible endogeneity of a region's trade openness. Geography turns out to be a good instrument for openness as participation in trade can be due to distance from a major seaport. We use a ranking of regions based on infrastructure-deficits (density of phones, roads and railways across inhabitants) as our instrument. Transition to a decentralised market economy is much more likely to take place in regions that inherited good density in physical infrastructure. Our instrument is also geography-based, in that we get the distance of firms and workers from important physical infrastructure. The positive relationship between earnings inequality and the stage of transition across regions remains when we apply an

² Faggio and Konings (2003) have investigated the relationship between job reallocation and output per worker. They found a strong causality from high job reallocation leading to higher output per worker. Given this we investigate these two variables as separate or alternative deterministic factors on earnings inequality.

infrastructure-deficit based instrumental variable approach to allow for reverse causality. We describe the data we use in section 2.2. In section 2.3 we document our econometric results. Finally, we make our conclusions in section 2.4.

2.2 Our Data

2.2.1 Infrastructure Deficits:

We use data from the regional yearbooks to rank voivodships (polish regions) by four infrastructure indicators. Using a Borda electoral scheme, the sum of the best four rankings establishes the overall score for each region. Thus, the highest possible score is 4, when a region is always ranked number one, and the worst possible score is 196, when a region is always ranked last, at 49. The regions are then sorted in ascending order. Large discrete breaks in the score of voivodships determined the hiatus between our six regional groupings, leading to a regional taxonomy that we use to summarise our data. The full ranking of regions in 1994 is used when we apply an infrastructure-deficit based instrumental variable approach to allow for reverse causality in the inequality and speed of transition relationship in section 2.3. The taxonomy in Table 2.1 reflects a systematic ranking of regions by their infrastructure development that persists during the transition period. With the exception of Warsaw and Lodz, eastern regions mainly inherited poor infrastructure, while western regions inherited superior infrastructure.

2.2.2 Polish Labour Force Survey Data:

The data used for earnings is taken from the Polish LFS data for the years 1994 to 1997 in November. The Polish LFS is a quarterly household survey, February, May, August and November, starting in May 1992. The survey includes individuals older than 15 years and there is no upper age limit. The Polish LFS does not differ from the usual western survey. It contains more than 50 questions and allows one to distinguish between the employed, the unemployed and those not in the labour force according to ILO/OECD definitions. The total number of observations in each survey is approx 50,000. For each observation we use a record of regional location (voivodship) and wage/net earnings in the previous month from a main job measured in polish zloty. This allows us to construct average monthly wages for each voivodship and year. The Coefficient of Variation is the measure of earnings inequality by region and year that we use in our econometric section. Yet, one could use alternative measures. We show the consistency of our measurement with other measurements in Table 2.2, a correlation matrix of nine inequality measures for the 49 regions across the years 1994 to 1997.

In Table 2.3 we undertake a shift share analysis of regional earnings inequality. We note that the overall measure of earnings inequality does not change over the four years with a Gini of 0.23. Yet clear and persistent patterns emerge across regions grouped by their stage of infrastructure development. Shares of worker populations remain constant across groupings. Regional mean earnings and dispersion are higher in the top two groupings, particularly the first group of seven regions. The tendency

for mean earnings and dispersion to rise over time for these groupings is offset by declines in relative income and dispersion in the other regions.

2.2.3 Amadeus Data:

We use the Amadeus Company Accounts Data to construct regional job reallocation rates and real output per worker. The data consist of incorporated companies across Agriculture, Industry, and Services that satisfy one of the following conditions: Employment > 100, Total Assets > 16 million US dollars and operating revenues > 8 million US dollars. The data set does exclude small firms.³ This is likely to underestimate the job reallocation rate but can be expected to track trends in local job reallocation rates. Given the population of large and medium sized firms one can expect it to capture real output per worker extremely well. The CSO in Poland do publish real GDP per capita data by region during the period 1995, 1996 and 1997. The correlation of real output per worker to real GDP per capita during these years is 0.96, 0.92 and 0.93 respectively. The econometric results using real GDP per capita, admit based on a smaller number of observations, are similar to those that use real output per worker across regions over four years.

We use the regional job reallocation rates constructed by Faggio and Konings (1999). They use the indices developed in Davis and Haltiwanger (1992). We define a discrete measure of firm i growth over the period $t-1$ to t in region j as follows:

³ Data has been checked for bias in using full sample PLFS data versus Amadeus with firms <100 employees. No systematic bias was found.

$$g_{ijt} = \left(\frac{y_{ijt} - y_{ijt-1}}{(y_{ijt} + y_{ijt-1})/2} \right) \quad (2.1)$$

To examine the contribution of expanding and declining firms to the overall evolution of regional employment we sum the growth rates of each growing firm (POS), weighted by firm employment size, S_{ijt} , and sum the absolute growth rates of each declining firm (NEG) weighted by firm size S_{ijt} ,

$$\begin{aligned} POS_{jt} &= \sum_{i=1}^n S_{ijt} g_{ijt} & \text{if } g_{ijt} > 0, \text{ and} \\ NEG_{jt} &= \sum_{i=1}^n S_{ijt} |g_{ijt}| & \text{if } g_{ijt} < 0. \end{aligned} \quad (2.2)$$

The annual net change, NET_{jt} , in regional employment is a net outcome that is induced by employment growth in expanding firms being offset by employment falls in declining firms. The reallocation of jobs across firms within regional employment is captured by the RES_{jt} index calculated as follows:

$$\begin{aligned} NET_{jt} &= POS_{jt} - NEG_{jt} \\ RES_{jt} &= POS_{jt} + NEG_{jt} - |NET_{jt}| \end{aligned} \quad (2.3)$$

In Table 2.4 we document job reallocation rates, output shares and real output per worker across our regions grouped by infrastructure development. One feature to note is that output is heavily concentrated into the top two groupings. Real output per worker remains persistently higher in the top two groupings. As noted in Faggio and Konings (1999) there are striking differences in job reallocation rates within regions.

For example in Warsaw the annual job creation rate was 4.7 per cent, the annual job destruction rate was 5.4 per cent, leading to an annual job reallocation rate of 9.4 per cent. Annually, nearly 10 per cent of employment is reallocated away from one set of firms towards another during each year of transition. In contrast in Zamoj, one of the weakest regions, the annual job creation rate was 2 percent, the annual job destruction rate was 4 per cent, leading to an annual job reallocation rate of 4 per cent.

Job reallocation rates are pure compositional shifts in the firms that host jobs in the regional employment pool over a period of a year. Restructuring requires that traditional firms either exit or move towards their production possibility frontier and induce new firms to enter. Over time, more jobs should find themselves in either new or restructured firms. The job reallocation index captures this move to efficiency in firm populations extremely well. In Table 2.4 we observe that job reallocation is increasing over time across all our groupings of regions but again our first grouping clearly displays persistently higher job reallocation when compared to other groupings in the same year. However less developed regions are increasing at a faster rate indicating some degree of convergence in the job reallocation rate.

The raw data suggests that the transition paths within regions are inducing job reallocation, output per worker and earnings inequality to rise with each other. This is true over time by each regional grouping and across regional groupings. The proposed hypothesis is that within regions initial conditions, amongst other factors, dictate the speed of restructuring (this process involves the movement of workers away from inefficient jobs to efficient ones and increases in real output per worker) and induce earnings inequality in worker populations to rise.

2.3 Generalised Two Stage Least Squares (G2SLS) for Panel-Data:

In what follows we provide econometric evidence for the assertion that earnings inequality is induced by advances in restructuring (increases in real output per worker or increases in job reallocation rates) across regions and time while controlling for simultaneity problems and the presence of other deterministic but omitted factors. We have information on 49 voivodships over a four-year period giving us a total of 196 observations. We estimate the impact of the (infrastructure-deficit) instrumented log of real output per worker, OPW_{jt} , and job reallocation rate, RES_{jt} , separately, in region j and period t , on the log of earnings inequality, EI_{jt} , in region j and period t while controlling for other factors. Models of earnings inequality within local labour markets (Coefficient of Variation) are written as follows,

Model I:

$$\ln EI_{jt} = \alpha + \beta_1 \ln OPW_{jt} + \beta_2 T_t + v_j + \varepsilon_{jt} \quad (2.4)$$

Model II:

$$\ln EI_{jt} = \alpha + \beta_1 \ln RES_{jt} + \beta_2 T_t + v_j + \varepsilon_{jt} \quad (2.5)$$

Unobserved heterogeneity in region j is controlled for by the inclusion of a unit specific residual, v_j , that is comprised of a collection of factors not in the regression that are specific to region and constant over time, for example, human capital and occupation structures of regions, varying participation rates of workers in the labour force, amongst other region specific factors. The random effect specification is justified on the basis of a Hausman (1978) specification test. The intercept and time

dummies, in addition to the random effects, are also included in the regression to control for the evolution of unobservable macroeconomic deterministic factors over time. We instrument output per worker in model I and the job reallocation rate in model II with RANK, regional (random effects) and year controls to avoid an endogeneity problem. RANK takes on a value of 1 to 49, the public infrastructure ranking of the regions in 1994, shown in Table 2.1. Instrumentation using the job reallocation rate as an instrument for output per worker, and vice versa, was attempted. However following theory initial conditions, or infrastructure levels in 1994 were found to work more satisfactorily.

In the first column of Table 2.5 and 2.6 we report 2SLS, rather than OLS, not allowing for unobserved heterogeneity in region j , justified on the basis of a Hausman test for simultaneity. The results of our G2SLS estimation procedure, allowing for unobserved heterogeneity in region j , is similar to that of Balestra, Varadharajan and Krishnakumar (1987), are presented in the second column of Table 2.5 and 2.6. The random effect specification is justified on the basis of a Hausman (1978) specification test.

G2SLS estimation in Table 2.5 and 2.6 produces a strong model specification on the basis of LM tests on the residuals. Compared to the 2SLS results we no longer have first-order autoregressive residuals and heteroscedasticity in the residuals. The level of earnings inequality is shown to be positively and significantly related to real output per worker in Table 2.5 and job reallocation rates in Table 2.6. Earnings are more dispersed in regions advanced in transition. This result contrasts strongly to inferences based on aggregate data.

2.4 Conclusion

Using data across Polish regions, the paper documents that earnings inequality is higher in regions that are more advanced in restructuring (higher labour productivity/job reallocation rates), when controlling for unobservable regional fixed effects and applying an infrastructure-deficit based instrumental variable approach to allow for reverse causality.

This finding contrasts strongly with findings using data at the national level where rapid growth does not seem to be associated with rising earnings inequality. This aggregate relationship is shown to be misleading and highlights the mistakes that can be made from making inferences based on aggregate data, particularly in large countries. .

Across the regions of Poland, the presence of firms and workers with different abilities to adapt to the market economy, allows market liberalisation to clearly induce earnings inequality during transition.

Table 2.1
Taxonomy of the Inherited Public Infrastructure of Polish regions *

Group 6	Group 5	Group 4	Group 3	Group 2	Group 1
41. Ciechanowskie	32. Chelmskie	25. Czestochowskie	17. Walbrzyskie	8. Katowickie	1. Warszawskie
42. Ostroleckie	33. Kieleckie	26 .Bialostockie	18. Slupskie	9. Zielonogorskie	2. Szczecinskie
43. Krosnienskie	34. Radomskie	27. Plockie	19. Elblaskie	10 Legnickie	3. Poznanskie
44. Sieradzkie	35. Tarnowskie	28. Suwalskie	20 Gorzowskie	11. Bydgoskie	4. Wroclawskie
45. Przemyskie	36. Koninskie	29 Kaliskie	21. Lubelskie	12. Opolskie	5. Krakowskie
46. Bialskopodlaskie	37 Skierniewickie	30 Rzeszowskie	22 Torunskie	13. Koszalimskie	6. Lodzkie
47. Siedleckie	38 Nowosadeckie	31 Piotrkowskie	23. Leszczynskie	14. Bielskie	7. Gdanskie
48. Lomzynskie	39. Tarnobrzeskie		24 Pilskie	15. Jeleniogorskie	
49. Zamojskie	40. Wloclawskie			16. Olsztynskie	

* Ranked in ascending order by a rank score that sums the ranked positions in four indicators,

A: Number of Telephones in a region per 1000 inhabitants : A developed telephone network is an important part of the social capital infrastructure within a region. Measuring the number of telephones in a region per 1000 inhabitants is a simple indicator of the quality of public infrastructure in the region. The most (least) developed region has 391.5 (136.2) phones per 1000 inhabitants.

B: Number of Fax Machines in a region per 1000 inhabitants: Related to the provision of a telephone network is the availability of fax machines within a region. The most (least) developed region has 60 (16.9) fax machines per 1000 inhabitants.

C: Number of Railways in a region per 100km squared: Another simple indicator of the quality of public infrastructure in a region is the number of railways in that region per 100 km squared. The most (least) developed region has 21.8 (2.7) railways per 100 km squared.

D: Number of Public Roads per 100km squared: The quality of public infrastructure is also enhanced by the number of public roads per 100 km squared in a region. The most (least) developed region has 180.1 (43.4) per 100km squared.

Table 2.2

Correlation Matrix of 9 Measures of Earnings Inequality across Polish LFS Regions, 1994-1997

	Coef. of Var.	Gini	Rel. mean dev.	Std. Dev. of logs	Mehran	Piesch	Kakwani	Theil entropy	Mean log dev.
Coef. of Var.	1.00								
Gini	0.78	1.00							
Rel. mean dev.	0.75	0.99	1.00						
Std. Dev. of logs	0.62	0.92	0.91	1.00					
Mehran	0.70	0.98	0.98	0.95	1.00				
Piesch	0.82	0.99	0.98	0.89	0.96	1.00			
Kakwani	0.87	0.98	0.96	0.89	0.94	0.99	1.00		
Theil entropy	0.97	0.88	0.86	0.75	0.82	0.91	0.95	1.00	
Mean log dev.	0.86	0.97	0.95	0.92	0.94	0.97	0.99	0.94	1.00

Measures: relative mean deviation, coefficient of variation, standard deviation of logs, Gini index, Mehran index, Piesch index, Kakwani index, Theil entropy index, and mean log deviation.

Table 2.3**Summary Statistics on Earnings and Earnings Inequality by Group**

	Population Share	Mean Earnings	Relative to National Mean	Earnings Share	Gini Co-efficient	Co-efficient of Variation
1994 Overall					0.23	0.49
Group 1	0.24	406.9	1.10	0.27	0.25	0.51
Group 2	0.29	388.1	1.04	0.30	0.23	0.46
Group 3	0.13	356.2	0.96	0.12	0.23	0.52
Group 4	0.12	347.7	0.94	0.11	0.21	0.42
Group 5	0.13	337.6	0.91	0.12	0.21	0.44
Group 6	0.09	326.2	0.88	0.08	0.21	0.44
1995 Overall					0.23	0.50
Group 1	0.24	532.0	1.09	0.26	0.26	0.57
Group 2	0.29	515.4	1.05	0.30	0.23	0.45
Group 3	0.13	460.1	0.94	0.12	0.22	0.46
Group 4	0.11	463.8	0.95	0.11	0.22	0.44
Group 5	0.13	438.7	0.90	0.12	0.21	0.42
Group 6	0.09	435.4	0.89	0.08	0.20	0.42
1996 Overall					0.23	0.52
Group 1	0.25	668.1	1.10	0.28	0.25	0.61
Group 2	0.29	636.0	1.05	0.30	0.24	0.46
Group 3	0.13	570.8	0.94	0.12	0.22	0.49
Group 4	0.11	566.3	0.93	0.10	0.22	0.48
Group 5	0.14	542.1	0.89	0.12	0.20	0.41
Group 6	0.09	549.2	0.90	0.08	0.19	0.42
1997 Overall					0.24	0.58
Group 1	0.25	745.2	1.11	0.28	0.27	0.66
Group 2	0.28	696.6	1.03	0.29	0.24	0.49
Group 3	0.13	630.4	0.93	0.12	0.21	0.45
Group 4	0.12	636.2	0.94	0.12	0.24	0.48
Group 5	0.13	618.5	0.91	0.12	0.21	0.45
Group 6	0.09	602.0	0.89	0.08	0.19	0.43

Source: Polish Labour Force Survey

Group 1 is the most developed and Group6 the least developed grouping in Public Infrastructure.

Table 2.4

Summary Statistics on Output and Job Reallocation by Group

	Output Share	Output per Worker	Job Reallocation Rate
1994			
Group 1	0.31	68	0.07
Group 2	0.27	60	0.04
Group 3	0.12	52	0.04
Group 4	0.12	51	0.03
Group 5	0.11	48	0.02
Group 6	0.07	38	0.01
1995			
Group 1	0.32	94	0.08
Group 2	0.28	82	0.06
Group 3	0.11	67	0.05
Group 4	0.11	65	0.05
Group 5	0.11	62	0.04
Group 6	0.07	52	0.02
1996			
Group 1	0.34	156	0.08
Group 2	0.27	113	0.06
Group 3	0.11	103	0.06
Group 4	0.11	99	0.05
Group 5	0.10	99	0.05
Group 6	0.07	70	0.03
1997			
Group 1	0.34	188	0.09
Group 2	0.27	144	0.07
Group 3	0.11	133	0.07
Group 4	0.11	130	0.06
Group 5	0.11	126	0.06
Group 6	0.07	92	0.04

Source: Amadeus Company Accounts Data

Group 1 is the most developed and Group 6 the least developed grouping in Public Infrastructure.

Table 2.5
Earnings Inequality and Output per Worker across Polish Regions 1994-97

	2SLS Model I	G2SLS Model II
	Log Earnings Inequality	Log Earnings Inequality
R² (Within)		0.05
R² (Between)		0.29
R² (Overall)	0.43	0.18
Constant	- 2.3 (7.1)*	-1.5 (6.7)*
Log Output Per Worker**	0.37 (5.1)*	0.19 (3.3)*
Region Dummies	YES	NO
Year Dummies	YES	YES
Random Effects	NO	YES
Observations	196	196
Hausman Random Effects Test		$\chi^2(3) = 0.3$
Hausman Simultaneity Test	$\chi^2(51) = 20.1$	$\chi^2(4) = 28.1$
Heterosced.	$\chi^2(52) = 62$	$\chi^2(52) = 8.6$
AR1	$\chi^2(1) = 1.5$	$\chi^2(1) = .03$

T-statistics in parenthesis, * indicates significance at the 5% level.

** Instruments include lnRANK, (random) regional effects and time dummies.

Table 2.6
Earnings Inequality and Job Reallocation across Polish Regions 1994-97

	2SLS Model I	G2SLS Model II
	Log Earnings Inequality	Log Earnings Inequality
R² (Within)		0.10
R² (Between)		0.22
R² (Overall)	0.66	0.19
Constant	-2.7 (1.2)	-0.3 (1.2)
Log Job Reallocation Rate**	0.08 (2.1)*	0.33 (3.9)*
Regional Dummies	YES	NO
Year Dummies	YES	YES
Random Effects	NO	YES
Observations	196	196
Hausman Random Effects Test		$\chi^2(3) = 0.2$
Hausman Simultaneity Test	$\chi^2(51) = 1.0$	$\chi^2(4) = 38.1$
Heterosced.	$\chi^2(52) = 45$	$\chi^2(52) = 9.6$
AR1	$\chi^2(1) = 7.1$	$\chi^2(1) = 4.1$

T-statistics in parenthesis, * indicates significance at the 5% level.

** Instruments include lnRANK, (random) regional effects and time dummies.

Chapter Three

Relative Skill Premia And Industry Dynamics, A Look At The Demand For Labour In Poland Post Transition.

3.1 Introduction

This paper follows the methodology of Bernard et al. (2003 (b)) looking at industry relative wage bills or industry skill premia and how they relate to industry dynamics. We show considerable regional specific effects in Poland's labour market, in that economic activity can be related to variation in relative wages and that industry skill premia are driven by the relative supply of skilled labour. Skill premia are negatively related to the number of skilled workers within a region, skill abundant regions will have a lower price of skilled to unskilled labour than skill scarce regions. We examine two industry similarity measures and how they relate to skilled wage premia. The first finds that regions that have bigger differences in relative wages share fewer common

industries. The second shows that regions that share the same industry shares have the same effects on their skill premia. We then go on to show that industry location and skill premia respond systematically to persistent relative wage differences over time. Regions with lower skill premia experience greater increases in their share of skill intensive industry employment. Leading to the suggestion that industries move towards workers more than workers move towards industry, or that perhaps capital moves faster than labour to differences in relative wages. Which implies that in the case for Poland the development of skilled labour pools may be more beneficial than encouraging greater FDI flows or new industry, a reverse of the current thinking in transition and developing economies.

We work with the Polish Labour Force Survey, a quarterly survey of 50,000 individuals, to get 20 variables on worker specific characteristics, including individual earnings at a industry level within each of Poland's 49 regions. We then use this earnings measure to form industry-region specific relative wage bills, for both skilled and unskilled labour.

Our regional analysis allows us to investigate the relationship between skill premia and industry structure, while controlling for unobservables that tend to be present in cross-country analysis, including how goods are produced and how workers are trained. Poland provides us with a "quasi" natural experiment. Polish regions inherited idiosyncratic industry and physical infrastructure coming out of the planning era. Huber and Scarpetta (1995) explain the growing polarisation in performance across Polish regions as an outcome of such. In addition, inter-regional job and worker flows (adjustments) have been virtually absent during transition (see Faggio and Konings,

1999, and Boeri and Scarpetta 1996) allowing independent developments across regions to persist over-time, leading to some of our findings that industries adjust production faster than workers migrate across regions. While institutions and data sets are compatible across regions, the speed of transition and the evolution of earnings and skill premia could be expected to be very different across the regions of Poland. Gora and Urszula (1999) identify a group of highly developed regions that have markedly higher earnings differentials, namely Warsaw, Katowice, Gdansk, Poznan and Krakow, when compared to the other 44 regions. Even if regions face common commodity prices and have identical technology, large differences in endowments can induce specialisation in different mixes of industries with different equilibrium relative factor prices (Leamer 1987). All in all because of the rapid process of transition we can see considerable structural change in Poland's regional labour markets in a relatively short time period, allowing us to relate this to skill premia.

We describe our data in section 3.2. In section 3.3 we explain our model, looking at regional effects on relative wage bills. We then extend this analysis in 3.4 to see if industry structure determines relative wage bills. This is tested using two measures of industry structure in 3.5 and 3.6. Section 3.8 and 3.9 look at the relative demand for skilled labour, between and within industry. Finally we conclude in 3.10.

3.2 The Data

The data used is taken from the Polish LFS data for the years 1993 to 1997. The Polish LFS is a quarterly household survey, February, May, August and November. The survey includes individuals older than 15 years and there is no upper age limit. The Polish LFS does not differ from the usual western survey. It contains more than 50 questions and allows one to distinguish between the employed, the unemployed and those not in the labour force according to ILO/OECD definitions. The total number of observations in each survey is approx 50,000. For each observation we use a record of regional location (voivodship), a two digit NACE industry classification and earnings in the previous month from a main job measured in polish zloty. This allows us to construct a quasi wage bill for each industry in each region, for skilled and unskilled labour. We do this for a set of homogenous manufacturing industries from our data set to avoid estimation problems coming from heterogeneous industries classifications such as those from services or agricultural data. Our data covers Poland during a time of significant structural change in its labour market, while the transition process is having its greatest effect.

3.3 Our Model

We follow the methodology of Bernard and Schott (2003) in looking at relative wage bills of skilled and unskilled workers, as a deviation from a base category, which they show controls for unobserved variation in factor quality and production technology across industries and regions. We also normalise the industry j wage bill of skilled workers relative to unskilled workers in all regions r , by the relative industry wage bill in a base region s and taking logs, we then have,

$$\ln \left(\frac{RWB_{rj}}{RWB_{sj}} \right) = \sum_r \alpha_r^s d_r + \varepsilon_{rsj} \quad (3.1)$$

Where $RWB = \text{wagebill}^{\text{skilled}} / \text{wagebill}^{\text{unskilled}}$, d_r is a set of region dummies, α_r^s is the coefficient on the region dummies where s is the base region, it will be shown later that results are independent of the choice of base region, in fact a preference is to use Poland as the base region where possible throughout this system of equations⁴. We express regional coefficients as deviations from a hypothetical share weighted category mean as in Kruger and Summers (1988) and also use the methods of Haisken-DeNew and Schmidt (1996) to correct for exact standard errors in our regional dummy estimates.

Our estimate α_r^s can then be interpreted as the quality adjusted bilateral relative wage bill differences for each region. Table 3.1 presents our results for the 49 Polish regions in each year. Warsaw, a skill abundant region, is consistently positive and

⁴ Excluding the own region from the definition of Poland as a whole.

significant across all years, indicating that their skilled wage bill is higher than Poland on average. While skill scarce regions, show a consistently negative coefficient. Fewer coefficients are significant over time, perhaps showing a convergence in skill premia. Figure 3.1 shows these estimated coefficients, for selected regions, over time. The results in this section show that regions of Poland that are relatively skill abundant have lower skill premia, i.e. that their relative wage bill is higher.

3.4 Relative wages and production structure.

We now look to whether industry production structure is related to relative wage premia, by regressing:

$$Z_{rs} = \beta_0 + \beta_1 |\hat{\alpha}_r^s| + \beta_2 I_r + \beta_3 I_s + u_{rs} \quad (3.2)$$

where Z_{rs} is one of two measures of industry similarity that we have constructed between regions r and s . The variable $\hat{\alpha}_r^s$ is the estimated bilateral relative wage bill differences taken from the previous equation, the absolute value is used to see if the magnitude of the difference is related to industry structure. I_r and I_s are controls for the number of industries in regions r and s , to control for the fact that two large regions each having a large number of industries are also likely to have a large number of industries in common. u_{rs} is a stochastic error.

3.5 Measure of industry similarity using industry overlap.

We firstly construct Z_{rs} as the numbers of industries in common between the regions r and s . This measure is a simple count of industries common to both regions, unfortunately the number of different industry categories at the 2-digit level in our data set do not allow this measure the accuracy it deserves. The results for this are shown in columns (1) and (2) of Table 3.2, column (2) added bilateral region pair dummies to yield a pure time series effect in the other coefficients. The signs are both negative as expected, the less industries you have in common with the base region the greater the relative wage bill differences or skill premia differences with the base region.

3.6 Measure of industry similarity using industry share.

We then construct a measure of industry share, again using the Polish Labour Force Survey data. Where the numbers L , in industry j are expressed as a share of the numbers employed in the entire region. This not only looks at whether the industry is present in both regions, but also its level of economic activity. This is widely used in economic geography literature (see Krugman 1991). This measure is constructed as the sum of absolute differences in industry shares of manufacturing employment in the two regions.

$$Z_{rs} = \sum_j \left| \frac{L_{rj}}{L_r} - \frac{L_{sj}}{L_s} \right| \quad (3.3)$$

This measure takes a value of 0 if both industry structures are identical and a maximum value of 2 if no industries are common. Hence similarity of industry structure is decreasing in this measure. Our results in Table 3.2, columns (3) and (4), show as expected that regions that have the same industry shares also have greater differences in relative wages. Hence for both measures we found that regions that had diverging relative wages were also less similar in terms of industry structure.

3.7 Changing industrial responses to relative skill premia.

This next section looks at whether industries adjust their demand for skilled labour across regions and within industries, depending on skill premia. Bernard et al (2003 (b)) found that initial skill premia had a considerable effect on future production with skilled labour, but examined this over a long time horizon. In our transition context, there is considerable structural change from year to year, thus initial conditions may not have future impact due to the systematic change of production markets.

3.8 Between Industries.

Firstly we consider whether firms adjust their use of skilled labour, depending on initial conditions, from an earlier period. That is to say when relative skilled labour costs are low in an initial period, does this have a positive effect on future demand for skilled labour between regions. We model this in the following regression:

$$\Delta_{0,T} \left(\frac{L^{Skilled}}{L} \right)_r = \delta_0 + \delta_1 \hat{\alpha}_{r_0}^{Poland} + \delta_2 \left(\frac{L^{Skilled}}{L} \right)_{r_0} + \omega_r \quad (3.4)$$

where Δ is the change across time periods 0 to T. We use the initial estimates of relative wage bill differences $\hat{\alpha}_{r_0}^{Poland}$, with Poland as the base region. The initial share of skill intensive employment for each region is included to allow for mean reversion and convergence effects. Again a positive coefficient on $\hat{\alpha}_{r_0}^{Poland}$ indicates a relative wage lower than Poland on average, hence we would expect a positive and significant coefficient indicating that lower relative skilled wages lead to increased shares of skilled workers. Our results are shown in Table 3.3, building up through the columns (1) to (3), in (3) we include the unemployment rate for that region, which does not significantly alter the other coefficients, but is prudent given the large scale labour market restructuring going on at different rates across regions of Poland during transition. We however do not find that initial relative wages determine increases in present day skilled labour allocations, which given the structural change during this time in Poland is not surprising. We do find that present day relative wages are important in determining the change in skilled labour use between this period and the last, Table 3.3 columns (4) to (6). This would indicate a very speedy reallocation of skilled labour, which for some regions is certainly possible given the degree of restructuring.

3.9 Within Industries.

Secondly do firms adjust labour demand within industries for skilled and unskilled labour? When initial relative skilled wage costs are low, do industries change their composition of workers from unskilled to skilled, in a sense a change in factor usage.

We model this using the following equation:

$$\Delta_{0,T} \left(\frac{Wagebill_{rj}^{Skilled}}{Wagebill_{rj}^{UnSkilled}} \right)_r = \eta_j + \lambda_1 \hat{\alpha}_{r_0}^{Poland} + \nu_{rj} \quad (3.5)$$

where η_j is an industry fixed effect and $\hat{\alpha}_{r_0}^{Poland}$ is again the initial estimates of relative wage bill differences with Poland as the base region. We would expect to see a positive sign here, indicating that low initial relative wages increase the factor usage of skilled labour within industry. However again here, as with the previous section, we find the coefficients for initial skill premia not to hold up. Our results, in Table 3.4 column (1) and (2), show that skill premia in the base period (1993) are negatively related to increasing skilled labour usage within industry in current periods (1994-1997). With the rapid nature of job reallocation in transition (Faggio & Konings 2003) this could be put down to large scale structural change. Table 3.4, columns (3) and (4) show the expected relationship, but for skill premia in the current period. Here we find a strong relationship between current low skill premia and the change in factor use of skilled labour between this period and the last. We also instrumented for current period skill premia by running Equation 3.5 with the lagged values of skill premia as instruments to insure that issues of endogeneity did not drive the relationship. While reducing the coefficients somewhat, the significance and sign remained.

We have found that Polish regions with low relative wages for skilled labour see prompt employment increases in skill intensive industry and in the use of skilled labour within industry.

3.10 Conclusion

We have demonstrated that Poland has a strong relationship between regional production structures and relative wages. We have shown that industry skill premia are negatively related to the supply of skilled labour within a region, those regions with a larger supply of skilled labour will have a lower price of skilled to unskilled labour. We found that regions that have bigger differences in relative wages share fewer common industries and have a different industrial structure. Industry location and skill premia respond systematically to persistent relative wage differences over time. Regions with lower skill premia experience greater increases in their share of skill intensive industry employment and in low skill premia regions they experience greater increases in the share of skill labour use within industry. All leading to the suggestion that firms move faster than labour and that development of skilled labour pools may lead to a greater share of skilled industry. This has stark ramifications for Poland and transition economies in general, with large pools of skilled labour and ever increasing FDI flows, our analysis shows that developing skilled labour pools should be a key priority, rather than focusing on attracting multinational investment.

Figure 3.1: Selected regional coefficients over time, Poland Base

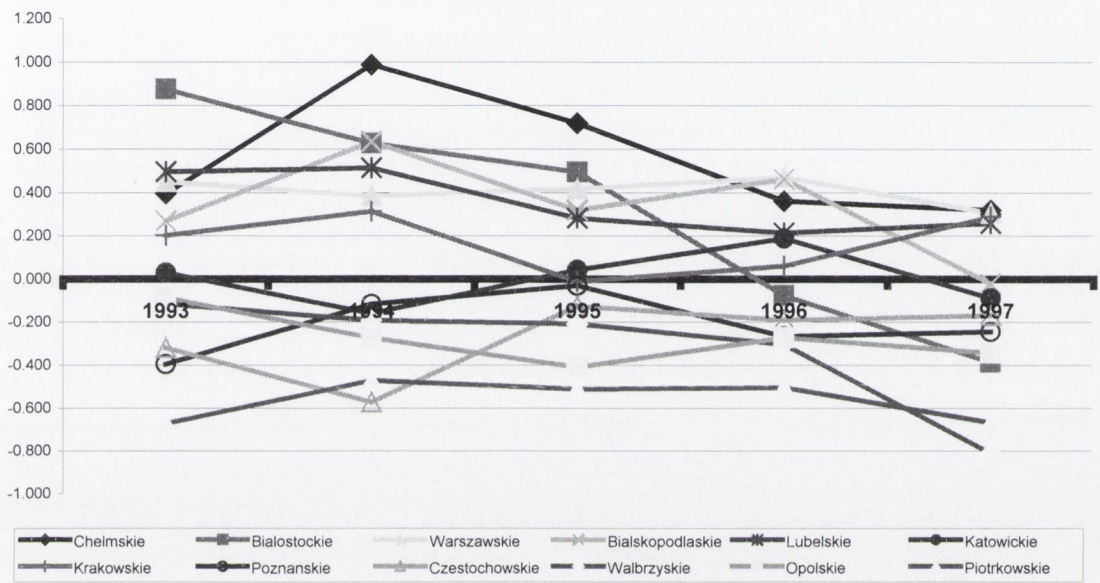


Table 3.1: Tests of common relative wage across regions, Poland base

Region	1993		1994		1995		1996		1997	
Warszawskie	0.449	***	0.385	***	0.417	***	0.470	***	0.306	***
Bialostockie	0.875	***	0.627	***	0.494		-0.076		-0.387	
Bialskopodlaskie	0.269	**	0.634	***	0.319	**	0.462	***	-0.021	
Bielskie	-0.082		0.050		-0.324		-0.143		0.066	
Bydgoskie	-0.202	***	-0.247	*	0.180		0.036		-0.106	
Chelmskie	0.395		0.987	***	0.719		0.361		0.319	
Ciechanowskie	0.139		0.145		0.496	**	0.160		-0.025	
Czestochowskie	-0.320	***	-0.572	*	-0.125		-0.190		-0.168	
Elblaskie	-0.349		-0.271	***	-0.168		0.309		0.009	
Gdanskie	0.205		0.235		-0.303		-0.178		-0.035	
Gorzowskie	-0.223		-0.057		-0.279		-0.043		-0.115	
Jeleniogorskie	-0.247		-0.107		0.002		0.123		-0.182	
Kaliskie	-0.186		0.308		-0.033		0.088		0.235	
Katowickie	0.029		-0.159		0.042		0.188		-0.088	
Kieleckie	0.242		0.378	**	0.085		-0.281		-0.322	
Koninskie	-0.231	***	-0.316	***	-0.046		0.212		-0.020	
Koszalinskie	0.012		0.025		0.155		-0.272		1.214	***
Krakowskie	0.202		0.313	**	-0.010		0.060		0.288	
Krosnienskie	0.194		0.304		-0.222		0.100		-0.597	
Legnickie	-0.216		-0.376		0.193		0.495		0.263	
Leszezynskie	-0.581		-0.574	***	0.152		0.192		-0.396	*
Lodzkie	0.424	*	0.104	*	0.332	***	0.301	***	-0.163	
Lomzynskie	0.101		-0.277		0.323		-0.104		-0.933	
Lubelskie	0.496		0.514	***	0.283		0.213	*	0.258	*
Nowosadeckie	-0.573		-0.191	**	0.084		-0.145		0.127	
Olsztynskie	0.269		0.152		-0.455		0.024		0.751	
Opolskie	-0.086		-0.274		-0.409	***	-0.271		-0.343	
Ostroleckie	-0.202		-0.300		-0.414	*	-0.515	*	0.718	
Pilskie	-0.503	***	-0.280		-0.315		0.013		-0.126	*
Piotrkowskie	-0.672	*	-0.471	***	-0.511	***	-0.504	***	-0.667	***
Plockie	0.231		0.075		-0.136		0.108		0.306	
Poznanskie	-0.395		-0.116		-0.030		-0.266		-0.244	
Premyskie	0.081		-0.118		0.335		-0.359		0.262	
Radomskie	0.122		-0.208		0.300		0.083		0.272	
Rzeszowskie	-0.238		-0.401		-0.158		-0.228		-0.005	
Siedleckie	-0.373	*	-0.520	***	-0.296	**	0.096		0.437	
Sieradzkie	-0.435		0.381		0.363		-0.146	***	0.077	*
Skierniewickie	0.046		-0.040		-0.351	***	-0.126	***	0.060	
Slupskie	-0.887		-0.190		0.146		-0.305		-0.461	*
Suwalskie	0.407		0.689		-0.049		0.526	**	-0.118	
Szczecinskie	0.256		0.287		-0.079		-0.596	*	-0.045	
Tarnobrzeskie	0.047		-0.440		-0.150		-0.240		-0.361	
Tarnowskie	-0.008	***	-0.139		-0.261		-0.175		0.134	
Torunskie	-0.098		-0.161		0.099		-0.148		0.155	
Walbrzyskie	-0.115		-0.192	*	-0.208	**	-0.303	**	-0.810	***
Wloclawskie	-0.308		0.409	*	0.198		-0.726	***	-0.095	*
Wroclawskie	0.208		-0.137		0.126		0.129		0.104	
Zamojskie	-0.275		0.064		0.054		0.561		0.727	*
Zielonogorskie	-0.165	**	0.083		-0.233	**	-0.221		-0.189	
F-stat (p-value)	0.0000		0.0000		0.0000		0.0000		0.0004	
Obs	641		1217		1107		1096		1003	

Table 3.2: Industrial Specialisation, Regions, Pooled yearly cross sections

Dependant variable: Z_{rs}	I _{rs} (sum industries in common)		Specialisation Index	
	(1)	(2)	(3)	(4)
$Abs(\hat{\alpha}_{r_o}^s)$	-0.122 (0.094)	-0.174 (0.108)	0.057 (0.021)	0.046 (0.021)
I _r	0.946 (0.015)	0.941 (0.018)	-0.011 (0.005)	-0.002 (0.006)
I _s	0.045 (0.013)	0.049 (0.015)	0.040 (0.005)	0.033 (0.005)
Observations	245	245	241	241
Year Dummies	Yes	Yes	Yes	Yes
Bilateral region pair dummies	No	Yes	No	Yes

Exact standard errors in brackets, Haisken-DeNew (1996)

Table 3.3: Change in the share of skill intensive industries and relative wages of skilled workers

Dependant variable: percentage point change in the share of skill intensive industries in region employment

	(1)	(2)	(3)	(4)	(5)	(6)
$\hat{\alpha}_{r_0}^{RI}$	-0.037	0.013	0.011			
	(0.009)	(0.034)	(0.034)			
$\hat{\alpha}_r^{RI}$				0.030	0.051	0.052
				(0.010)	(0.010)	(0.010)
$(L^N / L)_{rt}$		-0.276	-0.277		-0.30	-0.320
		(0.180)	(0.179)		(0.04)	(0.049)
$(U_{rate})_{rt}$			-0.001			-0.001
			(0.0005)			(0.0005)
Constant	-0.00001	0.079	0.095	0.002	0.086	0.107
	(0.0030)	(0.051)	(0.052)	(0.003)	(0.014)	(0.018)
Observations	196	196	196	196	196	196

Robust, exact standard errors in brackets, Haisken-DeNew (1996)

Table 3.4: Change in skill intensity of production and relative wages of skilled workers

Dependant variable: change in the region-industry relative wagebill 1993-1997

	(1)	(2)	(3)	(4)
$\hat{\alpha}_{r_o}^{PI}$	-0.379	-0.345		
	(0.169)	(0.169)		
$\hat{\alpha}_r^{PI}$			0.836	0.830
			(0.206)	(0.207)
Constant	-0.023	-0.309	0.005	-0.178
	(0.063)	(0.068)	(0.059)	(0.093)
Observations	336	336	336	336
2-Digit Industry Dummies	No	Yes	No	Yes

Robust, exact standard errors in brackets, Haisken-DeNew (1996)

Chapter Four

Regional Earnings Differences in Poland:

The Selection Effects of Education on Participation and the Speed of Transition on Wages.

4.1 Introduction

This chapter again focuses on the ‘winners and losers’ of transition. We examine educational attainment as a key determinant of wages, where having the right skill set selects workers into the employment pool. It is of note that these initial endowments are exogenously determined pre-transition. Once in this employed pool, wages are then determined by the speed of transition between regions.

At the start of transition, labour market conditions were characterized by full employment of the working age population in inefficient enterprises across oversized

industrial and agricultural sectors. In moving to a market economy many anticipated unprecedented worker reallocation. The expansion of services and downsizing of manufacturing and agriculture would have to be facilitated by worker reallocation. In addition, the downsizing, exit and entry of enterprises *within* sectors would also have to be accommodated by further worker reallocation. Aghion and Blanchard (1994), write down a model of wage setting within an Optimal Speed of Transition (OST) model of worker reallocation.⁵ We use this model as developed further by Duffy (2001) to look at the sensitivity of wages to excess layoffs and hiring. The government dictates the optimal speed at which workers are released from non-restructured enterprises⁶. To increase the speed of absorption of labour into the restructured sector, unemployment (excessive layoffs) can be used to maintain a downward pressure on wages. The extent to which unemployment can be used is constrained by having unemployment benefits financed out of labour taxes. Unemployment can determine the speed of labour reallocation. The model predicts that an optimal layoff rate in each period that maximizes the hiring rate in enterprises. Average pay in a labour market is predicted to be negatively related to the optimal annual (excessive) layoff rate and positively related to the annual hiring rate. The model relates the level of pay to the speed of worker reallocation. The pace of employment restructuring should be a key determinant of the mean wage.⁷ We aim to

⁵ Worker reallocation referred to the movement of workers from the non-privatized to the privatized sector. Since many privatized enterprises resisted restructuring, while some state owned undertook restructuring this dichotomy is empirically problematic. This has clearly been shown in the literature on firm performance and ownership; see Walsh and Whelan (2001). Hence we work in terms of a non-restructured traditional enterprises and restructured (traditional and de novo) enterprises dichotomy.

⁶ Exogenous (government imposed) restructuring can be replaced with a model of endogenous (insider controlled) restructuring. To opt for restructuring, the expected income from restructuring must compensate workers for the risk of becoming unemployed and for their forgone income stream from the non-restructured state. Workers require a wage premium for risk exposure during restructuring. With endogenous restructuring, annual layoff and hiring rates can fuel wage pressure over an above that created by exogenous government control of restructuring.

⁷ The assertion is that the need for structural change in employment is first order in a labour market in transition. Traditional enterprises need to downsize and new enterprises are needed to create outside

test this theory across forty-nine local Polish labour markets. The main aim of this paper is to look at the selection effects of education, while explaining regional disparity in mean pay. Motivated by Aghion and Blanchard (1994) we consider the role of annual (excessive) layoffs and hiring rates across regions as a determinant of regional pay disparities and educational attainment. Our strategy is to run individual regressions, assuming individual pay does not dictate regional annual worker reallocation, and estimate the, on average, impact of the speed of transition on pay, controlling for a rich set of individual characteristics and the selection process into employment, among other factors. Here we find educational attainment to be a key determining factor. First we answer a number of common questions. Is it right to treat Polish regions as local labour markets? Are there persistent regional variations in short-term unemployment and hiring rates across regions? Are there persistent regional disparities in the mean pay?

The lack of inter-regional worker and job flows during transition is well documented for Poland. Deichmann and Henderson (2000) document increasing wage differentials and persistent differentials in unemployment rates across regions, even amongst neighbouring regions, in Poland during the period 1990-1998. One might have expected migration flows to increase dramatically during transition, but a dramatic slowdown is documented. They put forward housing shortages as a key deterrent of migration. The absence of migration flows ensures that we do not have to concern ourselves with the standard Harris-Todaro critique, the need to model migration as a key labour supply determinant of regional wage levels. In addition, inter-regional job flows have been virtually absent during transition (see Faggio and Konings, 2003).

options for job searchers. Pay is more about labour demand dynamics and less about inherited human capital and participation considerations during the transition period.

Firm migration has not been a key feature of regional labour demand. We assume that workers and firms are locked into local labour markets during the period of our analysis, 1994-1996.⁸

Why should we expect the optimal speed of worker reallocation to differ across local labour markets in Poland? Local labour markets in Poland inherited extremely distinctive employment structures coming out of planning that have persisted. While most regions, by western standards, had a narrow range of employment activities, some eastern regions were extremely specialized. This is apparent in Table 4.1, which documents the regional concentration of employment by 2-digit sectors. The C1 concentration ratio illustrates that the biggest 2-digit sectors can account for as much as 60 per cent of total regional employment, while the C5, top five 2-digit sectors, accounts for the vast majority of regional employment. As a result of such initial conditions in employment structure the optimal speed of transition did differ across labour markets.⁹ In Table 4.2 we document the gaps in annual (excessive) layoffs and hiring rates relative to Warsaw. Such regional disparities in annual worker flows should reflect the speed of ongoing regional restructuring (or lack off) of traditional enterprises and the expansion (or lack off) of new enterprises.

⁸ We examine wage behaviour in an in-depth study of Poland's regional experience. A country study can miss important heterogeneity in regional labour demand dynamics. Within a regional study of Poland over a relatively short time period, the data, the culture and the macroeconomic institutions can be assumed to be similar across regions, while the pace of structural change in labour demand varied greatly.

⁹ Boeri and Scarpetta (1996) document idiosyncratic initial conditions within regions as the main reason for different speeds of regional employment restructuring during transition.

Finally we examine one of the focuses of the paper, regional disparities in mean pay. In the first two columns of Table 4.3 we document the mean monthly wage (thousands of Polish Zloty) across regions calculated for males from the November wave of the Labour Force Survey (LFS). To understand how representative the LFS data is we document the mean monthly wage across regions taken from Polish regional yearbooks.¹⁰ Even though the level of wages is higher in official data, the trends over-time and across regions are similar. We observe that the gap between pay in regions relative to Warsaw is persistent. On average, pay outside Warsaw is 30 per cent lower.

One of the main aims of this paper is to explain regional disparity in mean pay. Motivated by Aghion and Blanchard (1994) we consider the role of annual (excessive) layoffs and hiring rates across regions as a determinant of regional pay disparities, controlling for a rich set of individual characteristics and the selection process into employment, among other factors. Using this strategy we estimate the local short-term unemployment (excessive layoffs) and annual hiring rate elasticity of individual pay to be approximately -0.29 and +0.75, respectively. Large regional variation in short-term unemployment and hiring rates ensure that the speed of transition explains most of the disparity in *average* earnings across regions. Individual characteristics are clearly important for participation and where one is on the wage distribution *within* regions. We find that successful educational attainment selects individuals into the labour market, which then determines that labour markets mean earnings, given the pace of restructuring.

¹⁰ One feature of the LFS data is that earnings are only reported for full time hired employees. There is missing data on the self-employed and part-time workers.

4.2 Wage Behaviour During Transition

The model in this section is the basic labour reallocation model of Aghion and Blanchard (1994), as illustrated in Roland (2000). We normalize the labour force in a labour market to 1. The number of workers in restructured firms in date t is $N_R(t)$, the number of workers in a non-restructured state in date t is $N_{NR}(t)$, and the number of unemployed job searchers in date t is $U(t)$.

$$N_R(t) + N_{NR}(t) + U(t) = 1 \quad (4.1)$$

The objective of the government is to decide on the optimal number of worker flows from the non-restructured state in each time period, $dN_{NR}^*(t)/dt$, in full anticipation of the factors that determine the speed of reallocation.¹¹ Increases in employment in restructured firms in date t , $dN_R(t)/dt$, is determined by the following equation,

$$\frac{dN_R(t)}{dt} = \delta[1 - (w(t) + z(t))] \quad (4.2)$$

¹¹This model of exogenous (government controlled) restructuring can be replaced with a model of endogenous restructuring. During the reforms in 1990, majority insider privatization ensured workers took control of firms. The following condition had to be satisfied before workers would vote for restructuring, $rV_N \leq \lambda rV_R + (1-\lambda) rV_U$. The expected income stream for a worker, ex-post restructuring, must be at least as great as the current income stream in the non-restructured state, rV_N . A worker is given a probability λ of remaining in the restructured firm, earning an income stream of rV_R , and a probability $(1-\lambda)$ of becoming unemployed with an expected income stream of rV_U . The expected income stream after restructuring must compensate the worker for the risk of becoming unemployed and for the forgone expected income stream from the non-restructured state. One can write down the expected income stream in the event of a flow into unemployment, rV_U , and the expected income stream for a worker in the non-restructured state, rV_N . The minimum ex-post income stream, rV_R , necessary to induce an ex-ante vote for restructuring can be expressed as $rV_R = rV_U + c/\lambda$. Workers require a premium for exposing themselves to the risk of becoming unemployed during the restructuring process, as $0 < \lambda < 1$. With endogenous restructuring, annual layoff and hiring rates in restructured enterprises, can fuel wage pressure over and above that created by exogenous government control of restructuring where $\lambda = 1$.

The marginal revenue product of labour is normalized to 1. The marginal cost of labour is made up of a wage rate, $w(t)$, and a tax, $z(t)$, in time t levied on wages to finance unemployment benefits. The value of δ is the scale of operation of the restructured sector. This determines how many workers are employed in time t given the mark-up on one unit of labour. Factors outside the labour market (such as the quality of public infrastructure) determine the size of δ . The budget constraint of the government is written down as,

$$bU(t) = (1 - U(t))z(t) \quad (4.3)$$

where b is the per capita level of unemployment benefit that is assumed to be time invariant. As illustrated in Roland (2000), one can write down asset equations for the expected discounted (with ρ) income stream from unemployment and from employment in the restructured sector. Assuming there has to be a constant compensating differential, c , to induce people out of unemployment into the restructured sector, one can write the following reduced form expression for wage setting,

$$w(t) = b + c \left(\rho + \frac{dN_R(t)/dt}{U(t)} \right) \quad (4.4)$$

The expression forms the basis of our empirical work.¹² Pay is driven by outside options. In particular, it is negatively related to the unemployment rate (excessive layoffs during period (t) that are effective job searchers) and positively related to the hiring rate during period (t) in the restructured firms. $W(t)$, $dN_R(t)/dt$, and $U(t)$ are endogenous outcomes.

The government is assumed to control the optimal number of separations coming from non-restructured firms, $dN_{NR}^*(t)/dt$, in period t . Market forces will determine the hiring rate, $dN_R(t)/dt$, and the unemployment rate, $U(t)$. The objective of the government is to maximize the speed of the reallocation process, by maximizing $dN_R(t)/dt$. Using equations (5.1) to (5.4) one can express $dN_R(t)/dt$ as the following,

$$\frac{dN_R(t)}{dt} = \frac{\delta U(t)}{U(t) + c\delta} \left[1 - \rho c - \frac{b}{1 - U(t)} \right] \quad (4.5)$$

In Figure 4.1, we graph the inverse U relationship between the hiring rate, $dN_R(t)/dt$, and the unemployment rate, $U(t)$. Clearly from equation (4.4) if $U(t) = 0$, wages would be infinite and no reallocation can take place. In addition the hiring rate in the restructured sector is zero when, $U(t) = 1 - (b/1 - \rho c)$: unemployment is so high that the tax on employment to finance unemployment benefits reduces the speed of reallocation to zero. The maximum speed of transition $dN_R^*(t)/dt$ and associated $U^*(t)$ are illustrated in Figure 4.1. Knowing $dN_R(t)/dt$ and $U(t)$, one can back out the wage level from equation (4.4), $w^*(t)$, and optimal layoff rate from non-restructured sector, $dN_{NR}^*(t)/dt$, from equation (4.1).

¹² This approach imposes exogenous mark-ups in the restructured product and labour market. The explicit modelling of imperfections in product and labour markets can be found in Konings and Walsh (1994, 2000) and Bughin (1996).

The analysis above gives us a good economic foundation for why wage levels in period (t) respond to period (t) (excessive) layoffs and hiring rates (as a percentage of the labour force, normalized to one). We re-write equation (4.4) as the following,

$$\ln w_{jt} = \ln(b + \rho) + 2 \ln c_j + \beta_1 \ln\left(\frac{dN_R}{dt}\right)_{jt} - \beta_2 \ln U_{jt} + \varepsilon_{jt} \quad (4.6)$$

Pay in region j is negatively related to the unemployment rate (excessive annual layoffs effective in job search) and positively related to the hiring rate in region j in period t , among other country (benefit system) and regional j (compensating differentials) specific determinants. At this level of aggregation one should have a set of proposed instruments and controls for unobserved regional heterogeneity. Our strategy is to model the, on average, response of *individual* wages to the local short-term unemployment (excessive layoffs) rate and the local annual hiring rate, on average, controlling for individual characteristics and selection to employment. Our objective is to see whether the pace of labour reallocation can account for differences in mean regional wages.

An empirical relationship between the wage level and local unemployment and hiring rates is not new but the theoretical *interpretation* of these correlations is of great interest.¹³ In general equilibrium models where the conventional labour supply curve is replaced with a wage setting curve, as in the Aghion and Blanchard (1994), a

¹³ From the beginning of the 1970s, based on Adam Smith's theory of "compensating differentials" and a long-run zero migration equilibrium, Harris and Todaro (1970) argued that regions with high unemployment should also experience high wage levels. Hall (1970, 1972), Reza (1978), Adams (1985) and Marston (1985) find such a positive relationship.

negative relationship between pay and the unemployment rate is clearly predicted.¹⁴ Motivated by theories of imperfectly competitive theories of wage setting, many provide evidence that regional pay and unemployment are negatively correlated¹⁵. This is shown using British data, Blackaby and Manning (1987, 1990a,b,c), American data, Freeman (1988), Canadian data, Card (1990) and Belgian data, Janssens and Konings (1999).

Blanchflower and Oswald (1994) document a negative empirical relationship between local unemployment and pay determination, which they term a “Wage Curve”. A typical wage curve is described by the following specification;

$$\ln W_{it} = \beta_0 - 0.1 \ln U_{jt} + \beta_2 X_{it} + \beta_2 D_j + \beta_3 D_t + \varepsilon_{it} \quad (4.7)$$

The natural logarithm of individual i in period t hourly/monthly/yearly earnings, W_{it} , is explained by the natural logarithm of region j unemployment rate, U_{jt} , a vector of workplace and human capital characteristics, X_{it} (age, education, work experience and employment sector), regional and time dummies, D_j and D_t , respectively. Regression results on samples across 12 countries suggest that the unemployment elasticity of pay approximates -0.1 : a hypothetical doubling of unemployment is associated with a drop in pay of 10%. Using the International Social Survey Program series from 1991-1997 for nine countries, Blanchflower (2001) estimates wage curves for many CEE countries, including Poland. The elasticity of pay with respect to unemployment is

¹⁴ The macroeconomic models of Layard, Nickell and Jackman (1991) and the microeconomic efficiency wage model of Shapiro and Stiglitz (1984) are good examples of modelling negatively related wage and unemployment outcomes with conventional labour demand equations and imperfectly competitive wage setting behaviour

¹⁵ This correlation refers to levels of unemployment and wages and not changes in these variables found in a conventional regional Phillips curves.

estimated to be -0.13 using data on 4,747 individuals across 8 Polish regions. While magnitudes in the unemployment elasticity of pay vary across countries it seems that transition countries display more elastic responses.¹⁶

While we estimate the relationship between the level of pay and local short-term unemployment for males across all Polish regions using LFS data, the real strength of our work is that it is done in the context of imperfectly competitive wage setting in a labour market in transition, the Aghion and Blanchard (1994) model. We use the short-term unemployment rate to capture excessive layoffs, during an interval of a year, that are active in job search. This excludes the long term unemployed (LTU). The idea is to include job searchers in unemployment that reduce wage pressure. We wish to capture the impact of excessive annual layoffs on wage setting in the context of the Aghion and Blanchard (1994) model.¹⁷

The other side of labour reallocation in the Aghion and Blanchard (1994) model is that pay should be positively related to the annual hiring rate. Belzil (2000) was the first to examine the sensitivity of individual pay, in a country study, to the job creation rate while controlling for the business cycle with the unemployment rate. Structural change in employment, not captured by business cycle indicators, can be an important “omitted variable” in wage equations.

¹⁶ As summarized by Blanchflower (2001), prior to his work only a small literature estimated wage curves using individual micro data for Eastern Europe [for example Kertese and Kallo (1997) for Hungary and Pannenberg and Schwarze (1998) for East Germany].

¹⁷ Why these magnitudes in the unemployment elasticity of pay vary across countries, by gender or by the measure of unemployment, can be debated, but will depend on the model of imperfectly competitive wage setting one has in mind. There are many ways to replace the conventional labour supply curve.

4.3 Empirical Evidence

The Polish LFS is a quarterly household survey. This paper uses three data waves of the survey, corresponding to the November 1994, 1995 and 1996. The survey includes individuals older than 15 years and there is no upper age limit. However it does omit individuals living in military barracks and dormitories, and any household members residing abroad. The Polish LFS is similar to the usual western survey. It contains more than 50 questions and allows one to distinguish between the employed, the unemployed and those not in the labour force according to ILO/OECD definitions. We have deliberately excluded females in this study as they have more complex participation considerations than their male counterparts.

The total number of observations on males is 75,000 over 1994, 1995, and 1996. For each observation we use a record of age, type of completed education, regional location (voivodship), sector attachment in the reference week (reporting of sector attachment in non-employment is poor), tenure of current job, years of work experience, marriage status, and earnings which corresponds to their net earnings in the previous month from a full time job measured in thousands of polish zloty.¹⁸ Our analysis is based real earnings using the national consumer price index.¹⁹

¹⁸ Some may like to see individual controls for the ownership structure of the firm. In addition, one could have constructed excessive layoff rates for workers coming from state firms and hiring rates for workers flowing into privatized firms. Since many privatized enterprises resisted restructuring, while some state owned undertook restructuring this dichotomy is empirically very problematic. This has clearly been shown in the literature on firm performance and ownership; see Walsh and Whelan (2001). Hence we work in terms of (excessive) layoffs and hiring rates in general expecting that they capture ongoing restructuring of traditional enterprises and expansion of de novo enterprises.

¹⁹ A potential criticism of our work is that to measure real wages in different regions one should have regional consumer price data. However, we do have regional dummies in our regression equations to control for such an error.

We construct regional short-term unemployment rates (*UR*) and regional local annual hiring rates (*HR*) from the LFS data. Normally, the literature works with local unemployment rates, which includes the long-term unemployed. The local short-term unemployed are those that became unemployed during the year *and* are actively searching for work as a percentage of the labour force. We prefer to use the regional local short-term unemployment rate. This is a proxy for the annual (excessive) layoff rate that drives the space of labour reallocation in the theory model. Regional hiring rates are constructed by counting all individuals that have current job tenure less than a year as a percentage of the labour force. These variables are summarized in Table 4.2. We estimate a steady state wage equation described by the following specification²⁰,

$$\ln W_{it} = \beta_0 + \beta_1 \ln STUR_{jt} + \beta_2 \ln HR_{jt} + \beta_3 Educ_{it} + \beta_4 X_{it} + \beta_5 D_j + \beta_6 D_t + \varepsilon_{it} \quad (4.8)$$

The natural logarithm of individual *i* previous months real net earnings from a full time job²¹, W_{it} in period *t* is explained by the natural logarithm of the regional short-term unemployment rate, $STUR_{jt}$ and the regional annual hiring rate, HR_{jt} . $Educ_{it}$ are controls for education by category. We also control for a non-linearity's in age, work experience and sector dummies, X_{it} , regional and time dummies, D_j , and D_t , respectively.

²⁰ This equation is robust to computing values from Equation 4.6 of b and c given ρ . For example $\beta_0 = \ln(b + \rho)$, substituting values from Table 4.6 and assuming ρ to 0.9, *b* or unemployment benefit works out at 243 zloty per month. This can also be done for our regional compensating differentials C_j , where $\beta_5 = 2 \ln C_j$.

²¹ Admittedly, part time workers and self-employed are excluded. On the plus side, males in full time mainstream jobs are likely report earnings accurately.

In Table 4.4 we outline the descriptive statistics for our individual characteristics summarized for those in the state of full time employment and non-employment. It is clear that a slight majority have switched out of their planning job during transition. This varies greatly across regions. The growth of the non-employment pool as has been a big part of transition. We see that older, less educated males with long spells in planning employment have increasingly found themselves in non-employment during transition. The pace of this also differs across regions, reflecting the speed of structural change in employment.

In Table 4.5 we report our results for our employed sample of males, assuming random selection. In column I we report the responsiveness of individual wages to the local short-term unemployment rate and local annual hiring rate with only time dummies used as additional variables. In columns II and III we see that the estimates are robust to adding sector and region dummies.

In column IV we include controls for education.²² Years of schooling are not a good control variable for education. Following the literature, the nature of education under a communist regime turns out to be important. Flanagan (1994) using pre and post-transition data for the Czech Republic, includes education in the form of categorical variables, and finds a decrease in the rate of return to vocational education from 0.11 to 0.07 and an increase in the rate of return to university education from 0.31 to 0.39. Chase (1997) using similar data for the Czech Republic finds that the returns to

²² Normally in mature market economies we would expect investment in human capital to target high wage occupations. This selection bias is not a strong feature of this data as most human capital and occupation structures were an outcome of the planning era. We do not worry about instruments for education.

technical education/training greatly diminished while returns to academic education experienced a large increase during transition. We see from column IV that returns to education are higher for those that have more general or academic education compared to those with narrow or technical training at each stage of schooling. This emphasizes the need for categorical variables as controls for education.

In columns V and VI of Table 4.5 we add controls for age, with and without sector dummies. Finally, in columns VII and VIII, we add controls for current job tenure. We have also added an education-age interaction term, showing a significant return to older workers with university education, while other categories in the interaction term did not prove significant. Much of the work experience gained under communism by workers may not be rewarded so well in a market economy. Younger age groups have less work experience but any work experience accumulated, particularly during transition, may be highly rewarded in the market economy. We allow for such a non-linearity in return to age and for a flat experience and earning profile as documented for many other CEE countries²³. The estimated short-term unemployment elasticity of pay, -0.29, and annual hiring rate elasticity of pay, 0.75, remains even after including a rich set of individual controls. The hiring rate seems considerably more important than the short-term unemployment rate, perhaps due to all regions having considerable unemployment levels, while only some regions are fortunate enough to have a reasonable hiring rate. The random selection model depends strongly on the fact that the probability of participation in employment is not related to any of the

²³ Flanagan (1994) finds that the return to work experience gained under planning declined during the first few years of transition in the Czech Republic. Chase (1997) using micro-data for the Czech Republic and Slovakia also finds that returns to work experience fell during transition as young workers were favoured in jobs created during transition. Kreuger and Pische (1995) and Bird et al. (1994) for east Germany and Halpern and Korosi (1997) for Hungary document very flat experience earning profiles. Return to experience gained under planning clearly fell during transition.

explanatory variables above. Yet participation rates may decline when local annual layoffs are high and annual hiring rates are low. This sample selection bias can overstate the marginal impact of our explanatory variables. Correcting for such a sample selection bias can theoretically change the sign, magnitude or significance of the relationships found in Table 4.5.

We employ the Heckman full maximum-likelihood estimation procedure. Our selection model is written down as the following,

$$\begin{aligned} Z_i &= f(\ln STUR_{jt}, \ln HR_{jt}, X_{it}, D_j, D_t, Married_{it}) \\ Z_i &= 1 \text{ if employed} \\ Z_i &= 0 \text{ otherwise} \end{aligned} \tag{4.9}$$

The Heckman lambda is computed for each observation in the participating sample and the following regression models the contributions of our explanatory variables to the expected wage of employed males,

$$\ln W_{it} |_{Z_i=1} = f(\ln STUR_{jt}, \ln HR_{jt}, Educ_{it}, X_{it}, D_j, D_t, \lambda_i) \tag{4.10}$$

where λ_i is Heckman's lambda. Identification of the selection process needs instruments (or some other variables) to be significant in the selection equation but not in the conditional wage equation. We used whether a male is married as our instrument. They have incentives to work but this does not ensure higher earnings.

The lack of reported sector attachment by males in non-activity forces us to drop sector controls in our selection models. In Table 4.5, column VI and VIII, dropping sector dummies did not have a huge effect on our unconditional wage equations. Sector concentration can be quite regional specific (see Table 4.1). The inclusion of non-linearity in our explanatory variables avoids the criticism that the omitted variable we are controlling for is sample selection and not omitted non-linear forms in our relationships. The negative value of ρ indicates that the correction process will reinforce the magnitude of the marginal effects of the explanatory variables previously estimated. The *Wald Test* is used to reject our wage equations that assume a random selection process.

In Table 4.6 we present two models of expected earnings and associated selection models.²⁴ The Wald test for random selection is rejected in both models. The first two columns do not include work experience as a control. The estimated short-term unemployment elasticity of pay remains at -0.29 and annual hiring rate elasticity of pay is estimated to be a similar value 0.73 when compared to the model that assumes random selection. It is interesting to see that participation rates decrease in response to excessive annual layoffs and increase with annual hiring rates. Participation rates are endogenous to local labour market conditions. In addition we see that participation rates are very sensitive to age and education. Youth and higher education keeps you in the labour force. Yet, the expected earnings from age become much flatter and return to education fades away except for university graduates. In the western literature, the return to years of schooling can have an upward bias if not instrumented and a

²⁴ It is also possible to estimate the probability of an individual accepting a job, as such an elasticity of labour supply, from the selection equation. In turn this may then be used in the second stage earnings equation.

downward bias if sample selection is not taken into account. The effects are shown to offset each other bringing us back to the returns estimated in simple wage equations assuming random selection. In the transition context, education was inherited from the planning era and instruments are clearly not needed. Yet, we see that the dramatic decline in participation rates were not random and depend strongly on the category of education. Education predicts participation but not earning power, except in the case of university graduates.

Controlling for sample selection had very little impact on the effect of our local labour market variables on expected earnings but the impact of age and education changes dramatically. The last two columns include work experience as a control. We lose observations due to the reporting of work experience, but the results are basically the same. It is interesting to see that the effect of work experience on earning profiles is less flat when one takes account of previous work experience on participation.

How much of the mean earnings gap across regions is explained by our local annual rates of (excessive) layoffs and hiring? Warsaw pays 31 per cent more, on average, than the mean pay across all other regions during the period 1994-1996. In Table 4.7, using our estimated short-term unemployment elasticity of pay and annual hiring rate elasticity of pay we predict how much of this gap in average earnings, relative to Warsaw, across regions is explained by log differences regional annual (excessive) layoffs and hiring rates. While the effect varies from region to region, the pace of local labour demand dynamics, on average, explains most of the differential in mean pay across regions. While individual characteristics, such as educational attainment and age, determine participation rates and where one is on the wage distribution

within regions, the pace of local annual (excessive) layoffs and hiring rates are shown to dictate the mean wage disparities across regions.

4.4 Conclusion

The Polish labour market has been inhibited by the lack of inter-regional worker and job flows and intra-region differences in the pace of employment restructuring. Yet, these legacies of planning have allowed us to study the importance of regional labour demand dynamics on earnings in an environment far less complex than that observed in mature market economies. While individual characteristics, such as education, are clearly important for determining labour force participation rates and where one is on the wage distribution *within* regions, differences in mean wage *across* regions are clearly dictated by the pace of regional annual (excessive) layoffs and hiring rates. The assertion is that the need for structural change in employment is first order in a labour market in transition. Differences in expected pay across regions are explained more by differences in the pace of structural change in labour demand and less by labour supply considerations.

Figure 4.1
Optimal Unemployment and Hiring in the Restructured Sector

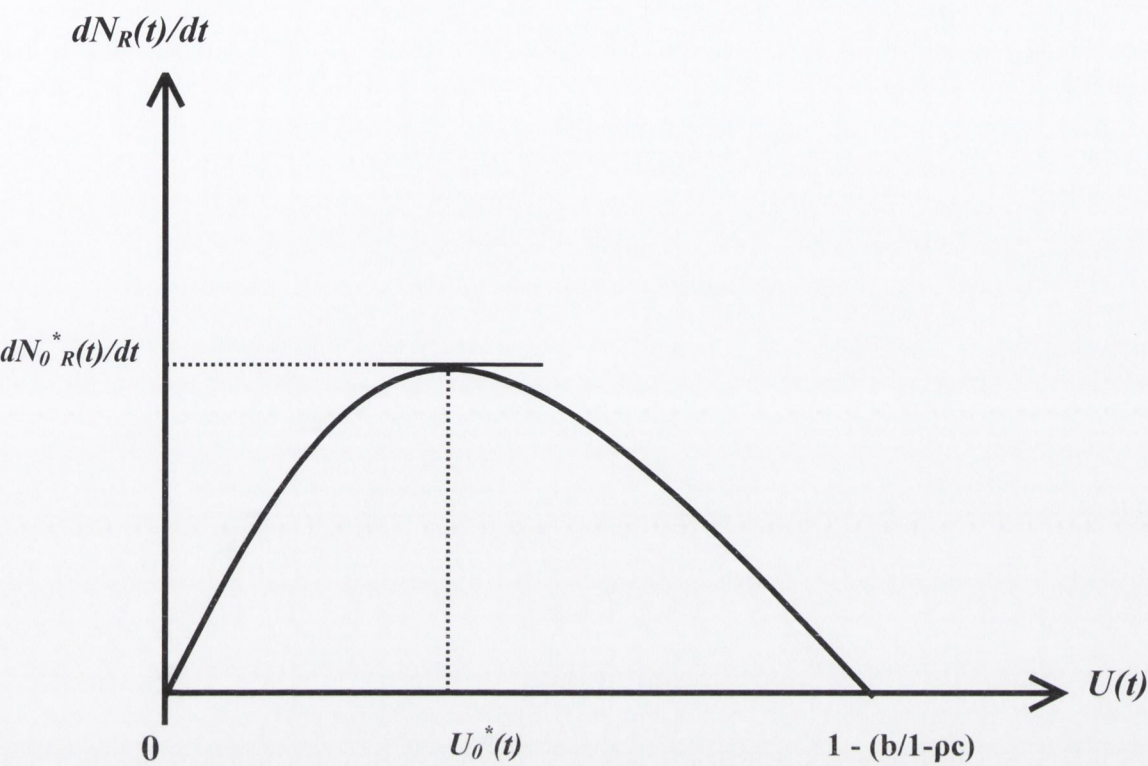


Table 4.1: Concentration Ratios of Employment into the top1, 2, 5 and 10 2-Digit Sectors (Average 1994-1996)

Region	C1	C2	C5	C10
Bialostockie	48	59	81	93
Bialskopodlaskie	34	48	71	84
Bielskie	14	23	47	69
Bydgoskie	16	28	51	74
Chelmskie	44	53	71	92
Ciechanowskie	45	54	72	88
Czestochowskie	20	31	56	75
Elblaskie	17	29	54	79
Gdanskie	16	30	60	80
Gorzowskie	14	28	54	78
Jeleniogorskie	14	26	52	74
Kaliskie	29	38	60	80
Katowickie	33	44	66	81
Kieleckie	41	49	70	83
Koninskie	26	38	65	84
Koszalinskie	16	27	55	83
Krakowskie	21	37	64	81
Krosnienskie	18	34	51	71
Legnickie	18	33	63	82
Leszezynskie	21	35	64	85
Lodzkie	36	45	67	84
Lomzynskie	56	63	79	92
Lubelskie	16	29	52	75
Nowosadeckie	43	53	71	86
Olsztynskie	20	39	51	82
Opolskie	16	27	51	73
Ostroleckie	42	51	72	87
Pilskie	17	29	57	73
Piotrkowskie	31	43	62	82
Plockie	35	44	65	84
Poznanskie	13	24	49	75
Premyskie	34	45	64	83
Radomskie	35	44	62	81
Rzeszowskie	32	44	66	83
Siedleckie	40	49	68	84
Sieradzkie	40	54	67	83
Skierniewickie	31	43	63	86
Slupskie	13	28	52	81
Suwalskie	34	44	65	86
Szezecinskie	15	30	57	79
Tarnobrzeskie	42	50	69	86
Tarnowskie	38	48	67	85
Torunskie	23	34	57	81
Walbrzyskie	11	21	46	70
Warszawskie	21	34	57	78
Wlodelawskie	50	58	71	89
Wroclawskie	14	26	53	72
Zamojskie	60	66	78	92
Zielonogorskie	13	24	48	76

(Source: Calculations based on Polish LFS)

Table 4.2: Persistent Gaps in Annual STU and Hiring Rates Across Regions

Regions	Annual STU Rate Labour Force Survey			Relative to Warsaw Labour Force Survey			Annual Hiring Rate Labour Force Survey			Relative to Warsaw Labour Force Survey		
	1994	1995	1996	1994	1995	1996	1994	1995	1996	1994	1995	1996
Bialostockie	0.04	0.04	0.05	0.98	1.09	1.59	0.12	0.16	0.18	0.52	0.64	0.76
Bialskopodlaskie	0.05	0.05	0.05	1.15	1.32	1.71	0.18	0.15	0.19	0.75	0.61	0.79
Bielskie	0.04	0.05	0.04	0.97	1.19	1.46	0.23	0.22	0.21	0.98	0.91	0.86
Bydgoskie	0.08	0.09	0.07	1.85	2.28	2.28	0.19	0.20	0.24	0.79	0.84	0.97
Chelmskie	0.06	0.04	0.06	1.28	0.93	1.97	0.17	0.12	0.17	0.72	0.51	0.70
Ciechanowskie	0.06	0.07	0.07	1.37	1.59	2.16	0.20	0.24	0.21	0.85	0.97	0.86
Czestochowskie	0.09	0.04	0.06	2.03	0.99	2.12	0.13	0.19	0.24	0.55	0.76	0.99
Elblaskie	0.09	0.09	0.03	2.04	2.12	1.03	0.24	0.21	0.29	1.00	0.86	1.19
Gdanskie	0.06	0.05	0.05	1.35	1.27	1.63	0.22	0.25	0.25	0.92	1.03	1.02
Gorzowskie	0.13	0.09	0.09	2.83	2.13	2.98	0.19	0.25	0.32	0.79	1.04	1.31
Jeleniogorskie	0.08	0.13	0.09	1.73	3.13	3.09	0.23	0.26	0.27	0.98	1.07	1.13
Kaliskie	0.06	0.06	0.06	1.25	1.41	2.02	0.19	0.17	0.18	0.80	0.70	0.74
Katowickie	0.04	0.03	0.03	0.92	0.71	1.12	0.16	0.19	0.17	0.67	0.76	0.69
Kieleckie	0.06	0.07	0.05	1.30	1.59	1.56	0.15	0.17	0.18	0.63	0.68	0.72
Koninskie	0.07	0.06	0.09	1.60	1.44	2.90	0.13	0.12	0.20	0.56	0.50	0.81
Koszalinskie	0.11	0.12	0.13	2.50	3.03	4.37	0.29	0.28	0.25	1.23	1.16	1.02
Krakowskie	0.05	0.05	0.03	1.06	1.14	1.01	0.19	0.17	0.19	0.82	0.71	0.78
Krosnienskie	0.03	0.09	0.06	0.62	2.23	1.87	0.22	0.16	0.17	0.93	0.65	0.71
Legnickie	0.08	0.08	0.05	1.76	1.91	1.64	0.15	0.14	0.22	0.63	0.59	0.89
Leszezynskie	0.09	0.05	0.05	1.93	1.26	1.50	0.14	0.24	0.23	0.58	1.00	0.93
Lodzkie	0.04	0.06	0.05	0.97	1.37	1.74	0.17	0.15	0.18	0.70	0.60	0.76
Lomzynskie	0.05	0.06	0.04	1.01	1.49	1.46	0.18	0.15	0.18	0.74	0.60	0.72
Lubelskie	0.09	0.09	0.07	2.06	2.20	2.16	0.21	0.22	0.21	0.88	0.90	0.86
Nowosadeckie	0.04	0.05	0.08	0.98	1.18	2.70	0.15	0.17	0.22	0.62	0.69	0.90
Olsztynskie	0.10	0.09	0.09	2.22	2.20	3.07	0.23	0.22	0.22	0.98	0.92	0.91
Opolskie	0.05	0.06	0.04	1.08	1.40	1.45	0.19	0.22	0.19	0.81	0.89	0.80
Ostroleckie	0.09	0.10	0.05	1.91	2.37	1.56	0.20	0.17	0.23	0.84	0.69	0.94
Pilskie	0.10	0.08	0.06	2.26	2.01	1.94	0.23	0.20	0.25	0.98	0.82	1.03
Piotrkowskie	0.08	0.05	0.07	1.85	1.33	2.24	0.16	0.20	0.17	0.66	0.81	0.71
Plockie	0.06	0.06	0.06	1.42	1.51	1.85	0.20	0.20	0.15	0.85	0.83	0.61
Poznanskie	0.05	0.04	0.04	1.15	1.05	1.42	0.18	0.22	0.19	0.74	0.90	0.79
Premyskie	0.06	0.06	0.05	1.43	1.49	1.78	0.10	0.13	0.15	0.44	0.55	0.61
Radomskie	0.06	0.08	0.05	1.38	1.86	1.82	0.15	0.18	0.16	0.65	0.73	0.66
Rzeszowskie	0.05	0.06	0.07	1.01	1.42	2.21	0.19	0.20	0.22	0.79	0.82	0.89
Siedleckie	0.06	0.05	0.04	1.42	1.15	1.33	0.19	0.19	0.18	0.80	0.76	0.75
Sieradzkie	0.08	0.09	0.04	1.73	2.13	1.36	0.17	0.16	0.17	0.73	0.67	0.72
Skierniewickie	0.10	0.02	0.03	2.18	0.45	0.86	0.17	0.18	0.21	0.72	0.75	0.86
Slupskie	0.18	0.12	0.14	3.94	2.99	4.49	0.19	0.25	0.28	0.81	1.03	1.14
Suwalskie	0.13	0.12	0.11	2.79	2.86	3.65	0.16	0.19	0.21	0.69	0.77	0.86
Szezecinskie	0.11	0.05	0.06	2.38	1.11	2.08	0.21	0.27	0.24	0.86	1.12	1.00
Tarnobrzeskie	0.05	0.06	0.04	1.09	1.54	1.48	0.12	0.17	0.14	0.51	0.70	0.59
Tarnowskie	0.06	0.06	0.03	1.37	1.34	1.07	0.16	0.19	0.24	0.66	0.79	1.00
Torunskie	0.08	0.07	0.08	1.88	1.73	2.74	0.20	0.19	0.22	0.84	0.79	0.88
Walbrzyskie	0.10	0.08	0.10	2.21	1.90	3.27	0.17	0.20	0.20	0.72	0.83	0.84
Warszawskie	0.04	0.04	0.03	1.00	1.00	1.00	0.24	0.24	0.24	1.00	1.00	1.00
Wlodelawskie	0.09	0.11	0.08	1.94	2.68	2.57	0.19	0.15	0.16	0.79	0.63	0.66
Wroclawskie	0.05	0.06	0.06	1.19	1.48	1.85	0.25	0.25	0.25	1.05	1.02	1.02
Zamojskie	0.05	0.06	0.04	1.05	1.34	1.28	0.15	0.16	0.21	0.61	0.65	0.85
Zielonogorskie	0.08	0.11	0.06	1.81	2.75	1.83	0.18	0.24	0.23	0.74	0.99	0.95
Mean	0.07	0.07	0.06	1.62	1.67	2.01	0.18	0.20	0.21	0.77	0.80	0.86
SD	0.028	0.026	0.024	0.622	0.625	0.809	0.037	0.040	0.038	0.157	0.164	0.156
Min	0.03	0.02	0.03	0.62	0.45	0.86	0.10	0.12	0.14	0.44	0.50	0.59
Max	0.18	0.13	0.14	3.94	3.13	4.49	0.29	0.28	0.32	1.23	1.16	1.31

Table 4.3: Persistent Gaps in Mean Monthly Wages Across Regions

Regions	Mean Monthly Wage Labour Force Survey			Relative to Warsaw Labour Force Survey			Mean Monthly Wage Regional Yearbook			Relative to Warsaw Regional Yearbook		
	1994	1995	1996	1994	1995	1996	1994	1995	1996	1994	1995	1996
Białostockie	333	470	601	0.67	0.66	0.64	449	586	738	0.68	0.67	0.65
Białkopodlaskie	366	512	669	0.74	0.72	0.72	477	628	784	0.73	0.72	0.69
Bielskie	398	535	764	0.80	0.75	0.82	489	646	808	0.74	0.74	0.71
Bydgoskie	386	582	746	0.78	0.82	0.80	482	634	800	0.73	0.72	0.71
Chelmskie	340	490	718	0.69	0.69	0.77	441	593	748	0.67	0.68	0.66
Ciechanowskie	377	508	681	0.76	0.71	0.73	433	566	713	0.66	0.65	0.63
Czestochowskie	359	502	654	0.72	0.70	0.70	437	585	741	0.67	0.67	0.66
Eblaskie	358	545	657	0.72	0.76	0.70	478	623	802	0.73	0.71	0.71
Gdanskie	436	661	844	0.88	0.93	0.90	522	692	873	0.79	0.79	0.77
Gorzowskie	393	501	709	0.79	0.70	0.76	457	606	757	0.69	0.69	0.67
Jeleniogorskie	432	579	662	0.87	0.81	0.71	513	678	827	0.78	0.77	0.73
Kaliskie	342	495	624	0.69	0.69	0.67	441	577	733	0.67	0.66	0.65
Katowickie	504	683	904	1.01	0.96	0.97	664	860	1061	1.01	0.98	0.94
Kieleckie	353	478	671	0.71	0.67	0.72	459	606	770	0.70	0.69	0.68
Koninskie	422	594	711	0.85	0.83	0.76	565	724	887	0.86	0.83	0.78
Koszalinskie	348	509	717	0.70	0.71	0.77	452	600	746	0.69	0.68	0.66
Krakowskie	435	593	726	0.88	0.83	0.78	509	669	881	0.77	0.76	0.78
Krosnienskie	325	471	631	0.66	0.66	0.68	448	595	747	0.68	0.68	0.66
Legnickie	443	580	765	0.89	0.81	0.82	607	816	1011	0.92	0.93	0.89
Leszezynskie	315	453	634	0.63	0.64	0.68	428	570	724	0.65	0.65	0.64
Lodzkie	392	565	750	0.79	0.79	0.80	494	647	839	0.75	0.74	0.74
Lomzynskie	360	505	650	0.73	0.71	0.70	441	588	751	0.67	0.67	0.66
Lubelskie	410	518	686	0.83	0.73	0.73	479	631	804	0.73	0.72	0.71
Nowosadeckie	336	450	582	0.68	0.63	0.62	425	553	699	0.65	0.63	0.62
Olsztynskie	367	516	699	0.74	0.72	0.75	473	618	775	0.72	0.70	0.69
Opolskie	377	574	802	0.76	0.81	0.86	487	650	825	0.74	0.74	0.73
Ostroleckie	393	492	671	0.79	0.69	0.72	482	645	805	0.73	0.74	0.71
Pilskie	361	522	689	0.73	0.73	0.74	443	379	745	0.67	0.43	0.66
Piotrkowskie	466	524	664	0.94	0.74	0.71	531	676	834	0.81	0.77	0.74
Plockie	440	593	766	0.89	0.83	0.82	535	721	885	0.81	0.82	0.78
Poznanskie	393	523	717	0.79	0.73	0.77	503	669	873	0.77	0.76	0.77
Premyskie	296	421	656	0.60	0.59	0.70	440	583	731	0.67	0.67	0.65
Radomskie	376	472	642	0.76	0.66	0.69	447	589	746	0.68	0.67	0.66
Rzeszowskie	352	495	650	0.71	0.69	0.70	466	618	784	0.71	0.70	0.69
Siedleckie	366	531	702	0.74	0.74	0.75	454	592	740	0.69	0.68	0.65
Sieradzkie	338	446	650	0.68	0.63	0.70	442	573	718	0.67	0.65	0.63
Skierniewickie	378	488	626	0.76	0.69	0.67	439	594	750	0.67	0.68	0.66
Slupskie	379	479	686	0.76	0.67	0.73	432	572	712	0.66	0.65	0.63
Suwalskie	341	510	723	0.69	0.72	0.77	436	579	733	0.66	0.66	0.65
Szezecinskie	444	560	797	0.89	0.79	0.85	539	710	880	0.82	0.81	0.78
Tarnobrzeskie	360	506	685	0.73	0.71	0.73	487	638	805	0.74	0.73	0.71
Tarnowskie	380	503	640	0.77	0.71	0.68	443	610	774	0.67	0.70	0.68
Torunskie	385	527	712	0.78	0.74	0.76	452	604	758	0.69	0.69	0.67
Walbrzyskie	397	498	614	0.80	0.70	0.66	481	616	778	0.73	0.70	0.69
Warszawskie	496	713	934	1.00	1.00	1.00	657	877	1131	1.00	1.00	1.00
Wlclawskie	356	481	583	0.72	0.67	0.62	444	586	749	0.68	0.67	0.66
Wroclawskie	398	593	758	0.80	0.83	0.81	501	659	844	0.76	0.75	0.75
Zamojskie	325	429	610	0.66	0.60	0.65	425	567	718	0.65	0.65	0.64
Zielonogorskie	385	494	648	0.78	0.69	0.69	450	597	742	0.68	0.68	0.66
Mean	382	524	696	0.77	0.73	0.74	479	629	797	0.73	0.72	0.71
SD	44	60	73	0.088	0.084	0.078	54	78	87	0.081	0.089	0.077
Min	296	421	582	0.60	0.59	0.62	425	379	699	0.65	0.43	0.62
Max	504	713	934	1.01	1.00	1.00	664	877	1131	1.01	1.00	1.00

Table 4.4: Descriptive Statistics

Employment	Obs.	Mean	Std. Dev.	Percentiles				
				10%	25%	50%	75%	90%
Net Monthly Wage	26404	569.2	329.1	280	360.8	494.8	670.3	927.8
Age	26404	37	10.2	24	29	37	45	51
Work Experience	26404	11	10.8	1	3	7	17	26
Married	26404	.8	.4					
Education	26404							
No Primary	.10							
Technical Training	14.13							
Primary Education	46.71							
Technical High School	2.80							
High School	23.64							
Technical College	1.61							
University	11.02							
Non- Employment	Obs.	Mean	Std. Dev.	Percentiles				
				10%	25%	50%	75%	90%
Age	48800	44	20.2	17	23	44	61	71
Work Experience	38434	26	17.3	3	10	29	43	50
Married	48800	.6	.48					
Education	48800							
No Primary	5.20							
Technical Training	43.58							
Primary Education	27.69							
Technical High School	3.96							
High School	14.21							
Technical College	0.68							
University	4.66							

Table 4.5: Wage Regressions across Polish Individuals

	I	II	III	IV	V	VI	VII	VIII
R²	0.08	0.11	0.19	0.3	0.34	0.27	0.4	0.28
Constant	6.1 (23.3)*	6.5 (12.1)*	6.3 (11.6)*	6.2 (9.6)*	5 (8.3)*	4.9 (8.2)*	5.1 (8.1)*	5.1 (8.2)*
Technical Training				0.03 -0.5	0.03 -0.2	0.01 -0.2	0.01 -0.2	0.01 -0.9
Primary Education				0.06 -0.8	0.1 -1.3	0.14 -1.7	0.1 -1.3	0.13 -1.8
Technical High School				0.18 (2.4)*	0.19 (2.7)*	0.22 (3.0)*	0.19 (2.4)*	0.23 (3.0)*
High School				0.21 (2.8)*	0.2 (2.97)*	0.24 (3.10)*	0.2 (2.45)*	0.23 (2.63)*
Technical College				0.24 (2.9)*	0.26 (3.2)*	0.22 (2.7)*	0.26 (3.1)*	0.22 (2.65)*
University				0.6 (8.0)*	0.48 (5.5)*	0.45 (4.9)*	0.48 (5.2)*	0.45 (5.0)*
ln STU Rate	-0.29 (2.4)*	-0.29 (2.4)*	-0.28 (2.3)*	-0.29 (2.4)*	-0.29 (2.5)*	-0.29 (2.4)*	-0.29 (2.4)*	-0.29 (2.4)*
ln Hiring Rate	0.71 (4.2)*	0.71 (4.2)*	0.72 (4.2)*	0.73 (4.2)*	0.74 (4.3)*	0.74 (4.4)*	0.75 (4.3)*	0.76 (4.5)*
Age					0.07 (5.8)*	0.09 (4.2)*	0.05 (4.4)*	0.06 (3.8)*
Age²					-0.001 (4.8)*	-0.001 (3.7)*	-0.001 (3.5)*	-0.001 (3.2)*
Age³					1.00E-06 (4.1)*	1.00E-06 (4.1)*	1.00E-06 (2.4)*	1.00E-06 (2.4)*
Education*Age interaction	No	No	No	No	Yes	Yes	Yes	Yes
of which: Age*University					0.008 (7.5)*	0.008 (7.2)*	0.008 (7.5)*	0.008 (7.2)*
Work Experience							0.02 (7.2)*	0.02 (6.11)*
Work Experience²							-0.001 (5.8)*	-0.001 (6.8)*
Work Experience³							0.00002 (5.2)*	0.00002 (6.7)*
Sector Dummies	No	No	Yes	Yes	Yes	No	Yes	No
Regional Dummies	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	26,404	26,404	26,404	26,404	26,404	26,404	26,404	26,404

T-statistics in parenthesis, Assuming Random Selection 1994-1996

* indicates significance at the 5% level.

* Robust Standard Errors, Number of clusters (regions) = 49

Table 4.6: Wage Regressions across Polish Individuals - Heckman Selection Model

Clustered (Regions)=49	1994-1996 Expected Real Earnings I	1994-1996 Selection I	1994-1996 Expected Real Earnings II	1994-1996 Selection II
Constant	6.1 (9.5)*	-5.6 (9.1)*	5.5 (8.6)*	0.01 (0.09)
Technical Training	-.13(1.7)	.6 (6.5)*	-.14(1.4)	.42 (3.5)*
Primary Education	-.14(1.1)	1.1 (9.4)*	-.001(0.11)	.80 (2.24)*
Technical High School	.02(1.12)	.88 (5.1)*	.05(1.12)	.81 (4.5)*
High School	.01(0.12)	1.0 (2.7)*	.08(1.0)	.85 (5.5)*
Technical College	.02(0.34)	1.2 (9.2)*	.04(0.45)	0.9 (6.21)*
University	.25(2.96)*	1.5 (15.2)*	.30(3.3)*	1.1 (5.6)*
ln STU Rate	-.29 (2.4)*	-.08 (3.2)*	-.29 (2.4)*	-.07 (2.7)*
ln Hiring Rate	.73 (4.3)*	.12 (2.1)*	.75 (4.5)*	.10 (1.5)
Age	.03 (1.3)	-.09 (12.2)*	.03 (11.6)*	-.09 (5.8)*
Age ²	-.001 (1.4)	.005 (9.2)*	-.002 (10.1)*	.003 (8.4)*
Age ³	.00001(2.1)*	-.00002 (5.3)*	.00003 (9.4)*	-.00003 (8.4)*
Education *Age interaction	Yes		Yes	
of which: Age*University	0.001 (5.21)*	0.009 (7.34)*	0.001 (4.85)*	0.009 (7.12)*
Work Experience			.06 (3.9)*	-.06(5.34)*
Work Experience ²			-.001 (3.7)*	.003(4.4)*
Work Experience ³			.00001(3.7)*	-.00001(4.8)*
Married		.43 (7.3)*		.38 (6.5)*
Rho	-.41 (8.85)		-.41 (10.3)	
Lambda	-.24 (13.3)		-.24 (13.5)	
Year Dummies	Yes		Yes	
Sector Dummies	No		No	
Regional Dummies	Yes		Yes	
No. Obs	(C = 48800 ; U = 26404)		(C = 38434; U =26404)	
Log Likelihood	-46829.127		-41204.22	
Wald Test	$\chi^2(1)=148.9$ Pr> $\chi^2=0.0001$		$\chi^2(1)=127.1$ Pr> $\chi^2=0.0001$	

T-statistics in parenthesis. Robust Standard Errors, Number of clusters (regions) = 49

* indicates significance at the 5% level.

**Table 4.7: Decomposition of Wage Gaps (averaged over 1994-1996) relative to Warsaw:
Estimated Contribution of Relative lnSTU rates and Annual lnHiring rates.**

Region	% Wage Gap Relative to Warsaw	% Estimated due Difference in lnSTU	% Estimated due Difference in lnHIRING	Residual
Bialostockie	43.2	4.7	33.6	4.8
Bialskopodlaskie	32.4	8.8	25.1	-1.5
Bielskie	22.8	4.7	6.7	11.3
Bydgoskie	23.0	21.8	10.9	-9.7
Chelmskie	31.9	8.8	32.5	-9.4
Ciechanowskie	32.6	14.6	8.4	9.6
Czestochowskie	34.3	15.0	19.2	0.1
Elblaskie	32.1	17.6	-1.0	15.6
Gdanskie	10.6	9.7	0.8	0.1
Gorzowskie	27.8	27.8	-3.8	3.9
Jeleniogorskie	27.0	27.4	-4.4	4.0
Kaliskie	39.3	11.9	21.9	5.5
Katowickie	4.0	-3.1	25.7	-18.7
Kieleckie	37.0	11.2	29.2	-3.4
Koninskie	21.1	18.4	34.7	-32.0
Koszalinskie	34.6	33.4	-9.7	10.9
Krakowskie	22.3	2.2	19.6	0.5
Krosnienskie	43.1	12.0	20.1	11.0
Legnickie	20.6	16.9	26.7	-23.0
Leszezynskie	41.7	12.9	12.3	16.4
Lodzkie	22.7	7.9	28.2	-13.4
Lomzynskie	37.8	7.6	28.5	1.7
Lubelskie	29.2	22.0	9.7	-2.5
Nowosadeckie	44.7	12.1	22.5	10.1
Olsztynskie	33.1	25.9	4.6	2.6
Opolskie	19.2	7.4	13.8	-2.1
Ostroleckie	34.3	20.2	14.7	-0.5
Pilskie	32.1	21.5	4.2	6.3
Piotrkowskie	27.7	16.5	23.8	-12.6
Plockie	17.7	13.0	20.3	-15.6
Poznanskie	27.6	4.8	15.7	7.1
Premyskie	45.9	12.6	47.1	-13.8
Radomskie	36.2	14.8	29.3	-7.8
Rzeszowskie	39.4	11.0	13.8	14.6
Siedleckie	31.0	7.8	19.4	3.8
Sieradzkie	39.5	16.2	26.2	-2.9
Skierniewickie	35.1	5.1	18.5	11.5
Slupskie	34.3	38.3	0.4	-4.3
Suwalskie	28.0	32.3	19.4	-23.7
Szezecinskie	17.4	17.6	0.1	-0.4
Tarnobrzeskie	33.6	8.8	38.4	-13.6
Tarnowskie	36.3	7.2	15.1	14.0
Torunskie	28.8	20.8	13.2	-5.3
Walbrzyskie	37.1	25.2	16.7	-4.7
Warszawskie	0.0	0.0	0.0	0.0
Wloclawskie	40.7	25.0	27.6	-11.9
Wroclawskie	20.4	11.1	-2.4	11.8
Zamojskie	43.0	5.7	26.3	11.0
Zielonogorskie	33.9	22.2	8.3	3.4
Average	30.4	14.6	16.6	-0.8
SD	9.88	8.83	12.41	11.02

Chapter 4, Annex: Nace 2-Digit Sector Categories

AGRICULTURE, FISHING AND FORESTRY

- Forestry, logging and related service activities.
- Agriculture, hunting and related service activities.
- Fishing, operation of fish hatcheries and fish farms.

MINING

- Mining & Extraction of coal and lignite, crude petroleum and natural gas, uranium & thorium ores, metal ores.
- Other quarrying.

MANUFACTURING

- Food products & beverages.
- Tobacco products.
- Textiles, wearing apparel, tanning and dressing of leather, manufacture of luggage, handbags, saddlery, harness and footwear.
- Wood, (and of products of wood and cork except furniture), pulp, paper and paper products.
- Publishing, printing and reproduction of recorded media.
- Coke, refined petroleum products and nuclear fuel.
- Chemicals and chemical products.
- Rubber and plastic products.
- Other non-metallic mineral products.
- Basic metals.
- Machinery, & equipment, office machinery and computers, electrical machinery, manufacture of medical, precision & optical instruments, watches and clocks.
- Manufacture of fabricated metal products.
- Manufacture of motor vehicles & other transport equipment.
- Other manufacturing: including manufacture of furniture, and recycling.

ELECTRICITY, GAS AND WATER SUPPLY

- Electricity, gas, steam and hot water supply. Collection purification and distribution of water.

CONSTRUCTION

- Construction.

WHOLESALE & RETAIL TRADE

- Retail & wholesale trade, repair of household and personal goods.

HOTELS & RESTAURANTS

- Hotels and restaurants.

TRANSPORT STORAGE AND COMMUNICATION

- Land transport, water transport, air transport, cargo handling and storage, other supporting transport activities, activities of transport agencies.

FINANCIAL INTERMEDIATION.

- Financial intermediation, insurance and pension funding, except compulsory social security, activities auxiliary to financial intermediation.
- Real estate activities, renting of machinery and equipment.

PUBLIC ADMINISTRATION AND DEFENCE

- Public administration and defence.

EDUCATION

- Education.

HEALTH & SOCIAL WORK

- Health and social work.

OTHER SERVICES

- Other Community, social and personal service activities Sewage & refuse disposal, sanitation, recreational, cultural and sporting activities, other service activities, Private households with employed persons.
- Private Households With Employed Persons.
- Extra-territorial organisations and bodies.

Chapter Five

5. Conclusion

Throughout this analysis we have examined the central theme of economic Transition, the movement of workers from large scale, inefficient state owned firms to new, small, efficient private firms, this reallocation of labour embodies the transition process itself. Its rapid progress in Poland has enabled us to test labour market economic theory in a confined number of years.

We have shown this reallocation of labour to be a key driving force in determining regional earnings inequality. In Chapter Two, our macroeconomic chapter, we estimated the impact of transition on earnings inequality using data across Polish regions 1994-1997. Our central result is that earnings inequality is higher in regions that are more advanced in restructuring (higher labour productivity/job reallocation rates), while controlling for unobservable regional fixed effects. At the national level rapid growth did not seem to be associated with earnings inequality. This aggregate relationship was shown to be misleading. The positive relationship between earnings

inequality and the stage of transition across regions remains when we applied an infrastructure-deficit based instrumental variable approach to allow for reverse causality.

In Chapter Three, our labour demand chapter, we used regional industry skill premia and industry dynamics to show considerable regional specific effects in Poland's labour market. We have shown that industry skill premia are driven by the relative supply of skilled labour. Skill premia are negatively related to the supply of skilled labour within a region, those regions with a larger supply of skilled labour will have a lower price of skilled to unskilled labour. We find that regions that have bigger differences in relative wages, share fewer common industries or industrial structure.

In Chapter Three we have also shown that industry location and skill premia respond systematically to persistent relative wage differences over time. Regions with lower skill premia experience greater increases in their share of skill intensive industry employment and low skill premia regions also experience greater increases in the intensity with which skilled workers are used within industries. All leading to the suggestion that firm's move faster than labour and that development of skilled labour pools may lead to a greater share of skilled industry.

Finally our labour supply paper, Chapter Four, looked at persistent gaps in Polish regional mean earnings. We modelled wage behaviour in regional labour markets as an outcome of the speed of transition. We found that individual characteristics, especially education, determined participation rates and where one is on the wage distribution within regions, also the pace of local annual (excessive) layoffs and hiring

rates are shown to dictate the mean wage disparities across regions. We found that it was important to stress the effect of initial endowments, or exogenous educational choices, on whether an individual was selected into the employment pool, and hence its impact on wages.

Our three central papers have allowed us to test distinct features of supply and demand in Polish labour markets during transition. We have found that through transition, initial conditions and having the right educational skill set selects a participant into employment rather than into the unemployment pool after restructuring. We found that the demand for that skilled labour was negatively related to skill premia, with skill abundant regions getting a greater share of industrial development over time. We also found that regions that had a faster pace of restructuring (higher job reallocation) also had higher productivity and higher earnings inequality. We found earnings inequality to be casually driven by the process of transition itself.

We note that further research on the area of labour markets in Transition should concentrate on later periods, to test if the process of reallocation is sufficiently complete fifteen years later. Research would suggest that large pools of unemployed mismatched skilled labour should now be sufficiently small due to these members leaving the labour force due to age. If the reallocation process is complete, earnings inequality should have stabilised. Suggestions that an unfunded pensions problem may also arise are worthy of research.

It would also be useful to examine the industrial structure of transition economies now that they are part of European Union, will the coming years show us that these workers are complements or substitutes to the European labour force.

*“Transition is history in the making and will sooner or later become a subfield of economic history. At the same time, transition can be seen as a subfield of development economics with **specific initial conditions**, compared to other development contexts: generalised state ownership and strong state power, **over industrialisation**, a **relatively high level of human capital** and of economic development, and **low initial income inequality**.”*

- Gerard Roland from the introduction to his book, ‘Transition and Economics: Markets, Politics and Firms’ (2000), where he relates what the important issues in Transition Economics are, and where the subject lies within the field of Economics.

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