Information Asymmetry, Education Signals and the Case of Ethnic and Native Germans

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CESIFO WORKING PAPER NO. 2683
CATEGORY 4: LABOUR MARKETS
JUNE 2009

CESifo *Working Paper No. 2683*

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Abstract

This paper analyses the effects of education signals for Ethnic Germans and Germans without a migration background ("Native Germans"). We base our analysis on a sorting model with productivity enhancing effects of education. We compare whether the signalling value differs between the migrants and non-migrants in the German labour market. Starting from the theoretical result that only a separating equilibrium can exist, we find substantial empirical differences between Ethnic and Native Germans with the same formal education level. This empirical analysis is done with a completely new dataset based on administrative data from the German Federal Employment Agency.

JEL Code: J24, J31, F22.

Keywords: sorting theory, human-capital theory, returns to education, migration.

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Financial support from Tiroler Wissenschaftsfonds is gratefully acknowledged.

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1 Introduction

For a long time, many Germans did not consider their country as a mayor destination for immigrants. However, in 2005 7.3 million people or 8.9 percent of the population were foreigners. Using a broader definition of migration by looking at people with a migration background, e.g. someone whose parents immigrated to Germany, then at the end of 2005 there were 15.3 Million such people living in Germany. This corresponds to 18.6 percent of the population.[1]

However, with regard to labour-market performance, migrants generally fare less well than Germans without a migration background. For example, the unemployment rate of foreigners in 2005 was 25.2 percent which was more than twice the rate for Germans which was "only" 11.9 percent (Bundesagentur für Arbeit 2007: Table 7.2).[2] One of the key factors to labour-market success as in all highly industrialised countries such as Germany is undoubtedly the level of education a person has. In 2005, the unemployment rate of individuals with no vocational training was 26.0 percent, whereas it was only 4.1 percent for those with a degree from university or technical college (Reinberg/Hummel 2007).

Due to data limitations, the vast majority of studies for migrants in Germany are based on an analysis of people of different nationalities. However, Germany has also received a substantial amount of migration of so-called Ethnic Germans (*(Spät-)Aussiedler*) who often grew up for example in Poland, Romania or the former Soviet Union but have German roots and are hence allowed to migrate to Germany. Between 1990 and 2004 roughly 2.5 million Ethnic Germans migrated to Germany. They receive German citizenship immediately after crossing the German border which entitles them to an unrestricted access to the German labour market. Due to their German citizenship, the Ethnic Germans can normally not be unambiguously identified in the data. The exception are studies based on the German Socio-Economic Panel (GSOEP) (see for example, Aldashev/Gernandt/Thomsen 2007, Constant/Massey 2003, Kreyenfeld/Konietzka 2001, Licht/Steiner 1994 or Riphahn 2002, 2003, 2005). Unfortunately, for our purposes, the GSOEP does not have detailed enough information on the labour market. Instead, we create a completely new and extremely rich dataset based on administrative data from the German Federal Employment Agency (*Bundesagentur für Arbeit* - FEA).

This paper analyses the effects of education signals for Ethnic Germans and Germans without a migration background ("Native germans") respectively. Intuitively, one might expect that, after controlling for other personal as well as occupational characteristics, the wage paid to people with the same (formal) education level but different migration backgrounds should be the same. Our results clearly show that this is not the case. We find substantial and robust differences between Ethnic and Native Germans with equal and high formal education levels.

Generally, there are two main explanations in the economics of education literature for the positive link between the level of education and wages: the human capital theory based on Becker (1975) and the signalling/screening (collectively known as sorting) theory which was originally developed by Spence (1973, 1974). Human capital theory focuses on the productivity augmenting

[1] All of the above figures come from Statistisches Bundesamt (2007: Table 1).

[2] These rates can only be calculated based on the number of civil employees. Hence, for example, the self-employed are not included. As a result, these rates are higher than official unemployment rates.

effects associated with education. Sorting theory assumes that the educational level signals certain characteristics that a person has. For example, if an employer knows from past experience that highly-educated individuals have more innate ability, then this is a characteristic that he or she cannot directly observe when hiring the employee but is willing to reward if he or she is able to obtain the information indirectly. This information is inferred from educational signals which act as a proxy for expected productivity.

It is often argued that sorting theories assume no productivity enhancing effects of education. To this extent there is a huge amount of literature which tries to test which of the two theories is correct by trying to separate empirically the purely productive enhancing effects of education (which are then assumed to support the human-capital theory) or the purely sorting effects of education in which education is assumed to leave productivity unaltered but is associated with other positive characteristics.[3]

We want to stress the point that there is no reason to assume that there are no productivity enhancing effects of education in sorting models. Therefore, in Section 2 we present a sorting model which explicitly takes such effects into account. Both the sorting model and the human capital approach imply that wages rise with the level of education. Therefore, as both human capital models and sorting models predict the same empirical result Brown/Sessions (1999) argue convincingly that it is – especially for empirical purposes – quite redundant whether education augments skills or signals innate abilities. Along similar lines, Lang (1994: p. 353) states, "the distinguishing characteristic of a sorting model is that knowing an individual's education provides employers with information about that individual's productivity which would be unknown otherwise."

In our view and as originally expressed in Weiss (1995), sorting theory in no way contradicts human-capital theory. On the contrary, there are numerous similarities between the two: In both theories wages are paid according to marginal productivity, firms maximise their profits and individuals their utility, the marginal benefit of education equals the marginal costs and, as can be seen from the model in Section 2, in both cases more education is associated with higher productivity. However, whereas human-capital theory tries to isolate the effects of education on productivity solely due to differences in education (and not differences in, for example, innate abilities), sorting theory implies:

> *"…if workers' productivities are in fact not perfectly observed (which is particularly true for newly hired workers), then the firms would have to infer the productivities […] from*

[3] For example, there are studies based on comparisons between workers in dependent employment and self-employed people in terms of years of schooling published by Wolpin (1977), Riley (1979), Katz/Ziderman (1980), Fredland/Little (1981), Tucker (1985), Cohn/Kiker/Mendes de Oliveira (1987), Grubb (1993), Alba-Ramirez/Segundo (1995), Brown/Sessions (1999, 1998), Lofstrom (2000), van der Sluis/van Praag (2004), Castagnetti/Chelli/Rosti (2005) and Garcia-Mainar/Montuenga-Gómez (2005). Psacharopoulos (1979, 1983), Lee (1980), Tucker (1986) and Cohn/Kiker/Mendes de Oliveira (1987) compare the rates of return to schooling between the competitive and the non-competitive sectors of an economy. Liu/Wong (1982) measure the effect of tenure. Alba-Ramirez/Segundo (1995), Arabsheibani/Rees (1998) and Brown/Sessions (1999) ground their research on comparisons between public and private sector workers. The decomposition of earnings is studied by Tucker (1985). Albrecht (1981) and Albrecht/van Ours (2006) analyse the relationship between the returns to schooling and job information. Studies using data of identical twins have been published by Miller/Mulvey/Martin (1995, 2004). Wiles (1974), Miller/Volker (1984) and Arabsheibani (1989) base their analysis on comparisons between the salaries of workers in occupations relevant to their educational qualification to those with the same qualification working in jobs not directly related to their qualifications.

noisy signals such as interviews, tryouts, and reference letters together with their education levels." Fang (2006: 1154)

I.e. as already mentioned above, firms need to form expectations about productivities based solely upon observable characteristics. This in turn has important implications for our empirical analysis as what we are wanting to estimate is not the rate of return on education. Instead, it is the *ex ante* employer beliefs about how innate abilities are related to education and hence productivity. Thus, sorting theory implies that:

"The coefficient on education is fully capturing the effects of that inference process and would not be affected by the inclusion of additional explanatory variables that are not observed by the firm. Even if the researcher knows the results of accurate tests of attributes like perseverance or a taste for additional learning, if the firm does not have that direct information available, then the sorting model predicts that including these variables in the wage equation will not affect the coefficient on schooling" (Weiss 1995: p. 135f.).

This theoretical implication is also in line with the huge body of evidence on the rates of return to education (see Card 2001 for a comprehensive survey). Table II in his article shows that the difference in the coefficients on education between OLS estimates (which do not take unobservable innate abilities into account) and IV estimates (which do try to take them into account) can be small and not significant.[4] Recently, Gebel/Pfeiffer (2007) have also estimated returns to education and compared OLS with the conditional mean independence approach developed by Wooldridge (2004). Again, although there are some differences in the two results, the general picture between the two is very similar.

The objective of this paper is therefore not to prove whether the sorting or human-capital approach prevails and to which extent both theories apply. Hence, we do not want to further contribute to this long debate. As, however, it is broadly accepted that education in any case also has a signalling value, we will compare whether this signalling value differs between a distinct group of migrants and non-migrants in the German labour market. To the best of our knowledge, this comparison approach has never been performed yet. Our focus is on the starting wage of a person, i.e. at a time when the employer cannot observe (much) more than the researcher. At this stage of the wage-bargaining process, the education level acts as a signal about the expected productivity of a potential employee. This means that it contains the sum of productivity enhancing effects due to education and the expected characteristics (which indirectly affect productivity) that are associated with such education levels.

Our paper is structured as follows: In the next section we present the theoretical model from which we derive our hypothesis that we then want to test empirically. We describe our data in Section 3 before presenting the estimation results in Section 4. Section 5 provides our conclusions.

[4] In general, the coefficients obtained from the IV estimates are higher. However, as pointed out in the article this may be because the IV estimator depends crucially on the assumption that the instruments are uncorrelated with other latent characteristics of individuals that may affect their earnings. In addition, measurement error in the schooling variable causes a downward bias in OLS estimates (see Griliches 1977 or Angrist/Krueger 1991) but not necessarily in IV estimates.

2 Screening with Productivity Enhancing Effects of Education

Starting point of the analysis is a general theoretical model of screening with productivity enhancing effects of education (cf. Hirshleifer/Riley 1992: ch. 11). We assume that there are two types of individuals which differ with respect to their innate abilities θ_p, where $p = H$ denotes high and $p = L$ denotes low ability, i.e. $\theta_H > \theta_L$. Net utility of an individual is

$$U(w, s, \theta) = w - C(s, \theta) \tag{1}$$

For simplicity, net utility U is assumed to increase linearly in the wage w and decrease in the perceived cost of education C. As usual, this perceived cost increases convexly with the signalled level of education s and decreases with innate ability θ. Hence, individuals with a higher innate ability require a smaller increment in income to be willing to increase their education level. This also implies that high ability individuals have flatter indifference curves in the (s, w)-space.

It is often assumed in sorting models that education only has a signalling value and no direct effect on productivity. However, there is no reason and no need for this assumption (see, for example, Spence 1974, Weiss 1983, Lang 1994). With such productivity enhancing effects of education, the net value of production π of a firm also depends on both s and θ. Hence, the net value of production can be written as

$$\pi(w, s, \theta) = P(s, \theta) - w \tag{2}$$

where $P(s, \theta)$ denotes the marginal product of a worker with an education signal s and an innate ability θ.

Figure 1 shows the equilibria when there are two types of workers who differ in their innate abilities. If the types are observably distinct, i.e. we have perfect information, their equilibrium contracts are (s_L^*, w_L^*) and (s_H^*, w_H^*) shown by points A and B, respectively. In these points, the respective zero-profit (i.e. we assume perfect competition as usual) and indifference curves are tangential. In this case, with perfect information, there is no signalling effect, i.e. the signal s simply reflects the productivity level of an applicant. Hence, no party could improve its position without either a decrease in utility or losses by the firms. At the same time, as points A and B are utility-maximising, high (low) productivity workers will never signal an education level below s_H^* (s_L^*).

If the two types cannot be distinguished by the employer, i.e. we have imperfect information, type L workers would prefer a type H contract in which their indifference curve would then go through point B which is associated with a higher net utility level. However, firms would make a loss if they paid both type L and H workers the high productivity wage w_H^*. Therefore, firms have an interest in separating the two types and will hence not offer the contract (s_H^*, w_H^*).

Figure 2 shows the case of a separating equilibrium with imperfect information. In order to prevent type L-workers from mimicking the workers with a high innate ability, firms will now continue to offer type L workers the contract (s_L^*, w_L^*). However, the contract for type H workers is now (s_H^s, w_H^s), i.e. in going from an equilibrium with perfect to one with imperfect information, high-ability workers have to invest more in education to separate themselves and

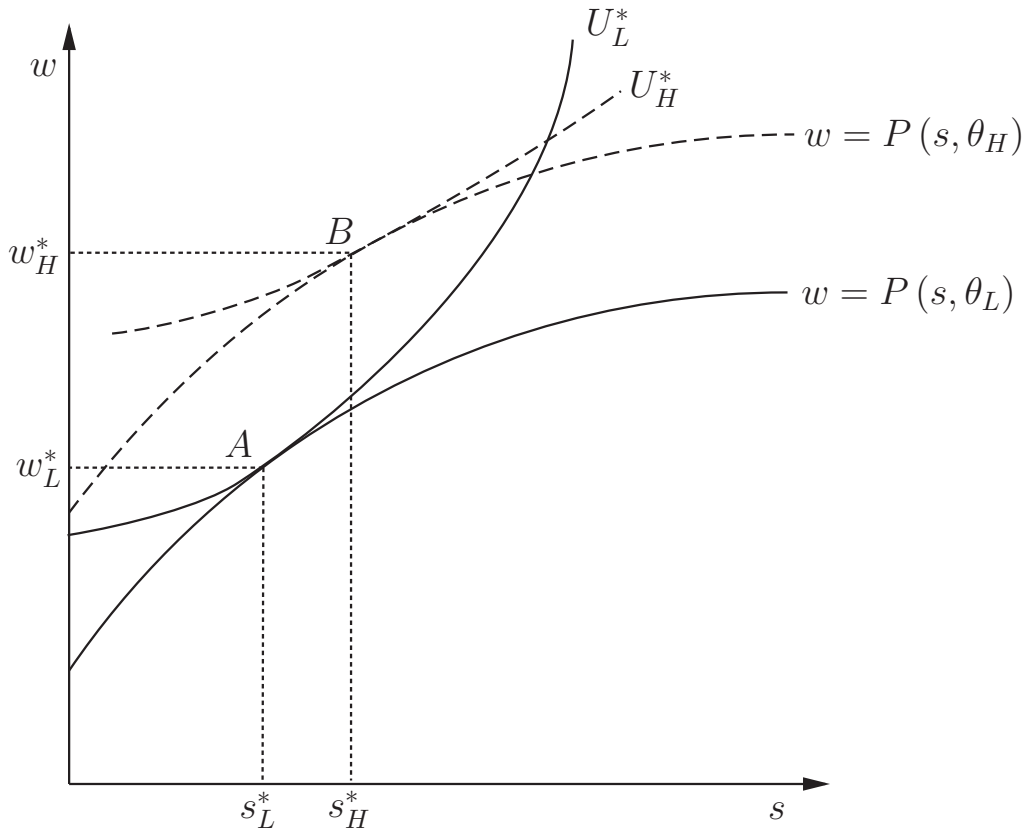

Figure 1: Perfect Information Contracts with Two Types of Workers

move from point B to point C in Figure 2. With such a contract pair, type L workers are just indifferent between contracts A and C. Hence, high-ability workers have to signal marginally above s_H^s in order to really separate themselves from the low-ability workers. The type H workers incur a negative externality, as they need to invest in a higher signal level than is the case under perfect information. Hence, their utility decreases from U_H^* to U_H^s.

However, as shown in Figure 3, depending on the relative productivities (and shares of the two types of workers), a separating solution may not represent an equilibrium. For example, both types of workers prefer a pooling contract with wages of or above $\tilde{w}_{HL}$. If the average productivity of the two types of workers is higher than this wage, then the scope of possible pooling contracts is given by the shaded area BCD in Figure 3. As an educational level of at least s_H^* is required to reach the productivity level at which firms can pay $\tilde{w}_{HL}$ without making a loss, this signalling-level marks the lower bound of the shaded area. The upper bound is again the signal S_H^s as this is the level after which typ-L workers would then prefer a separating contract.

However, Rothschild/Stiglitz (1976) show that – with competition amongst firms – it is no longer possible to determine a unique pooling equilibrium which is stable. This can be seen from Figure 4 which is an enlargement of the relevant area in Figure 3. For example, if one firm were to offer a contract as shown by point D, then another firm could offer a contract to the north-east of D such as the wage-signal combination shown by point Q, in which both type H and L workers reach a higher utility. The range for such pooling equilibria is limited to the right by U_L', i.e. the indifference curve of the type L-workers which goes through D, the lowest possible wage-

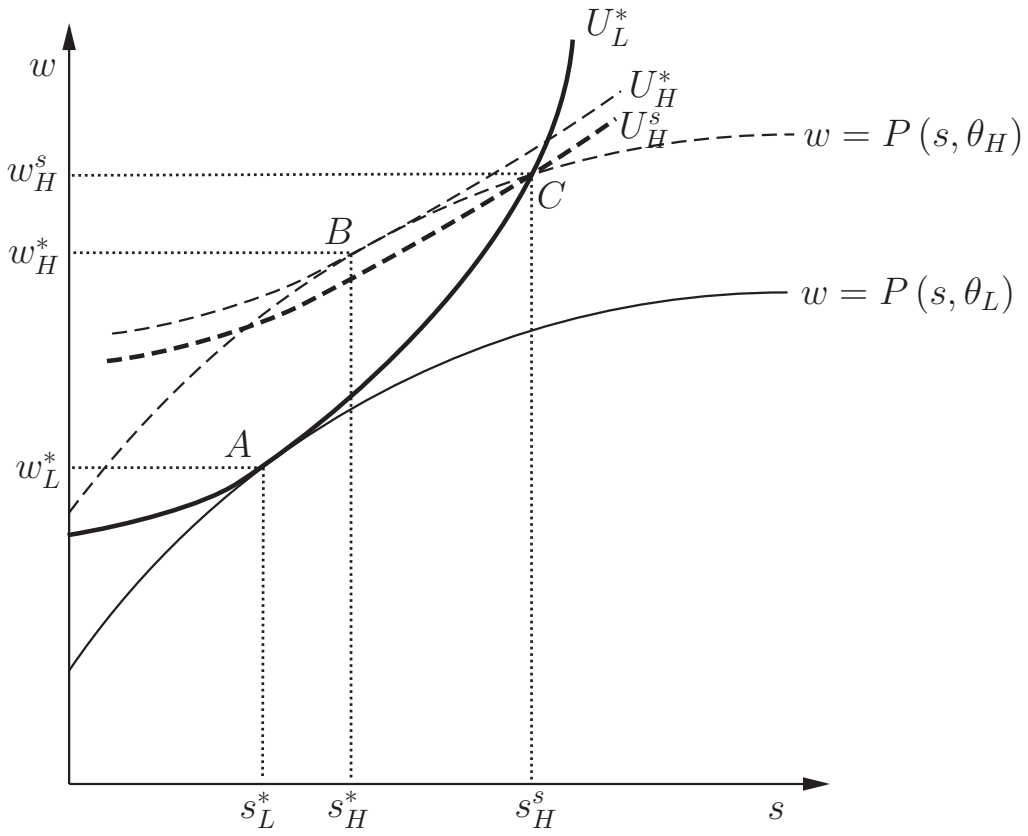

Figure 2: Imperfect Information Separating Contracts for Two Types of Workers

signal-combination in which there would be a pooling equilibrium. However, point Q cannot be a stable pooling equilibrium, as firms could react and offer a contract-point R. As compared to D, type H workers would increase but type L workers decrease their utility level. Therefore, only the high-ability workers would prefer this contract. In this case, the competitor originally offering the contract point Q would now make a loss as only the low-ability individuals would stay in the firm with productivities below the wage associated with Q. At the same time, firms offering R would make positive profits as they only employ high-ability workers with productivities higher than the wage associated with R. Even if then another firm were to offer a higher wage than the reactive firm, the firm paying R would "only" lose its workers and end up making zero profits but would not incur any losses. Therefore, in the potential pooling equilibria range BDU_L', there is always the possibility for competitors to react by offering new contracts which make the original offers unprofitable. Engers/Fernandez (1987) show that in such a case there will only be one unique "reactive equilibrium" and that in this equilibrium there will be offered two separate contracts for the two types of workers. Hence, no pooling equilibria can exist and there is only the separating equilibrium as originally shown by points A and C in Figure 2.

A very important conclusion out of this theoretical analysis for the following empirical research is that, in contrast to many models of imperfect information, in our case there is no room for both pooling and separating equilibria. As we showed that only one separating equilibrium can exist, we should observe separating behaviour on the labour market. Hence, we derive the following four hypothesis which we want to test empirically:

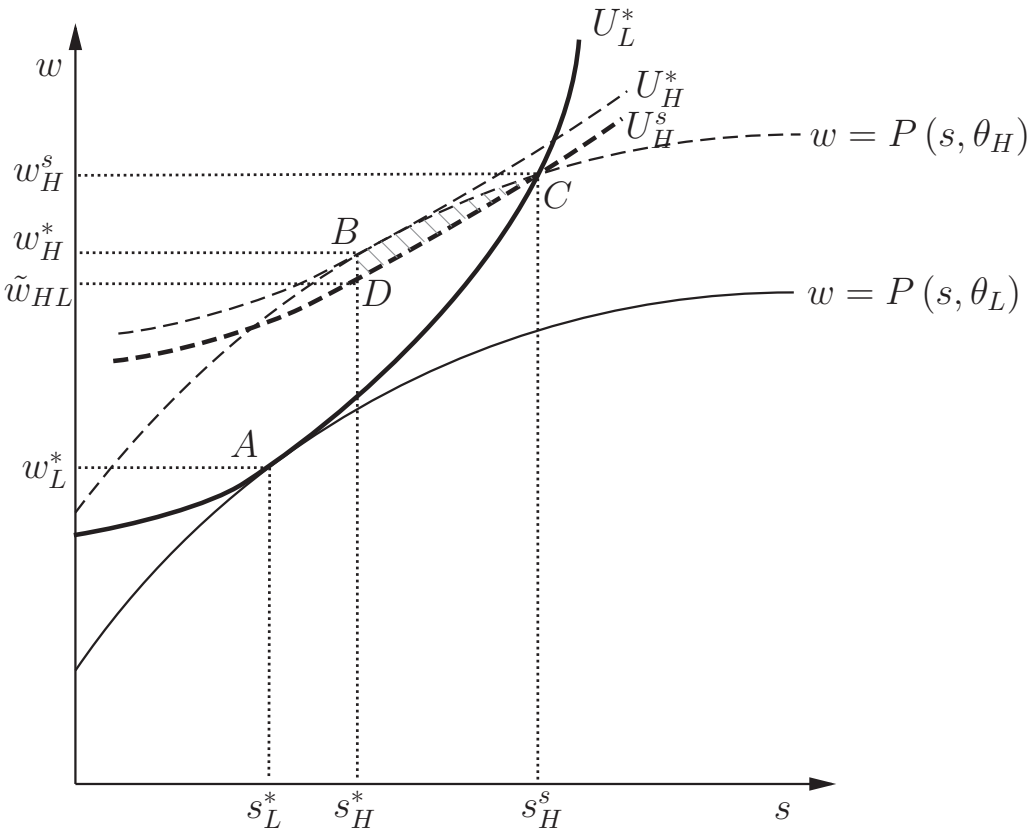

Figure 3: Imperfect Information with Pooling Contract for Two Types of Workers

1. There is always either a separating or reactive equilibrium, i.e. there will always be different contracts for people with different signal levels. Hence, we expect that the coefficients for the various education levels differ significantly. This should hold both for the Ethnic as well as native Germans.

2. If employers associate a lower productivity with foreign degrees than for degrees obtained in the home country, then their zero-profit curves will be lower for foreign education signals.[5] In this case, a person with a degree from abroad will receive a lower wage than a person with the same formal degree stemming from the home country.

3. If it is true that low-skilled occupations do not require formal qualifications, we expect that the wages associated with the low-ability individuals (i.e. people who invest in the lowest education signal which in the empirical research below is equivalent to "no vocational training") be the same. Hence, we want to the test whether the coefficient of the low-education signal is the same across the two groups.

4. If both hypothesis 2. and 3. hold, then the difference in the coefficients between low- and high-skilled Native Germans should be higher than the corresponding difference for the Ethnic Germans.

[5] This attitude could be caused for example by risk-averse employers or by experience from past hirings.

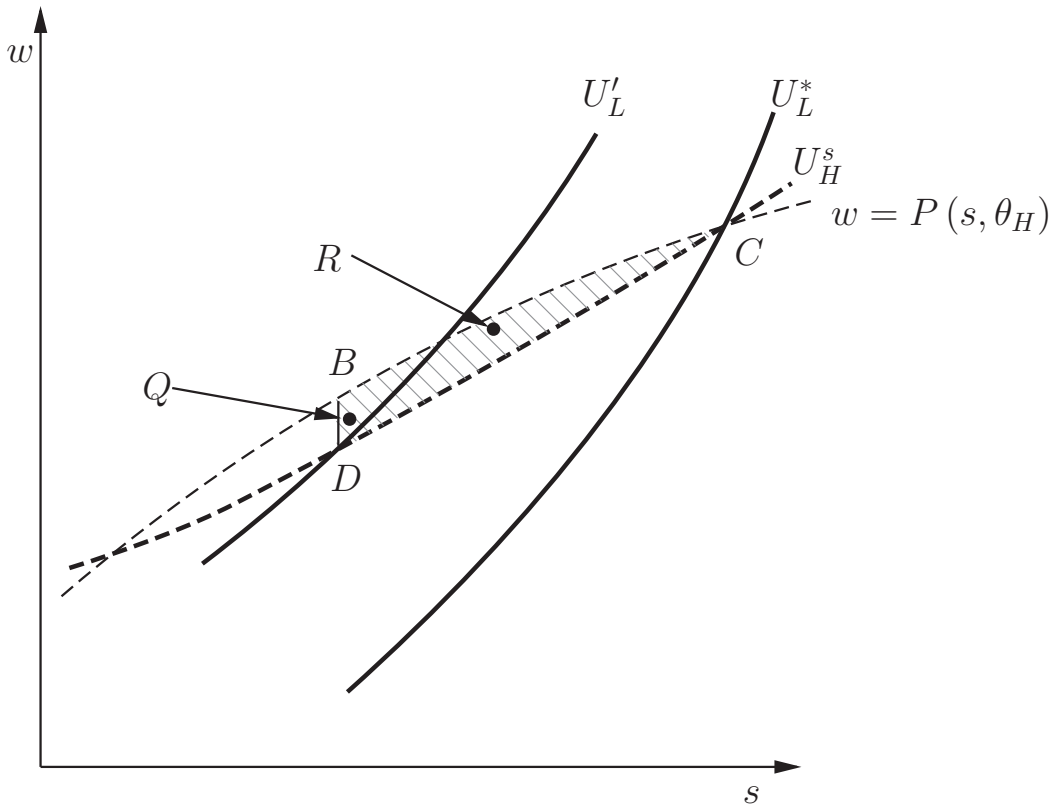

Figure 4: Imperfect Information with Pooling Contract and Reactive Equilibrium for Two Types of Workers

3 Data and Descriptives

Until recently, in official German statistics only the nationality was recorded. As Ethnic Germans obtain the German nationality as soon as they migrate to Germany, this meant that it was more or less impossible to identify them in official statistics. Hence, research used either the German Socio-Economic Panel (GSOEP) or qualitative research methods to analyse this migration group. However, the GSOEP does not contain enough labour-market information for our purposes. Particularly, the GSOEP is an annual household panel. Hence, it is not possible to identify all new jobs a person begins within a year. However, as will be made clearer below, it is the starting wage in a new job which is of primary interest here.

Instead, we use the rich administrative data set from the German Federal Employment Agency (FEA) for our analysis. This data is converted to the so-called "Integrated Employment Biographies" (*Integrierte Erwerbsbiografie* – IEB) by the Institute for Employment Research, Germany which is affiliated with the FEA. With this data it is possible to observe all times in which a person is:

- either registered as unemployed or as a job-seeker (who can, for example, be simultaneously employed),
- is entitled to welfare benefits administered by the FEA,
- participates in an active labour-market programme administered by the FEA,

- is employed either in a job which is liable to social-security contributions or in a so-called "Mini-Job" in which the individual earns a maximum of 400 € per month without having to pay social-security contributions.

Thus, with this data set we are able to observe on a daily basis the transition from either unemployment or programme participation to a new job, or if a person remains employed but changes the company.

We use this data set to create a completely new database for Ethnic Germans which overcomes the difficulties mentioned above with the other data on this migration group. Within the IEB there are several means of identifying Ethnic Germans:

1. A person is registered unemployed or as a job-seeker after January 1st. 2000.[6]
2. A person receives "*Eingliederungsgeld*" – a special welcome payment to Ethnic Germans.[7]
3. A person participates in a special German language course designed for Ethnic Germans.

We only need to identify a person as an Ethnic German by one of these methods and at one point in time. As a person always has the same "customer-number" in all spells of the data, it is then simply possible to transmit the information containing the migration status to all other spells of that person.

As our dataset is completely new, we need to see how representative it is for the group of Ethnic Germans. Since for 2005 it is possible to at least estimate the number of Ethnic Germans using the German microcensus (the yearly 1 % official household survey in Germany), we compare the number of 25 to under 55 year olds (the age group of interest in our subsequent analysis) as measured by the microcensus with the number of Ethnic Germans we are able to identify for this age group using our dataset. This is shown in Table 1. As can be seen from the Table, we manage

Table 1: Number of 25 to under 55 year olds in the IEB and Microcensus

Number		**Coverage**
IEB	Microcensus 2005	**Rate**
(1990 – 2004)	(1949 – 2005)	**(in %)**
972 083	1 090 378	89.2

to identify a very high percentage of the Ethnic Germans. It needs to be noted though that the comparison needs to be interpreted with caution. First, Ethnic Germans are not unambiguously identifiable in the Microcensus so that the figure is based on estimations using this data.[8] Second, the number of people are counted in 2004 in the IEB but in 2005 in the microcensus. Third, in the IEB we can only identify Ethnic Germans migrating in 1990 or later whereas the microcensus also

[6] To a certain extent, we are also able to identify Ethnic Germans via this method who were unemployed prior to this date. However, this is only the case if the "customer number" used internally can be uniquely linked to an individual. Often this number was deleted in the records once the person had found a job and subsequently given to a different person. As of January 1st. 2000, the customer number is always unique.

[7] In fact, migrants from the former East Germany were also eligible to this payment. However, we can explicitly differentiate between these and Ethnic Germans as we only use this identification strategy if the payment was made after July 1st 1990, a time at which it was no longer made to people coming from former East Germany.

[8] We thank Holger Seibert from the IAB for performing this estimation for us.

counts people immigrating as far back as 1949. Hence, although a perfect comparison cannot be made, the coverage rate is so high that we feel sure that we have a representative and almost complete sample of the Ethnic Germans.

In the following, we compare the signalling effects of education between Ethnic and Native Germans. For this purpose, we use our data on the Ethnic Germans as described above and, in order to obtain a file which is still manageable, we use a representative subsample of 2 % of all Native Germans actively participating on the German labour market in the same age group.

As stated in the introduction, we are interested in measuring the value associated with different educational signals for the two groups we are considering: Ethnic and Native Germans. Therefore, our focus is looking on the starting wage of a person, i.e. at a time when the employer cannot observe (much) more than the researcher. At this stage of the wage-bargaining process, the education level acts as a signal about the expected productivity of a potential employee. This means that it contains the sum of productivity enhancing effects due to education and the expected characteristics that are associated with such education levels.

The IEB only has data on average daily wages. If the employment spell begins and ends in the same year, the average is simply calculated as gross wage income divided by the number of days worked for the employer.[9] If the employment spell ends in a later year, then the average is calculated with regard to the income and number of days worked in the year in which the employment spell started.[10] This means that we face a trade-off with regard to the time length in which we consider the wage to be a "starting-wage": The shorter we define the time interval, the less people will be in our sample. However, the longer we choose this period to be, the more our wage might differ from that paid at the beginning. Here, we base our wage on a maximum of the first six months of an employment spell.[11] The means of calculating the average daily wage leads to two potential cases which we observe: Either the person starts a new job towards the end of a year, i.e. during the last six months of a year, or the job begins and ends within one year and only lasts for a maximum of six months. However, the latter case with only relatively short job durations is likely to be a special subsample of new jobs. Therefore, to begin with, we restrict our analysis to jobs starting in the second half of the year and will later investigate whether this has an effect on the results.

We identify starting wages either if a person has a prior unemployment spell or is participating in an active labour-market programme. If a person directly moves from one job to the next then we can identify this change by a change in the plant number. However, we are not able to tell whether this new job is with a new company or simply a new job with the old company but at a

[9] The annual or monthly wages used to calculate the average are in fact right-censored as only a wage up to the maximum contribution to the social security system is considered. However, less than two percent of our sample where affected by this restriction. Performing censored regression analysis does not alter the findings. We also drop spells from our analysis in which the daily wage is less than 20,- €. as this implies a monthly wage of under 400,- €. Such so-called "Mini-Jobs" are subject to special regulations.

[10] For administrative reasons, every employer has to make at least one declaration per year to the social security system for each employee. Hence, if an employee works for the same firm for several years, then in the first year the average is only calculated for the days worked in that year. In subsequent years, the average is calculated based on the annual income in that year and the number of days in the year.

[11] We also performed our analysis for starting wages based on three months. This does not alter our results substantially (cf. Table 6 below).

different location. Hence, we impose the restriction that there must be a gap of at least one day between job to job changes.[12]

Table 2 provides some descriptive statistics of how this wage is distributed across the education levels as well as between Ethnic and Native Germans.[13]

Table 2: Distribution of the Wage by Educational Level and Group

	No vocational training	Vocational training	Univ. degree
Ethnic Germans			
Mean wage	3.76	3.88	3.99
N	61,002	123,231	14,545
Share (in %)	30.69	61.99	7.32
Native Germans			
Mean wage	3.78	3.95	4.42
N	12,225	65,069	10,225
Share (in %)	13.97	74.35	11.68

It can immediately be seen from the table that there are marked differences between the two groups. The mean starting wage of highly qualified Ethnic Germans is more than 40 % lower than the corresponding wage for the Native Germans. Also the distribution of the educational levels differs substantially. There are (in relative terms) more than twice as many Ethnic Germans with no vocational training. The share of Native Germans with a university degree is more than 1.5 times higher.

Information on educational degrees is also of great importance for our analysis. This information stems from employers. However, as no financial payments depend on this report, it seems to be slightly unreliable (cf. Fitzenberger/Osikominu/Völter 2005). Hence, we use information about a person´s education level from other spells in the IEB to try and get a more plausible report on education. More precisely, since a person generally has to show his certificates to a placement officer at the job center, we use the education information from unemployment spells and transmit this to all subsequent spells in which education information is missing. If there is still no information about a person's educational degree, we see if there is information in an employment spell and replace as many missings as possible.

Table 2 highlights the fact, that there are large differences between Ethnic and Native Germans with respect to the distribution of their educational levels. The share of Ethnic Germans with no vocational training is more than twice as high as for the Native Germans. Similarly, the share of Native Germans with a university degree is over 50 % higher than the share for Ethnic Germans.

When trying to measure the effect of education signals on wage we obviously need to take further personal and occupational characteristics into account. The main explanatory variables we include (besides dummies for time and branch of occupation) are age, sex, labour-market

[12] In theory, people changing jobs within one company should not have a gap at all between their employment spells. However, sometimes employers seem to register their new employees with a minor delay when they change plants.

[13] We define "university degrees" as degrees from universities and universities of applied studies.

experience, the size of the firm and the commuting distance. Table 3 shows how these variables are distributed between the two groups.

Table 3: Descriptive Statistics of Main Exogenous Variables

	Age	Total labour-market experience	Labour-market experience in branch	Proportion female	Firm size	Commuting distance
Ethnic Germans						
Mean	37.43	2.84	0.45	0.32	235.02	36.31
Std. error of mean	0.02	0.01	0.00	0.00	2.63	0.19
Native Germans						
Mean	30.89	5.1	0.83	0.40	484.77	52.53
Std. error of mean	0.03	0.01	0.00	0.00	9.19	0.37

There are two ways by which we control for labour-market experience in Germany. As Germany in general has a fairly occupationally segregated labour market, we include both the absolute amount of labour-market experience as well as the amount of labour-market experience in the same branch (on a two-digit-level) as the new job.[14]

We further control for firm size and local labour-market conditions. As shown in Ammermüller/Kuckulenz/Zwick (2006), these conditions can have a significant influence on the wage a person receives. In addition, this effect differs for people of different skill levels. Hence, we include the local unemployment rate in our regressions.

As it is well known that women generally receive lower wages than men and that large firms pay more than smaller ones, we also include these variables in the regression analysis.

Finally, we take the commuting distance into account. On the one hand, longer commuting distances might require higher wages as a compensation for the higher travel costs. On the other hand, commuting might also be a signal as to how motivated an employee is, i.e. long commuting might signal high motivation.[15] In order to avoid distortions in the wage caused by people working part-time or participating in a labour-market programme, we will only consider individuals with full-time unsubsidised jobs.

4 Results

The aim of this section is to test the theoretical hypothesis listed on page 8. To this extent, we estimate the following earnings equation:

$$\ln w_{ijt} = \beta_{1j} + \beta_{2j} educ2_{ijt} + \beta_{3j} educ3_{ijt} + \beta_{4j} age_{ijt} + \beta_{5j} age^2_{ijt} + \beta_{6j} lm\_exp_{ijt}$$

[14] Ideally we would also like to include the branch an Ethnic German worked in (or was trained in) before he or she immigrated to Germany. As Kreyenfeld/Konietzka (2002) have shown, for Ethnic Germans it makes a large difference whether they can work in the same sector as in their destination country or not. Unfortunately, our data does not include information about work or training outside of Germany.

[15] The dataset includes the district where a person lives and works. Since many districts are large, we observe the same district and hence zero commuting distance for over 50 % of our sample. Therefore, we took the minimum positive commuting distance in our dataset and imposed this fictitious distance for people living and working in the same district.

$$+ \beta_{7j} lm\_exp_{ijt}^2 + \beta_{8j} rel\_sec\_exp_{ijt} + \beta_{9j} female_{ijt} + \beta_{10j} firm\_size_{ijt} + \beta_{11j} unemp\_rate_{ijt} + \boldsymbol{\gamma}_j' \mathbf{D_{ijt}} + u_{ijt} \quad (3)$$

where $\ln w_{ijt}$ is the log wage of person i in group j at time t. $j \in \{E, N\}$ denotes the group a person is associated to, i.e. Ethnic German (E) or Native German (N). $educ2_{ijt}$ is a dummy variable if someone has vocational training and similarly, $educ3_{ijt}$ denotes a university degree.[16] We include labour-market experience (lm_exp) defined as the total time of employment in Germany both linearly and quadratically. The variable $rel\_sec\_exp_{ijt}$ is the fraction of time a person has spent in the current branch relative to the total time he or she has worked in Germany. Finally, we also included the unemployment rate in the community where the new job starts ($unemp\_rate_{ijt}$) to take local labour-market conditions into account.[17] $\mathbf{D_{ijt}}$ is a vector of branch and time dummies.

Table 4 shows the results for the case that we restrict the coefficients $\beta_{4j} - \beta_{11j}$ and the vector of dummy-variable coefficients $\boldsymbol{\gamma}_j'$ to be the same for Ethnic and Native Germans. It can be seen

Table 4: Estimation Results of the Restricted Model

Dep. Var.: $\ln(wage)$	Coef.[a)]
$educ2_{ijt}$	0.069***
$educ3_{ijt}$	0.222***
$native$	-0.004
$educ2Xnative$	0.038***
$educ3Xnative$	0.337***
rel_sec_exp	0.087***
lm_exp	0.039***
lm_exp^2	-0.001***
age	0.015***
age^2	0.000***
$female$	-0.130***
$\ln(distance)$	0.021***
$\ln(firm\_size)$	0.027***
$unemp\_rate$	-0.017***
N: 264,805	

Robust standard errors
*** Significant at the 1 %-level
a)Including dummies for branch and year

from the table, that in both groups, individuals with higher education signals than those with no vocational training, have significantly higher wages. This difference is 6.9 % for people with vocational training and jumps to 22.2 % if people have a university degree. This is in line with our hypothesis 1 from Section 2.

Hypothesis 3 that there should be no difference between the low-qualified Ethnic and Native

[16] As shown in the article by Card (2001), usually – at least when testing the human-capital theory – the education variable is instrumented for. Unfortunately, the FEA data does not include any suitable instruments so that we are not able to compare the coefficients using different estimation methods.

[17] We also instrumented this variable with its one and two months lag. This does not alter the main results.

Germans is also confirmed. The coefficient for the natives in Table 4 is not significant. This is the case even though we have a very large sample.

There are, however, significant differences between the wages for individuals with vocational training and university degrees between the two groups. The medium-qualified natives have around 4 % higher wages. The difference for the highly qualified between the two groups is much higher at around 34 %. This is also in line with the hypothesis 2 from Section 2.

All other parameters for the control variables have the expected sign and are highly significant. For example, the wages for females are roughly 13 % lower than those for males and wages increase with firm size. Both total labour-market experience and specific experience in the current sector exert a positive influence on the wage. However, there is a certain threshold for the effect of total labour-market experience. Age has a positive influence. Hence, given a certain amount of labour-market experience, individuals manage to increase their wage when they take up new jobs at higher ages. People who commute further also receive higher wages, either as compensation for their higher commuting costs or perhaps due to the motivation signal mentioned above. Finally, an increase in the unemployment rate is associated with lower wages, a sign that employees have poorer bargaining positions in this case. Although not shown in the table, the regression also included 56 sector and 4 year dummies. These were jointly highly significant, respectively.

We performed numerous F and Wald tests with robust or clustered standard errors to see whether the restriction of equal coefficients $\beta_{4j} - \beta_{11j}$ and the vector of coefficients $\boldsymbol{\gamma}_j'$ is feasible for both groups (Ethnic and Native Germans). All tests rejected this hypothesis, so that in the following, we will concentrate on results of separate analysis for the two groups (see Table 5).[18]

Table 5: Estimation Results of the Unrestricted Model

Dep. Var.: $\ln(wage)$	Ethnic Germans Coef.[a)]	Native Germans Coef.[a)]
$educ2_{ijt}$	0.062***	0.124***
$educ3_{ijt}$	0.225***	0.534***
rel_sec_exp	0.060***	0.183***
lm_exp	0.042***	0.029***
lm_exp^2	-0.002***	0.000***
age	0.017***	0.013***
age^2	0.000***	0.000***
$female$	-0.141***	-0.115***
$\ln(distance)$	0.014***	0.031***
$\ln(firm\_size)$	0.024***	0.033***
$unemp\_rate$	-0.014***	-0.019***
N	184,882	79,923

Robust standard errors
*** Significant at the 1 %-level
[a)]Including dummies for branch and year

[18] An F-Test (with homoscedastic errors) to test whether the parameters for the control variables are identical for the two groups leads to an F-Value of 71.13 with 69 and 264,666 degrees of freedom and thus rejects the null-hypothesis at all significance levels. The Wald test with robust calculation of the variance-covariance matrix for the unrestricted model leads to the same result.

The coefficients for the Ethnic Germans are similar to those from Table 4. Medium-skilled Ethnic Germans have wages which are 6.2 % higher than those of Ethnic Germans with no vocational training. The difference between the latter group and the high-skilled Ethnic Germans is 22.5 %. For the Native Germans the differences are 12 % and 53 %, respectively.[19] This difference is again nearly the same as in Table 4. These findings are clearly in support of our hypothesis 1 and 2 from Section 2, i.e., there are significant differences between the education signals and there are large differences between Ethnic and Native Germans with identical (formal) educational signals.

The role that past experience in the same sector as the one in which the new job starts also differs substantially between the two groups with the effect much stronger for the Native than the Ethnic Germans. All other control variables remain highly significant, have the same sign and roughly the same magnitude as was the case for the restricted regression model. Perhaps at first glance slightly surprising is the fact that the quadratic age term is not negative. This is probably due to the fact that only people under 55 are included in our regressions, an age at which the declining part of the wage-age profile as is usually observed may not yet have been reached.

In a further step we check how robust our results are with respect to different specifications. The education coefficients concerning these different specifications are shown in Table 6. In the first line of this table we simply repeat the coefficients from Table 5 for better comparability.

Table 6: Robustness Checks of Education Signals with Different Model Specifications

	Ethnic Germans		Native Germans	
	voc. training	univ. degree	voc. training	univ. degree
Unrestr. model	0.062***	0.225***	0.124***	0.534***
Linear-specification	0.069***	0.231***	0.131***	0.551***
Log-linear-specification	0.071***	0.226***	0.115***	0.523***
Including short-job-spells	0.061***	0.221***	0.125***	0.528***
3-month wage	0.052***	0.211***	0.116***	0.541***
3-day gap	0.059***	0.215***	0.118***	0.513***
10,- Eur. limit	0.073***	0.234***	0.203***	0.624***
2-year stay	0.084***	0.280***		

Robust standard errors
*** Significant at the 1 %-level

The unrestricted model includes age and labour-market experience both linearly and quadratically. Lines 2 and 3 of Table 6 show the education coefficients for two different approaches using an unchanged dataset: In the linear specification we omit both the quadratic terms and in the log-linear specification we use the (natural) logarithm of age and labour-market experience as arguments. As one can see, the general picture remains the same.

Lines 4 to 8 of Table 6 show the education coefficients for robustness tests which imply variations in the dataset. Firstly, instead of only including jobs which started in the second half of a year

[19] We also calculated the coefficients for foreigners. The wage differences associated with their educational signals were always below those of the Native Germans, but well above those of the Ethnic Germans. Surprisingly, the coefficients of the foreigners were quite close to the coefficients of the Native Germans and quite different to the coefficients of the Ethnic Germans. However, due to the large heterogeneities amongst the foreigners, we refrain from presenting the results here.

to make sure that we do not just have short jobs in our sample, we include all jobs for which we observe the wage for up to six months in a particular year, i.e. we also include jobs which begin and end in the same year and hence only last a maximum of six months. As can be seen from Table 6, this only has marginal effects on the levels of the coefficients and no effects on their significance levels.

Although we assume that often the wage changes after six months when the probation period ends, we also tested a model specification where the starting wage is only based on a maximum of three months (and for the same reason as above, we only looked at jobs which started in the final three months of a year). Again, there are only small effects on the education coefficients.

The next robustness check which we perform is to vary the number of days that must be between two jobs one person has. We argued above that a gap of one day should be sufficient to be able to filter out those people changing jobs within one company from those starting new jobs at new companies. To test whether our results depend on this assumption, we also include the results when we increase this gap to three days. This reduces the coefficients slightly but does not change any of our main findings or the significance levels of the coefficients.

As mentioned in Section 3, in the unrestricted model we omit spells with starting wages below 20,- € from our analysis. In a further robustness check, we lower this wage limit and only omit new jobs with starting wages under 10,- €. Here we observe upward differences of the education coefficients particularly for Native Germans. This is caused by the fact that because of lowering the wage limit the share of people without vocational training increases substantially especially for Native Germans, i.e. for Native Germans from 14.0 % to 39.7 % and for Ethnic Germans from 30.7 % to 42.6 %.

It could be argued that Ethnic Germans need a certain amount of time once they have arrived in Germany to orientate themselves. To take this fact into account, in the last robustness modification of the unrestricted model we only looked at spells of Ethnic Germans whose first record in the IEB is at least two years old. It can be seen that both education coefficients do indeed increase, but are still well below the values for Native Germans.

All in all, the additional regression results presented in Table 6 show that the basic scenario presented before is very robust. Increasing coefficients for both Ethnic and Native Germans occur especially if jobs with starting wages from 10,- € are included. In addition, only including those Ethnic Germans which have been in Germany for at least two years also leads to an increase in their education coefficients. However, even in these cases, the empirical results still confirm the theoretical hypothesis.

5 Conclusion

This paper analyses the effects of education signals for Ethnic Germans and Germans without a migration background ("Native Germans"). Ethnic Germans are an important immigration group in Germany for two reasons: First, with roughly 2.5 million migrating to Germany between 1990 and 2004, they represent a "large" immigration group. Second, due to their German roots, they

gain German citizenship upon migration into Germany and hence – unlike other groups of migrants – unrestricted access to the German labour market.

We base our analysis on a sorting model with productivity enhancing effects of education. Hence, we do not test whether the sorting or human-capital theory is valid. Instead, we compare whether this signalling value differs significantly between a distinct group of migrants and non-migrants in the German labour market. We first show theoretically that only a separating equilibrium can exist. This has several implications for our empirical analysis. First, we expect significant differences between the effects of low-, medium- and high educational signals on wages irrespective of whether they are Ethnic or Native Germans. Second, if employers associate a lower productivity with foreign degrees than for degrees obtained in the home country, then a person with a degree from abroad will receive a lower wage than a person with the same formal degree stemming from the home country. Third, if it is true that low-skilled occupations do not require formal qualifications, we expect that the wages associated with low educational signal individuals be the same. Fourth and finally, if the former two hypothesis hold, then the difference in the coefficients between low- and high-skilled Native Germans should be higher than the corresponding difference for the Ethnic Germans.

As most datasets do not allow us to identify Ethnic Germans as they only record nationality, we test these hypothesis using a completely new and extremely rich dataset based on administrative data from the German Federal Employment Agency. We find empirical support for all four hypothesis. In addition, we test how robust our conclusions are with respect to different model specifications and econometric methods. All four hypothesis continue to hold, irrespective of which variation we tried.

Although many papers have shown that migrants, defined as foreigners, generally fare less well on the German labour market than natives do, this paper clearly highlights the fact that this also holds for one group of migrants which has not been analysed in as much detail and which has completely unrestricted access to the German labour market.

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