Native immigrant wage differentials in Germany - assimilation, discrimination, or human capital?

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Native-Immigrant Wage Differentials in Germany

Assimilation, Discrimination, or Human Capital?

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Abstract

This study uses the concept of stochastic frontiers for analyzing the income disparity between ethnic groups in West Germany. Estimation of a potential rather than an average earnings function increases the explanatory power of the human capital approach and allows for detecting discrimination as well as assimilation processes. The empirical results imply that the human capital gap explains more than 75% of the wage differential between natives and foreign nationalities in Germany. As for ethnic Germans migrants, their wage disparity can be explained by 50% with human capital differentials. Surprisingly, only small differences could be observed with regard to the question of earnings efficiency. On an average, inhabitants as well as immigrants transformed about 85% to 90% of their potential income into actual earnings. The sources for the individually diverging efficiency ratios are not well understood, with discrimination only found for ethnic Germans from Eastern Europe. Somewhat disappointing, the assimilation hypothesis was clearly rejected for all migrants with again the exception being ethnic Germans from Eastern Europe.

JEL classification: J31, J61, J71

Keywords: Immigration, Assimilation, Discrimination, Earnings Frontier, Human Capital Approach

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1 Introduction

Worldwide immigrant flows have dramatically increased since the beginning of the nineteen-eighties. Many of these immigrants have chosen a non-traditional destination, like Germany or France, for their new home country. As for Germany, more than 2.5 million persons from Eastern Europe (mainly the former Soviet Union, Poland and Romania) arrived in the course of the last 15 years. Because of their ethnic extraction, the majority of them has legitimate claim for German citizenship. During the same time period, West Germany was also the destination country for 1.5 million citizens from East Germany (the former GDR). Looking back into the past, a similar phenomena could be observed during the nineteen-sixties, when about 3 million foreigners from the southern regions of the EU (Spain, Italy, Greece), the former Yugoslavia and Turkey moved to West Germany. Putting together and ignoring refugees, which may be viewed as temporary phenomena, currently more than 12% of the West-German population is foreign born (for some details see *Loeffelholz and Köpp, 1998*).

In this paper, the substantial discrepancy in wages between the different groups of immigrants and the native population is analyzed. The focus on wages is supported by *Cain (1986),* who argues that earnings are a more fundamental measure for the success on the labor market than employment characteristics. For example, monthly gross earnings of males from Eastern Europe or Turkey are more than 24% below the average of inhabitants. Even after correcting for different working hours, a 17%-differential remains to be explained. In contrast, hourly earnings from EU citizens living in West Germany show a 14% discount, whereas East Germans have nearly catched up – their wage disadvantage stands at just 4%. Details are presented in *Table A-1* in the appendix.

Within the framework of the human capital approach, these different earnings gaps are due to average group differences in productivity relevant characteristics. The assimilation hypothesis proposed by *Chiswick (1978)* may then be viewed as a supplementary part of the human capital theory. Following *Chiswick*, foreign born employees experience a wage discount relative to their labor productivity immediately after immigration, but catch up in subsequent periods. The more of the wage gap can be explained by differences in the human capital endowment and temporary adjustment problems, the convincing is the idea of an efficient and nondiscriminatory working labor market. Any remaining disparity in earnings may be due to unobserved variables - or due to discrimination.

The political importance of this question is evident: If the assimilation hypothesis is confirmed *(Bauer and Zimmermann, 1995,* for ethnic Germans) and immigrants show an outperforming labor market success, their high productivity growth rates will substantially contribute to an enhanced macro-economic environment. As a consequence, the host country should invest in the education of young immigrants to accommodate their human capital endowment to the national standard. However, if discrimination is found a major source of the earnings gap, anti-discriminatory laws or similar measures may be discussed. Finally, if neither assimilation[1] nor discrimination is responsible for the discrepancy, the selection of immigrants by the host country was insufficient. Lower levels of the human capital endowment plus a possible migration discount are indicating a permanent productivity gap relative to natives. As an implication, immigrants would not contribute to increasing macro-economic growth rates, but instead represent a long-term burden for the public welfare system.

To determine the characteristics of the earnings function, in a first step not the traditional ”average” function, but a frontier relationship is estimated. That idea was originally introduced for the analysis of firms, where the quality of the management is not homogenous, but differs between firms (*Farrell, 1957*). As a main consequence, the cost structures of some firms are not optimal. To be more specific, firms are allowed to produce not the maximum possible output given a set of inputs, but a lower volume - with varying degrees of inefficiencies between firms (*Fried et al., 1993,* give a survey about estimation methods). Transferred to the labor market, the earnings frontier gives the highest potential income associated with varying amounts of human capital inputs. All individuals are on or below this curve. In a second step, the individual-specific distances from the frontier are explained by a bundle of possible sources, with assimilation and ethnic discrimination at the core of the interest of this paper.

The estimation of frontier relationships has become increasingly popular during the last years, especially for the analysis of financial institutions (for a survey see *Berger and Humphrey, 1997*). Within the field of labor economics, this approach has been used for some US studies (*Herzog et al., 1985, Hofler and Polachek, 1985, Hunt-McCool and Warren, 1993*). For the immigration problem there exists a study of *Daneshvary et al. (1992),* who define assimilation as a decrease in the difference between actual and potential earnings over time and test this hypothesis for the US immigration market. *Robinson and Wunnava (1989)* use the concept of an earnings frontier to measure the

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[1] Empirical evidence on guest workers in Germany is questioning the assimilation hypothesis (*Licht and Steiner, 1994, Pischke, 1993).*

degree of gender discrimination. However, by restricting their sample on female employees, they have to assume that every difference between deterministic earnings and the earnings frontier is due to discrimination, which is not realistic. As will be shown in this study, the reference group (here: the natives) is also suffering from earnings inefficiency, which only leaves the difference between the inefficiency levels as possible source for discrimination or assimilation.

The structure of the paper is as follows: Section 2 contains the specification of the estimated model and the estimation method. In section 3 the dataset is described. Furthermore, the estimated earnings frontier is presented and analyzed. From these estimations, conclusions on the explanatory power of the human capital approach for the migrant-native wage gap are drawn. Section 4 analyzes the individual deviations from the frontier by regressing these deviations on general and migrant-specific variables. From these regressions, the assimilation hypothesis as well as discriminatory behavior against different groups of migrants is tested. Finally, section 5 sums up.

2 Specification

Basic assumption is the existence of a semilogarithmic human capital production function of the extended *Mincer (1974)* type

$$\ln E_i = \alpha + \beta' X_i + \varepsilon_i \qquad i = 1,\ldots,n\,, \tag{1}$$

where E_i denotes hourly earnings of individual *i*, X_i is a vector of socio-economic characteristics, α as well as the β-vector represent unknown parameters, and ε is the error term. Equation (1) assumes that wages are systematically dependent on the endowment with human capital *X*, which is proxied by the factors education (schooling, training, university degree), labor market experience, times of unemployment, type of work (blue collar versus white collar) and actual working hours. The latter variable captures the possibility of a declining per-hour-productivity. In general, a positive relationship between the human capital endowment and the market wage is expected because of a direct link between human capital and labor productivity.

The focus of this paper is on the earnings differences between natives and immigrants. One possible reason of this earnings discrepancy maybe the existence of discrimination against foreigners, which can be detected on the basis of equation (1). Two alternatives are dominating the empirical literature on that question: Either one income equation is estimated with a dummy variable for ethnic affiliation or gender, which is interpreted as evidence in favor of discrimination if the dummy parameter is statistically significant

and negative in sign. Or separate earnings functions for different groups are estimated, with discrimination being present if the parameters for the reference group (e.g. natives or males) are representing higher wages for a given human capital endowment (*Blinder, 1974; Oaxaca, 1973*). Discrimination is therefore captured by different parameter values instead of additional variables. However, as *Darity and Mason (1998)* note in their overview article, one should not expect that the conclusion about the existence of discrimination is dependent on the chosen technique.

Similarly, to test for the assimilation hypothesis, earnings functions of immigrants are traditionally including a variable "years since migration" (*YSM*). The assimilation theory of *Chiswick (1978)* is supported if the empirical results show higher starting wages of natives, but a positive coefficient for the *YSM* regressor. The basic assumption behind this hypothesis is a depreciation of the value of human capital due to the cross-border movement, which can be compensated by adjusting to the new working environment during the next years.

In this paper an alternative method is chosen to detect assimilation and discrimination processes. The idea is to estimate one single frontier earnings function for the whole sample, which represents the maximum earnings one can receive given his human capital endowment. All individuals have earnings that are at or below the frontier. There may exist various reasons for a deviation from the potential income, with assimilation and ethnic discrimination obviously being important candidates. Other sources for observed "income inefficiency" may be regional or occupational immobility of employees, information deficiencies, or market power of firms.

Figure 1 is graphically illustrating the frontier earnings function and actual earnings of a representative native in comparison with an immigrant. The frontier earnings curve is concave with regard to the age[2] variable. Typically, neither immigrants nor natives can reach the frontier, but will realize somewhat lower earnings. In this context, the assimilation hypothesis can be tested by regressing the distance from the frontier on a constant, the years-since-migration variable, and a set of other explaining variables. The assimilation hypothesis is supported if *ysm* is significantly positive and the constant term lower than in a parallel regression for natives. Discrimination against migrants would widen the gap between potential and actual earnings; it can therefore be captured by introducing dummy variables representing the different ethnic affiliations. As in opposite to *Robinson and Wunnava (1989),* the inclusion of a reference group (here: the natives)

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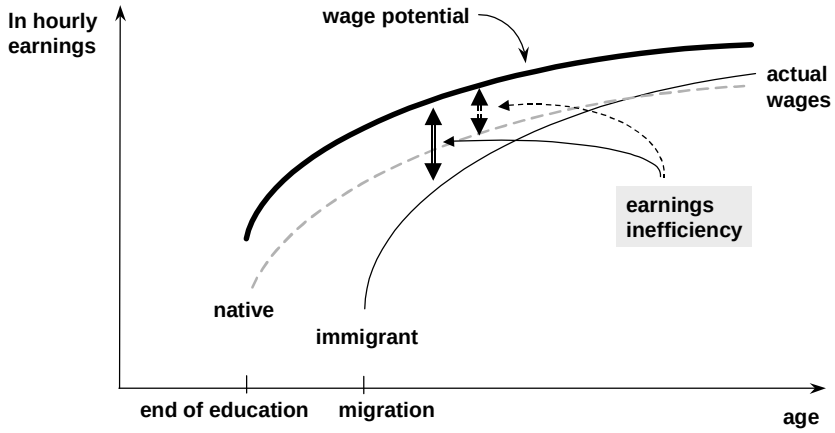
[2] Estimations in the empirical part of the paper are based upon actual labor market experience.

allows for an analysis of the different distances to frontier. That increases the plausibility of the approach, because some reasons for a shortfall from the potential earnings curve may also be relevant for natives (e.g. regional or occupational immobility, market power of firms).

Figure 1:
Earning Pattern of Natives and Immigrants with Assimilation



To estimate the income frontier for a parametric specification, deterministic and stochastic methods can be differentiated. Because of its higher flexibility and the diminished outliers problem, in this study the stochastic approach is used (for an overview see *Greene, 1993*). The stochastic frontier approach assumes that the error term ε_i from (1) is split up into two parts:

$$\ln E_i = \underbrace{\underbrace{\alpha + \beta' X_i}_{\text{frontier income}} - u_i}_{\text{actual income}} + \upsilon_i \qquad i = 1,\ldots,n \tag{2}$$

White noise is represented by $\upsilon_i \sim N(0, \sigma_\upsilon^2)$, whereas u_i reflects labor market inefficiency of a specific person *i*. The stochastic term u_i is restricted to be non-negative, because otherwise one would be allowed to earn more than his potential (maximum) earnings. Characterized within the econometric framework, the deterministic part of the earnings function $\alpha + \beta' X_i$ defines an envelope associated with specific amounts of human capital. Since some individuals will probably earn less because of various reasons ($u_i \geq 0$), the composite error term ε_i has a nonzero mean which reflects the systematic deviation of actual wage from the hypothetical norm.

To estimate the parameters of the underlying function, the stochastic distribution of the inefficiency term u_i has to be specified. The most popular assumption is a half normal distribution for u_i, introduced by *Aigner et al. (1977)*.[3] The log-likelihood function for the half-normally distribution is

$$\ln L(\alpha,\beta,\sigma^2,\lambda)=\sum_{i=1}^{N}\left[-\ln\sigma\ +\ln\frac{\sqrt{2}}{\sqrt{\pi}}-\frac{1}{2}\frac{\varepsilon_i^2}{\sigma^2}+\ln\Phi\left(\frac{-\varepsilon_i\lambda}{\sigma}\right)\right] \tag{3}$$

where $\Phi(\cdot)$ is the standard normal distribution function, $\sigma^2=\sigma_\upsilon^2+\sigma_u^2$, $\lambda=\sigma_u/\sigma_\upsilon$, and $\varepsilon_i=\ln E_i-\alpha-\beta' X_i$.

Estimation of (3) produces the compounded residual ε_i, which consists from pure randomness (υ_i) and the difference between potential and actual earnings (u_i). The numerical value of u_i has to be determined indirectly. Following *Jondrow et al. (1982)*, the conditional expectation value of u_i given ε_i can be calculated as

$$E(u_i|\varepsilon_i)=\left(\frac{\phi[\varepsilon_i\lambda/\sigma]}{\Phi[-\varepsilon_i\lambda/\sigma]}-\frac{\varepsilon_i\lambda}{\sigma}\right)\sqrt{\frac{\sigma_u^2\sigma_\upsilon^2}{\sigma_u^2+\sigma_\upsilon^2}}\,, \tag{4}$$

with $\phi(\cdot)$ representing the density function of the standard normal distribution. Again, $\Phi(\cdot)$ is the standard normal distribution function. All information necessary for the estimation of E(u_i) is available from the parameters of the maximized likelihood-function (σ, λ, σ_u, σ_υ) or can easily be calculated (ε_i).

From (4), the distance from the earnings frontier u_i can be determined for each individual $i=1,\ldots,n$. However, more interestingly than the absolute value of u_i is the efficiency ratio EFF_i, which gives the percentage of the potential income actually realized by person *i*. Because of the semilogarithmic form of the earnings equation (1), EFF_i can be derived as

$$EFF_i=\frac{\exp(\alpha+\beta' X_i-u_i)}{\exp(\alpha+\beta' X_i)}=\exp(-u_i) \tag{5}$$

EFF_i is restricted to the interval]0,1], with the upper boundary representing a worker who transforms his human capital endowment perfectly into market income. A value of less than one - e.g. 0.90 - indicates that the underlying employee actually earns 90% of this potential income.

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[3] Alternatively, the more flexible Gamma-distribution proposed by *Greene (1990)* could be considered, but the greatly increased complexity of the estimation procedure has prevented its widespread usage.

In a second step, the different EFF_i–values are explained by some characteristics of the employee, supplemented by market-specific and migration-specific factors: [4]

$$
\begin{aligned}
EFF_i = {} & \delta_0 \\
& + \delta_1 * MARRIAGE_i + \delta_2 * CHILD_i && \rightarrow \text{immobility} \\
& + \delta_3 * SMALL_i + \delta_4 * MEDIUM_i && \rightarrow \text{market power of employer} \\
& + \delta_5 * YSM_i + \delta_6 * TEMPORARY_i + \delta_7 LANGUAGE_i && \rightarrow \text{assimilation} \\
& + \delta_{7+n} \sum_{n=1}^{5} ORIGIN_i^n && \rightarrow \text{discrimination} \\
& + \varepsilon_i^1
\end{aligned}
\tag{6}
$$

MARRIAGE gives the marital status, *CHILD* the number of children living in the household of individual *i*. To be married and to educate children are important determinants of regional immobility, which is a potential candidate for driving a wedge between potential and actual income. The sign of these parameters is therefore expected to be negative. The dummy variables *SMALL* and *MEDIUM* take the value one if the relevant firm has less than 20 respectively between 20 and 2000 employees. Large firms with more than 2000 employees are the reference scenario. Given the assumption that unions are more powerful in big firms, δ_3 and δ_4 should have a negative sign.

As discussed before, actual earnings levels may also be influenced by assimilation and discrimination. To capture an potential assimilation process, the traditional *YSM* variable is inserted into the list of regressors. Supplementary to *YSM* are the dummy variables *TEMPORARY* and *LANGUAGE*, which are equal to one if a person intends to return to its country of origin (*Dustmann, 1993*, finds evidence on the importance of that factor) and doesn't have sufficient knowledge of spoken German, respectively. Discrimination is introduced by the set of dummy variables *ORIGIN*, which are categorizing the migrants into five main groups: Ethnic Germans from Eastern Germany and Eastern Europe, respectively, guest-workers from the European Community, guest-workers from Turkey, and – finally – guest workers from other Non-EU countries. ε_i^1 represents a regular error term. The estimation of (6) was run for the whole sample and separately for each group of migrants.

[4] Alternatively one could specify a model where the parameters of the frontier model and the potential determinants of deviation are entering the estimation process jointly *(Reifschneider and Stevenson, 1991).*

3 Human Capital Approach: Empirical Results

Empirical basis of this paper is the ”German Socio-Economic Panel” (GSOEP) for 1997, where a representative number of natives and all types of immigrants is interviewed. Only persons living and working in the western part of Germany are considered in this paper. To reduce distortions from self-selection, extreme outliers or measurement errors, the research population was confined to a subsample of males between 18 and 64 years of age. All part-time employees with less than 20 working-hours per week were also deleted. Furthermore, all self-employed and persons with missing information were excluded. After these corrections, the final sample consists from 2262 persons, from which 1548 are natives. A description of the variables and the mean values can be found in *Table A-4* in the appendix. To identify a possible relationship between the source countries of migrants and their labor market success, the dataset is further differentiated with respect to the current citizenship and the regional origin of the migrants. The six categories are defined as in *Table 1*.

Table 1:
Categories of Immigrants

Description	**Sub-categories**	**Sample size**
Foreign born, German citizenship (ethnic Germans)	→ from the former GDR	48
	→ from Eastern Europe	141
Foreign born, foreign citizenship (guest workers)	→ from EU member countries	175
	→ from Turkey	157
	→ from other Non-EU countries	49
Born in Germany, foreign citizenship (offspring of guest workers)	→ offspring of guest-workers	74

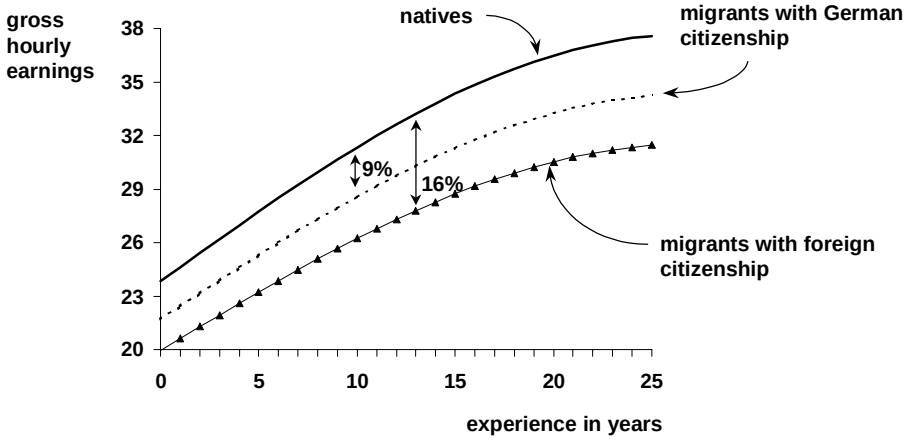
In a first step, the income frontier (1), which is specified as

$$\begin{aligned}\ln E_i = {} & \alpha + \beta_1 * AGE + \beta_2 * SCHOOL + \beta_3 * TRAINING + \beta_4 * COLLEGE \\ & + \beta_5 * EXPERIENCE + \beta_6 * EXPERIENCE^2 + \beta_7 * JOBLESS \\ & + \beta_8 * OCCSTATUS + \beta_9 * HOURS + \varepsilon_i\end{aligned} \quad , \tag{7}$$

was estimated on basis of the whole sample. This functional form allows for concavity in the experience variable ($\beta_6 < 0$). No regressors like firm size or marital status were added, because these factors are not considered as components of the human capital

stock. However, as equation (6) shows, these variables are allowed to influence the distance between potential and actual earnings.

Figure 2:
Frontier Earnings Functions of Inhabitants and Immigrants



Simulation based on actual working time of a representative native.

The results of the Maximum-Likelihood (ML) estimation and - for comparison - of the standard OLS-method are presented in *Table A-2* in the Appendix. From OLS, the overall goodness-of-fit is $\overline{R}^2 = 0.38$ and therefore quite satisfactory. The ML-iteration process turned out to be stable and converging. All of the estimated parameters are found to be statistically significant and show the expected sign. A Likelihood-ratio test clearly rejects the hypothesis that only random error exists (that would be equivalent to $\lambda = 0$). The advantage of the stochastic frontier approach against the traditional method can be measured by a variance decomposition provided by the ML results. As *Greene (1993)* points out, the contribution of the variance of u to the variance of ε is $[(\pi/2)-1]\sigma_u^2 / \{\sigma_v^2 + [(\pi/2)-1]\sigma_u^2\}$. Inserting the ML estimates from *Table A-2*, approximately 20% of the variance of the composite error term is assigned to earnings inefficiency.

The analysis of the economic content of the estimated earnings frontier underlines the important role of education for the labor market. As the calculations show, every year of schooling is shifting the wage frontier upwards by roughly 3.5%. A college degree turned out to be more important than occupational training: The increase in income is estimated to be 26% and 5%, respectively. Every year of unemployment is decreasing the potential wage by about 2.5%.

Figure 2 is graphically illustrating the results with the focus on the relationship between experience and the frontier wage of native and migrants. The vertical difference between the curves is neutralizing the different age structures and therefore capturing the observed heterogeneity in schooling, training, and college education. As can be seen, the market value of these variables is highest for natives, followed by ethnic German immigrants. Remarkable differences exist between the last-ranked guest-workers and their offspring (not shown in *Figure 2*), with the educational level of the latter even overtaking that of the relatively high-skilled immigrants from Eastern Europe.

Table 2:
Explanatory Power of the Human Capital Approach for the Wage Gap

	Observed hourly earnings (DM)	observed difference	Expected earnings from earnings frontier*	human capital approach explains ... % of difference**
Natives	31.40		33.20	
Foreign born, German citizenship (ethnic Germans)	26.00	-17.2%	30.45	48.5%
- Eastern Europe	*24.50*	*-22.0%*	*29.60*	*48.9%*
- Eastern Germany	*30.10*	*-4.0%*	*32.90*	*21.4%*
Foreign born, foreign citizenship (guest workers)	26.20	-16.6%	28.90	77.8%
- EU citizens	*26.90*	*-14.3%*	*30.10*	*65.0%*
- Turks	*26.10*	*-16.9%*	*27.90*	*94.4%*
- other non-EU	*24.90*	*-21.7%*	*28.20*	*69.0%*
Born in Germany, foreign citizenship (offspring of guest-workers)	24.80	-21.0%	26.10	99.1%

* Antilog of group-specific sample means multiplied by ML-parameters.
** Comparison of the predicted wage differential between natives and migrants from the frontier with the observed wage differential.

Table 2 is comparing observed earnings with the predicted earnings from the wage frontier, given the total set of the human capital variables. From that comparison, it can be derived how many percentage points of the observed difference are due to the productivity gap (human capital approach). As the results indicate, the explanatory power of the human capital theory is nearly perfect predictor for the offspring of guest-workers, a good one for the guest-workers themselves, and a satisfactory one for ethnic Germans. At the average, 99%, 78%, and 49%, respectively, of the observed wage dif-

ferential between the groups can be explained by different positions on the frontier earnings curve. The low wage of Turk employees can be explained by more than 94% by their modest human capital endowment. Finally it should be noted that the low potential wage of the offspring of guest-workers is due to their low average age, which finds expression in a relatively low experience variable.

4 Earnings Efficiency

From the ML-estimates and the compounded residual ε_i, conclusions on the inefficiency part of ε_i can be drawn (see equation (4)). By transforming $u_i = -\varepsilon_i + \upsilon_i$ into more meaningful EFF_i-values (equation (5)), the following picture condensed from the calculations: At the average, employees could realize 88% of their potential earnings as actual earnings. Roughly 96% of all observation are within the 2-sigma-interval, with the estimated standard deviation of EFF_i being 0.03. Surprisingly, the differences between natives and migrants turned out to be small: A slightly more heterogeneous appearance of migrants notwithstanding, the distances between estimated and potential income are very similar for all groups (see *Table 3*).

Table 3:
Income Efficiency by Group

	Mean value of EFF_i	Standard-deviation
Natives	0.882	0.031
Foreign born, German citizenship (ethnic Germans)	0.871	0.040
- Eastern Europe	*0.868*	*0.041*
- Eastern Germany	*0.878*	*0.036*
Foreign born, foreign citizenship (guest workers)	0.879	0.032
- EU citizens	*0.877*	*0.034*
- Turks	*0.883*	*0.031*
- other non-EU	*0.875*	*0.033*
Born in Germany, foreign citizenship (offspring of guest-workers)	0.883	0.034

In a second step, the relationship between earnings efficiency EFF_i and its potential sources is analyzed (equation (6)). *Table 4* shows the estimation results for the whole

sample, whereas the group-specific regressions are presented in *Table A-3*. Although not all results will be discussed in detail here, some comments seem to be in order.

Table 4:
Explanation of Earnings Efficiency

	Coefficient	**Standard error**
CONST	0.8832***	0.0016
MARRIED	0.0062***	0.0015
CHILD	0.0006	0.0005
SMALL	-0.0192***	0.0020
MEDIUM	-0.0057***	0.0015
DUMMY Eastern Europe	-0.0119***	0.0030
DUMMY Eastern Germany	-0.0067	0.0055
DUMMY European Community	-0.0040	0.0039
DUMMY Turkey	0.0015	0.0037
DUMMY Other non-EU	-0.0044	0.0050
LANGUAGE	-0.0063**	0.0026
TEMPORARY	-0.0058**	0.0027
$\overline{R}^2$	0.064	
Observations	2262	
probability of F	0.000***	

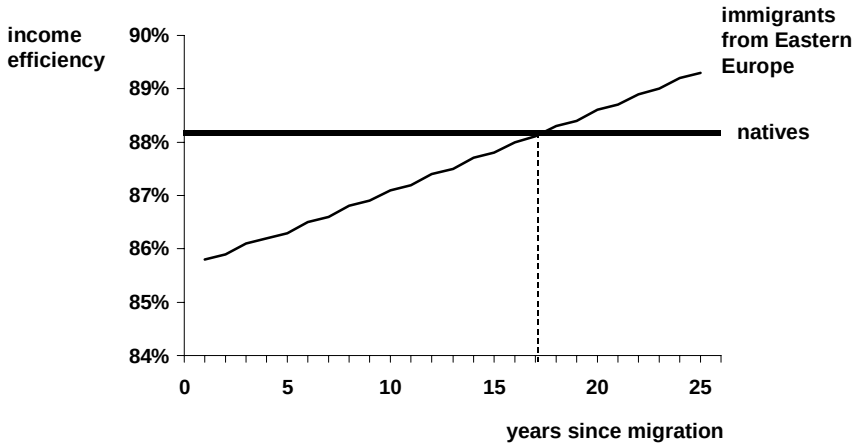
Dependent variable is EFF_i. *, ** and *** represent a significance level of 90%, 95% and 99%, respectively (two-sided).

As the probably most robust result, to be employed at small firms with less than 20 employees significantly increases the wedge between potential and realized earnings. To be more specific, the EFF_i value is estimated to decrease by at least 2% in this case. That result is in line with other studies[5] and may be due to a smaller influence of unions, for example. Interestingly, the difference between medium sized firms (20-2000 employees) and the reference group (firms with more than 2000 employees) is at just 0.6% and therefore only statistically, but not economically significant.

[5] For example, *Althammer and Wenzler (1996)* and *Bauer and Zimmermann (1995)* show a positive influence of firm size on earnings, too. Notice, however, that both studies use firm size as explaining variable within the earnings equation context, whereas in this paper firm size is explaining the difference between potential and realized earnings. Only direct human capital measures are entering the earnings equation (7).

With regard to the question of discrimination, statistical evidence was only found for immigrants from Eastern Europe. To be born in Eastern Europe increases the distance from the frontier by about 1.2%, which explains a further twentieth of the 22%-wage differential to natives (*Table 3*). For all other migrants, the estimates show no signs of discrimination.

Figure 3:
Assimilation Path of Immigrants from Eastern Europe



Only partial support was found for the assimilation hypothesis. As can be seen from the group-specific regressions (*Table A-3* in the appendix), with the exception of ethnic Germans from Eastern Europe the *YSM*-variable did not turn out to be statistically significant. For that group, immediately after immigration the distance to the frontier is 2.4% wider than for a native. Eight years after immigration – which is the mean *YSM*-figure for this group – the difference has reduced to 1.4%. Simulation runs predict that parity with the native population will be reached after 17 years stay in West Germany (see *Figure 3* for an illustration).

Finally, it should be noted that equation (6) can explain only a small part of the observed variance in EFF_i. The determination coefficient takes a value of modest 6% for the whole sample and only slightly more for the group-specific estimations, which leaves a lot of room for further speculation about the forces for the different levels of income efficiency.

5 Conclusion

The 1980's were characterized by a resurgence of immigration to West Germany, accompanied by a change in the origin mix from Southern Europe (Turkey, Yugoslavia,

Italy, Spain, Greece) to Eastern Europe. Not surprising, these huge immigration waves were accompanied by a political debate over the quantity and types of migrants, which can be adopted. From an economic point of view, the observed wage differentials between natives and all types of migrants have to be taken serious because of their probably negative macro-economic consequences.

This paper is following recent research in population economics, assessing the labor market performance of the different types of migrants living in West Germany. On the basis of a stochastic earnings frontier, income profiles of non-natives are compared with those of the native population. The estimation of earnings frontiers allow for quantifying the maximal income (aside from white noise) which can be earned given the level of human capital. Furthermore, individual differences between potential and actual income are estimated and - in a second step - put into relationship to a set of regressors. The regressors include proxies for possible discrimination and assimilation effects.

By determining the potential wages of natives and migrants on the earnings curve, it can be seen that significant shares of the observed wage differential can be explained by varying endowments. About 50% of the wage disadvantage from ethnic Germans and more than 75% for guest-workers are predicted by the earnings frontier. For Turk guest-workers, which represent the largest ethnic group of guest-workers, the explanatory power is even stronger: About 95% of the wage differential are due to their lower human capital stock. Similarly high values were found for the offspring of guest-workers.

With regard to the wedge between potential and actual income, the stochastic frontier estimations predict that on an average about 75%-80% of the potential income can be realized as market earnings. The difference between natives and migrants is in the range of 1 to 3%, which seems surprisingly low. As for the explaining factors of this wedge between potential and actual wage, discrimination and assimilation play a minor role. The empirical results suggest that statistically significant discrimination can only be measured against ethnic Germans from Eastern Europe. Ceteris paribus, their income efficiency is estimated to be 1.2% lower than that of other employees. Confirming the results *of Licht and Steiner (1994), Pischke (1993),* and *Bauer and Zimmermann (1995),* assimilation was only found for ethnic Germans from Eastern Europe. The necessary time for complete assimilation is predicted to be about 17 years. For guest-workers the assimilation hypothesis is not supported.

Aside from the mentioned results on assimilation and discrimination, to be employed at a small firm could be clearly identified as negative. The market power of small firms is obviously sufficient to pay their employees beyond the value of their human capital en-

dowment and therefore below their productivity. However, in general only a small part of the distance to the earnings frontier can be explained.

Finally, it should be noted that some doubts remain if the relative success of the Eastern Europeans can be extrapolated to the future: *Borjas (1985)* supposes for the United States that the quality of immigrants has deteriorated over time, and assimilation is much less important for earnings growth than cross-sectional comparisons indicate. He pointed out that cross-sectional studies may be biased because they do not disentangle intergenerational mobility from assimilation. With regard to Germany, a similar process could take place as the consequence of negative self-selection: Motivated by generous welfare transfers and high tax rates, not the best but the less successful or older persons are attracted to migrate to Germany. Policy should avoid a repetition of the failure from the sixties, where obviously no selection of the guest-workers has taken place.

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Appendix

Table A-1:

Mean and Standard Deviation of Income for Natives and Migrants

	Monthly earnings			**Hourly earnings**		
	mean value	difference to natives	standard deviation	mean value	difference to natives	standard deviation
natives	5420		2357	31.40		13.16
Foreign born, German citizenship	4428	-18.3%	1921	26.00	-17.2%	8.80
- Eastern Europe	*4095*	*-24.4%*	*1461*	*24.50*	*-22.0%*	*7.14*
- Eastern Germany	*5408*	*-0.2%*	*2664*	*30.10*	*-4.0%*	*11.56*
Foreign born, foreign citizenship	4210	-22.3%	1438	26.20	-16.6%	8.35
- EU citizens	*4360*	*-19.6%*	*175*	*26.90*	*-14.3%*	*9.71*
- Turks	*4112*	*-24.1%*	*1003*	*26.10*	*-16.9%*	*7.38*
- other non-EU	*4100*	*-24.3%*	*1304*	*24.90*	*-21.7%*	*7.60*
Born in Germany, foreign citizenship	4121	-24.0%	1393	24.80	-21.0%	8.40

Male employees only; all data for 1997.
Source: German Socio-Economic Panel (GSOEP); own calculations.

Table A-2:

OLS and Maximum Likelihood Estimates of Earnings Equation

	Average Earnings Function (OLS)		**Frontier Earnings Function (Maximum Likelihood)**	
	Coefficient	Standard error	Coefficient	Standard error
CONST	3.1258***	0.0690	3.2521***	0.0746
SCHOOL	0.0315***	0.0055	0.0318***	0.0055
TRAINING	0.0524***	0.0121	0.0506***	0.0121
COLLEGE	0.2574***	0.0233	0.2582***	0.0233
EXPERIENCE	0.0337***	0.0020	0.0335***	0.0021
*EXPERIENCE^2 * 100*	-0.0615***	0.0046	-0.0610***	0.0046
JOBLESS	-0.0266***	0.0040	-0.0266***	0.0040
OCCSTATUS	-0.1137***	0.0145	-0.1157***	0.0146
HOURS	-0.0099***	0.0008	-0.0097***	0.0008
σ^2			0.0909***	0.0092
λ			0.6604***	0.1895
$\overline{R}^2$	0.383			
Observations	2262		2262	

Dependent variable is ln of hourly (gross) earnings.

Standard errors for Maximum Likelihood from the covariance of analytical first derivatives. *, ** and *** represent a significance level of 90%, 95% and 99%, respectively (two-sided).

Table A-3:

OLS Estimates of Inefficiency Equation for Immigrants by Region of Origin

	Foreign born – German citizenship (ethnic Germans)				**Foreign born – Foreign citizenship (guest workers)**					
Born in ...	**Eastern Europe**		**East Germany**		**EU members**		**Turks**		**Else Non-EU countries**	
	Coefficient	Stand. Error	Coefficient	Stand. error	Coefficient	Stand. error	Coefficient	Stand. error	Coefficient	Stand. error
CONST	0.8671***	0.0141	0.8989***	0.0182	0.8926***	0.0121	0.8968***	0.0117	0.8992***	0.0228
MARRIED	0.0017	0.0096	-0.0196*	0.0116	-0.0013	0.0063	0.0032	0.0077	-0.0014	0.0121
CHILD	0.0022	0.0025	0.0051*	0.0027	0.0001	0.0015	0.0009	0.0011	-0.0031	0.0020
SMALL	-0.0311***	0.0103	-0.0288**	0.0140	-0.0301***	0.0083	-0.0413***	0.0084	-0.0316	0.0201
MEDIUM	-0.0130	0.0091	-0.0034	0.0123	-0.0095	0.0062	-0.0095*	0.0055	-0.0112	0.0172
YSM	0.0015*	0.0008	-0.0002	0.0004	0.0002	0.0003	-0.0003	0.0004	-0.0003	0.0006
LANGUAGE	-0.0016	0.0074	–		-0.008*	0.0053	-0.0049	0.0049	0.0049	0.0116
TEMPORARY	–		–		-0.0010**	0.0050	0.0022	0.0047	0.0010	0.0010
$\overline{R}^2$	0.083		0.105		0.110		0.113		0.076	
Probability of F	0.007***		0.085*		0.000***		0.001***		0.173	
observations	141		48		175		157		49	

Dependent variable is is EFF_i. *, ** and *** represent a significance level of 90%, 95% and 99%, respectively (two-sided).

Table A-4

Description of the Primary Data (Mean Values)

Variable	Definition	Natives	Foreign born – German citizenship (ethnic Germans)		Foreign born – Foreign citizenship (guest workers)			Born in Germany, foreign citizenship
			Eastern Europe	East Germany	EU members	Turks	Else Non-EU countries	
EARNINGS	Gross DM-income from wages/salaries per hour	31.40	24.50	30.10	26.90	26.10	24.90	24.80
SCHOOL	Years of schooling	10.2	8.9	9.8	8.3	8.3	8.3	9.7
TRAINING	Equals 1 if employee received occupational training; 0 otherwise	0.51	0.33	0.33	0.19	0.16	0.22	0.51
COLLEGE	Equals 1 if employee has university degree, 0 otherwise	0.20	0.17	0.25	0.07	0.05	0.06	0.05
EXPERIENCE	Actual full-time work experience in years (without time of apprenticeships)	17.9	16.1	18.4	23.4	17.0	20.0	6.3
JOBLESS	Time of unemployment in years	0.59	0.99	0.79	0.72	1.07	1.43	0.80
OCCSTATUS	Occupational status: equals 1 if blue collar worker; 0 otherwise	0.40	0.84	0.44	0.84	0.92	0.86	0.64
HOURS	Number of actual working hours per week	43.3	41.9	44.3	40.7	40.3	42.1	42.1
MARRIED	Equals 1 if married; 0 otherwise	0.66	0.84	0.71	0.81	0.89	0.80	0.39
CHILD	Number of dependent children living in household	1.04	1.32	1.50	1.46	2.40	1.51	1.22
SMALL	Equals 1 if firm has less than 20 employees, 0 otherwise	0.16	0.28	0.25	0.18	0.12	0.22	0.20
MEDIUM	Equals 1 if firm has more than 20 and less than 2000 employees, 0 otherwise	0.51	0.53	0.48	0.60	0.60	0.67	0.53
YSM	Years since immigration to West-Germany	–	8.6	25.2	25.0	20.2	18.6	–
LANGUAGE	Equals 1 if individual has modest or no knowledge of oral German, 0 otherwise	–	0.32	–	0.37	0.47	0.29	0.04
TEMPORARY	Equals 1 if individual intends to re-migrate, 0 otherwise	–	–	–	0.57	0.48	0.41	0.27
	Number of observations	1545	141	48	175	157	49	74

Male employees only; all data for 1997. Source: German Socio-Economic Panel (GSOEP); own calculations.