Assimilation of immigrants in Germany: evidence from an earnings frontier approach

Günter Lang

Angaben zur Veröffentlichung / Publication details:

Lang, Günter. 1997. "Assimilation of immigrants in Germany: evidence from an earnings frontier approach." Augsburg: Volkswirtschaftliches Institut, Universität Augsburg.

INSTITUT FÜR VOLKSWIRTSCHAFTSLEHRE

der

UNIVERSITÄT AUGSBURG

Assimilation of Immigrants in Germany

Evidence from an Earnings Frontier Approach

by

Günter Lang

Beitrag Nr. 156 Februar 1997

Volkswirtschaftliche Diskussionsreihe

Institut für Volkswirtschaftslehre
Universität Augsburg

Universitätsstr. 16
86159 Augsburg
Telefon (08 21) 5 98-(1)

Assimilation of Immigrants in Germany

Evidence from an Earnings Frontier Approach

by

Günter Lang

Beitrag Nr. 156 **Februar 1997**

Assimilation of Immigrants in Germany

Evidence from an Earnings Frontier Approach

Günter Lang*
University of Augsburg/Germany
February 1997

Abstract

This study uses the concept of stochastic frontiers for testing the assimilation hypothesis in the West-German labor market. Estimation of a potential rather than an average earnings function increases the explanatory power of the human capital approach and allows for the determination of individual levels of income efficiency. The results imply that immigrants from East Germany and Eastern Europe exhibit a significantly steeper earnings profile than natives, clearly supporting the assimilation hypothesis for this group. Ten years after arrival immigrants reach „wage parity" with West Germans. 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 75% to 80% of their potential income into actual earnings. The reasons for the individually diverging efficiency ratios are not well understood, with the market power of small firms against their employees being identified as the most important source.

JEL classification: J31, J61
Keywords: Immigration, Assimilation, Earnings Frontier

* I'm indebted to Joerg Althammer for valuable suggestions.

Dr. Günter Lang, WiSo-Fakultät, Universität Augsburg, Universitätsstraße 16, D-86159 Augsburg, Germany, Phone **49-821-598-4195, Fax 49-821-598-4230, e-mail guenter.lang@wiso.uni-augsburg.de.

Introduction

Worldwide immigrant flows have dramatically increased since the beginning of the eighties. Many of these immigrants have chosen a non-traditional destination, like Germany or France, for their new home country. As a result, more than 2 mio persons from Eastern Europe (mainly Russia, Poland and Romania) arrived in Germany. Because of their ethnic extraction and in contrast to guest workers or refugees, these people have legitimate claim for permanent residence in Germany. Most of the East European immigrants moved to the western part of Germany, where additional 1.5 mio East Germans arrived. Ignoring guest workers and refugees, which may be viewed as temporary phenomena, more than 5% of the West German population is foreign born and migrated during the last 15 years. Not very surprising, this immigration process is accompanied by a heated political discussion.

In this paper, the assimilation hypothesis proposed by *Chiswick (1978)* is tested for these East European immigrants. Following *Chiswick*, foreign borns have lower wages than inhabitants immediately after immigration, but catch up in subsequent periods. The political importance of this question is evident: If the assimilation hypothesis is true and immigrants show an outperforming labor market success, their high productivity should substantially contribute to enhanced growth in the host country. Durable low wages are more difficult to interpret, however: On the one side, low earnings could be the result of discrimination against inhabitants, which raises important political and economic questions. On the other hand, this outcome could indicate a permanent productivity gap relative to natives, implying a long-term burden for the public welfare system.

Existing empirical work on the assimilation feature has concentrated on the US (for an overview see *Borjas, 1994, Chiswick, 1994*). For Germany, there exist some work for guest workers (e.g. *Licht and Steiner, 1993, Dustmannn, 1993, 1996, Pischke, 1993*), whereas the large immigrant flows from Eastern Europe are hardly analyzed (for some newer contributions see *Bauer and Zimmermann, 1995, Schulz and Seiring, 1994*). The reason for this deficit are insufficiencies in the database, which could be overcome with the latest supplement of the Socio-Economic Panel (see *Schupp and Wagner, 1995,* for a description). For 1994, this supplement consists of about 250 households, which immigrated from Eastern Europe (incl. East Germany) and show a German extraction.

To enhance the quality of the earnings estimates, not a classical „average" function, but a frontier technique is used. The estimation of frontier income functions is based on models which were originally introduced for production technologies (*Farell, 1957*). In

that framework, firms are allowed to produce inefficient. This means that not the maximum possible output is produced with a given set of inputs, but a lower volume - with varying degrees of inefficiencies between firms (*Fried et al., 1993*, give a survey about estimation methods). Imperfect markets allow for the permanent existence of such deviations from the frontier function. Transferred to the labor market, individual-specific information deficiencies, immobility or discrimination could prevent workers from realizing maximum possible earnings. Analogous to a production frontier, the earning frontier gives the highest potential income associated with varying amounts of human capital inputs.

The estimation of production or cost frontiers 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, Robinson and Wunnava, 1989, 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 and test this hypothesis for the US immigration market.

The following section contains the stochastic specification of the employed earning frontiers and the estimation methods. In section III the dataset is described. Furthermore, separate frontier earnings estimates for East European immigrants and inhabitants are presented. From these estimates, conclusions on the assimilation hypothesis can be drawn. Section IV analyzes deviations from the frontier in more detail, especially by comparing income efficiency from inhabitants and foreigners. The relationship between individual degrees of earning efficiency and some hypothetical sources like marital status or firm size is presented, too. Finally, section V sums up.

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 earnings of individual i, X is a vector of socio-economic characteristics, α and β are fixed but 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 age, schooling, training, work experience and times of

unemployment. As better the endowment with human capital, as higher the productivity and therefore the market wage.

The income equation (1) is estimated separately for immigrants and inhabitants in Germany. To test the assimilation hypothesis proposed by *Chiswick (1978)*, earnings of immigrants are allowed to be additionally influenced by the term „years since migrations". The assimilation theory is supported if the empirical results show higher starting wages for natives, but a positive coefficient for the migration variable. This is due to the assumption that migration depresses the worth of human capital, which is compensated during the next years by factors like continuous training or increasing language skills, however. After a certain time and because of a high motivation, immigrants may even overtake earning levels of inhabitants. Therefore one has to compare the wage function of inhabitants with that of immigrants at different levels of „years since migration".

In this paper special interest is taken on the specification of the error term ε. The idea is to estimate a „frontier earnings function" for inhabitants as well as for foreigners, which gives the maximum earning one can receive with his given bundle of socio-economic characteristics. For this purpose, frontier estimation techniques, which can be divided into Data Envelopment Analysis (DEA) and econometric approaches, have to be used. Because of the parametric structure of the earnings function (1), the econometric frontier approach is appropriate for the estimation process. Econometric techniques can again be subdivided into deterministic and stochastic procedures, with the latter being used in this study because of its higher flexibility and the diminished outliers problem (for an overview see *Greene, 1993*).

The stochastic frontier approach can be characterized by an error term ε, which consists from two parts: $\varepsilon_i = \upsilon_i - u_i$. Standard random error υ_i is represented by $\upsilon_i \sim N(0, \sigma_\upsilon^2)$, whereas u_i reflects labor market inefficiency of an specific person *i*. This second part u_i is restricted to be non-negative, because otherwise one would be allowed to earn more than his potential (maximum) earning. 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 individuals can earn less because of information deficiencies, immobility and so on ($u_i \geq 0$), 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. Two of the most popular assumptions are the half normal distribution and the exponential distribution of u_i, introduced by *Aigner et*

$$EFF_i = \frac{\exp(\alpha + \beta' X_i - u_i)}{\exp(\alpha + \beta' X_i)} = \exp(-u_i) \qquad (6)$$

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.

The knowledge of individual values EFF_i raises the question for the sources behind these different levels in earnings efficiency. Therefore in a second step a simple regression was run, explaining EFF_i by some individual and market specific factors: [2]

$$EFF_i = \delta_0 + \delta_1 * MARRIAGE + \delta_2 * CHILD + \delta_3 * SMALL + \delta_4 * MEDIUM + \varepsilon_i^1 \qquad (7)$$

MARRIAGE gives the marital status, *CHILD* the number of children living in the household of individual *i*. To be married and educating children are important determinants of immobility, therefore the influence of these factors is expected to be negative. The dummy variables *SMALL* and *MEDIUM* take the value one if the firm, where worker *i* is employed, has less than 20 respectively between 20 and 2000 employees. Large firms with more than 2000 employees are the reference scenario. If unions are more powerful in big firms, δ_3 and δ_4 should have a negative sign. ε_i^1 represents a regular error term. Again, the estimation of (7) was run separately for inhabitants and immigrants.

Earnings Estimates and Assimilation

This paper strongly profited from the latest supplement to the German „socio-economic panel" (GSOEP), where a random sample of immigrants was interviewed. The bulk of this immigration sample consists of East Germans and East Europeans with a German extraction, who migrated to Western Germany since 1984. In contrast to guest workers, these persons can be considered as permanent immigrants without a return motivation. There are three arguments for this assumption:

- Economic, social and political conditions in many East European countries are not attractive for the German minority. This is especially true for Russia, which is the most important source of East European immigrants.

---

2 Alternatively one could specify a model where the level of inefficiency and some potential determinants of this inefficiency are entering the estimation process jointly *(Reifschneider and Stevenson, 1991)*.

Table 1:

Description of the dataset

Variable	Definition	Mean Value	
		Inhabitants	Immigrants
EARNING	gross DM-income from wages/salaries divided by hours of work	28.92	20.88
AGE	age of person in years	41.50	39.43
SCHOOL	years of schooling	10.67	9.91
TRAINING	equals 1 if employee received occupational training or university degree; 0 otherwise	0.94	0.85
EXPERIENCE	actual full-time work experience in years (without time of apprenticeships)	19.99	16.67
JOBLESS	time of unemployment in years	0.55	0.59
IMMIGRATION	years since immigration to West-Germany	–	4.85
MARRIED	equals 1 if married; 0 otherwise	0.82	0.93
CHILD	number of children living in household	0.80	0.45
SMALL	equals 1 if firm has less than 20 employees, 0 otherwise	0.16	0.27
MEDIUM	equals 1 if firm has more than 20 and less than 2000 employees, 0 otherwise	0.47	0.58
	Number of observations	1099	182

Male employees only; all data for 1994.
Source: German SOEP; own calculations.

- For East Germans, there may exist a return motive if economic conditions catch up with West Germany. The assimilation process should not be influenced, however, because country specific labor market conditions in the unified Germany will have disappeared at this time.

- From a formal point of view, the German extraction ensures the right for a German passport and permanent stay. No further residence permit is needed.

To test the assimilation hypothesis, the immigrant sample was compared to a sample of West-German inhabitants. To reduce distortions from self-selection, extreme outliers or measurement errors, the research population was confined to a subsample of males between 18 and 65 years of age. Furthermore, all self-employed or persons with missing information were excluded. In *Table 1* the variables and the datasets are described,

clearly showing a considerable higher income of inhabitants in comparison to immigrants.

To analyze this earning structure in more detail, income functions are separately estimated for both research populations (likelihood functions (2) and (3)). The wage function (1) was specified as

$$\ln E_i = \alpha + \beta_1 * AGE + \beta_2 * SCHOOL + \beta_3 * TRAINING + \beta_4 * EXPERIENCE + \beta_5 * EXPERIENCE^2 + \beta_6 * JOBLESS + \beta_7 * IMMIGRATION + \varepsilon_i \quad (8)$$

with $\beta_7 = 0$ for inhabitants.[3] This functional form allows for concavity in the experience variable. No regressors like firm size, marital status and so on were added, because these factors aren't considered as components of the human capital stock. However, as equation (7) shows, these variables are allowed to influence the wedge between potential and actual earnings.

The results of the Maximum-Likelihood estimation and - for comparison - of the standard OLS-method are presented in *Table A- 2* in the Appendix. The iteration process turned out to be stable and converging. Most of the estimated parameters are statistically significant; exceptions are the training-variable for natives and the squared experience term as well as the jobless parameter for immigrants. Likelihood-ratio tests clearly reject the hypothesis that only random error exists ($\lambda = 0$ for the half-normal assumption; $\theta = 0$ for the exponential case). The advantage of the frontier approach is evident since the stochastic frontier approach reduces the residual variance σ_v^2 by about 50% (natives) respectively 60-70% (immigrants).

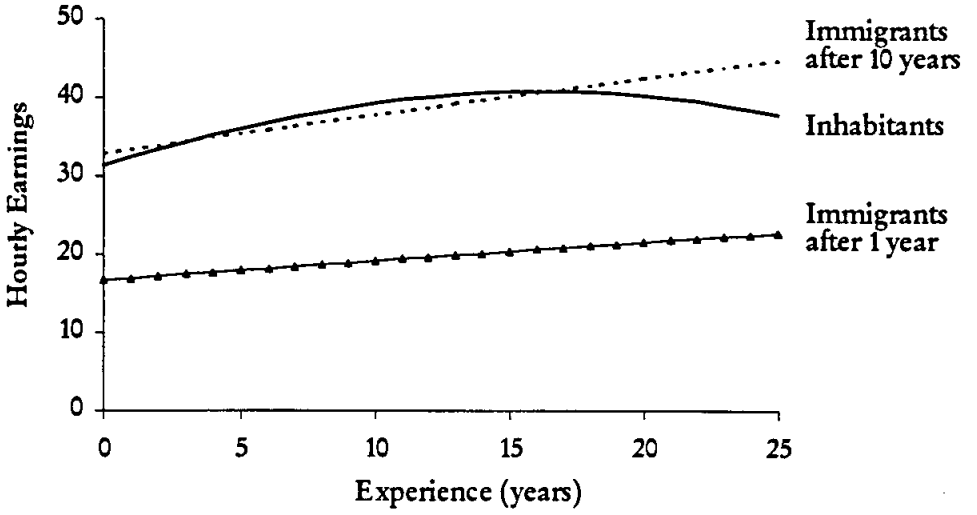
Although all parameter signs are independent from the estimation method, remarkable differences between parameter values appear. These discrepancies are relative small between the half-normal and the exponential distribution, whereas the differences between the frontier and OLS model are more important. One additional year of schooling, for example, increases immigrant wages by 1.7% in the OLS case, but by more than 2.8% with the half-normal frontier estimation. Similarly, return on training decreases from 25% (OLS) to 16% with an exponential distributed inefficiency term.

---

3 To control for differences between East Germans and Eastern Europeans, additional estimations were run including a Dummy for East Germans. Neither for the earnings function (8) nor for the efficiency equation (7) could be found any significant influence. Furthermore, the parameter values turned out to be very stable against this modification.

Figure 1:

Frontier Earning Functions of Inhabitants and Foreigners



Simulation based on human capital stock of a typical inhabitant (41.5 years old, 10.7 years of schooling, 0.94 received training, 0.55 years of unemployment).

However, with the main focus of this paper, differences between inhabitants and immigrants are of greater interest. As the parameter estimates show, return on schooling is greater for inhabitants (6.7% versus 2.8%), whereas training has a stronger effect for migrants (less than 6% versus more than 16%). The *AGE* variable even turns the sign from significantly positive for West-Germans to significantly negative for East Europeans. In the human-capital context, the negative sign is more in line with expectations, because older people are more likely to be ill and have less physical strength. The wage-increasing effect of getting older - accumulating job experience - is explicitly considered by the experience variable. Finally, the income of natives depends more heavily on individual skills than this could be observed for immigrants, as the constant term is higher for the second group.

Most important, however, the results strongly support the assimilation hypothesis in the sense of *Chiswick (1978).* This implication can be illustrated by *Figure 1*, where frontier earnings of a „typical" native employee is plotted against frontier earnings of immigrants. Equipped with an identical human capital stock as the native colleague, the immigrant has a potential income of about 60% relative to the inhabitant and immediately after arrival. The earnings profile turns out to be much steeper in the subsequent years, however: Ten years after arrival, the differences between natives and former East Europeans have disappeared. Former East Europeans have perfectly assimilated within a relatively short time period, at least in terms of income. If immigrants would even

overtake nationals after this period is unclear, because the sample only covers individuals who crossed the border after 1984. An extrapolation beyond this time horizon would therefore be speculative.

Earning Efficiency

Given the parameter estimates in *Table A- 2*, the underlying distribution of earnings inefficiency can be determined. For example, the density function of u in the half-normal case[4] can be expressed as

$$d(u) = \begin{cases} \frac{\sqrt{2}}{\sqrt{\pi}\sigma_u} \exp\left[-0.5\left(\frac{u}{\sigma_u}\right)^2\right] & \text{if } u \geq 0 \\ 0 & \text{else} \end{cases} \tag{9}$$

As can be seen from *Figure 2*, where the half-normal case is illustrated, the estimated differences between natives and foreigners are small[5]. Given the distribution in (9), the mean value of u is $\sigma_u\sqrt{2/\pi}$, which produces 0.280 for inhabitants and 0.319 for immigrants. Transformed to efficiency values EFF_i, the results are 75.6% versus 72.7%. This implies that immigrants are somewhat more inefficient in transforming human capital to market income, but the discrepancy turns out to be of minor interest.

From the earnings frontier estimates, individual values ε_i and u_i can also be determined for all natives and immigrants within the research population (equations (4) respectively (5)). *Table A- 1* in the appendix provides the distribution of the expected efficiency values, confirming the above mentioned results. A slightly more heterogeneous appearance of immigrants notwithstanding, the distances between estimated and potential income are very similar for both groups. Average *XEFF* values are close to the forecast from the distribution function. The ranking coefficient between the exponential and the half-normal model is at 0.99, supporting the reliability of the results. Actually, the major difference is the trivial more pessimistic assessment of the half-normal model.

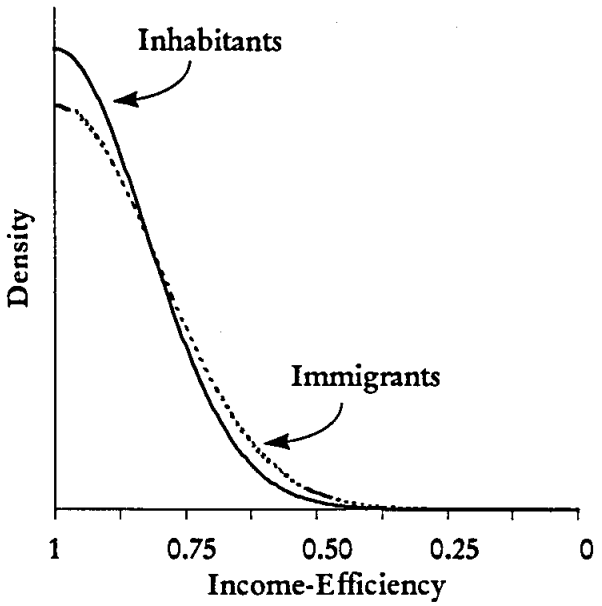
---

4 For the exponential assumption, the distribution is $\theta\exp[-\theta u]$, $u \geq 0$.

5 A very similar picture arrives for the exponential case.

Figure 2:

Estimated Distribution of Income Efficiency for Half-Normal Assumption



Income efficiency calculated as exp(-*u*).

In a second step, the relationship between wage inefficiency and its potential sources is estimated (equation (7)). *Table 2* shows the regression results for both groups and the half-normal as well as the exponential distribution. As can be seen, to be employed at small firms with less than 20 employees significantly increases the wedge between potential and realized earning. In that case, the EFF_i value is estimated to decrease by about 8% (natives) respectively 9%-11% (immigrants). This general picture is in line with other studies[6] and may be due to a smaller influence of unions, for example. Interestingly, the wedge between medium sized (20-2000 employees) and large firms (>2000 employees) is at just 2% and significant only for the native group.

Some open questions remain with regard to the marital status and the number of children: To be married should have a negative effect on mobility and therefore income efficiency, but this expectation doesn't find empirical support. Indeed, native married males can even approach their individual frontier by about 4%. The parameter for immigrants is insignificant, but positive, too. The existence of children in one's household

6 For example, *Althammer and Wenzler (1996)* and *Bauer and Zimmermann (1995)* also show a positive influence of firm size on earnings. 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 earning. Only direct human capital measures are entering the earning equation (8).

also should decrease mobility and drive a wedge between potential and realized income, but this could be observed only for the immigrant population.

Table 2:

Explanation of Earnings Efficiency

	Inhabitants		Immigrants	
	Half-Normal	Exponential	Half-Normal	Exponential
CONST	0.759***	0.803***	0.768***	0.838***
MARRIED	0.032***	0.049***	0.044	0.032
CHILD	0.005*	0.004	-0.051***	-0.046***
SMALL	-0.077***	-0.076***	-0.105***	-0.092***
MEDIUM	-0.019***	-0.016**	-0.022	-0.019
R^2	0.089	0.112	0.175	0.168

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

Finally, it should be noted that equation (7) can explain only a small part of the earnings efficiency differences. The determination coefficient takes values of about 10% for West-Germans respectively 15% for East Germans, which leaves a lot of room for further speculation about the reasons for diverging levels of income efficiency.

Conclusions

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. These new immigrants are Germans from former East Germany or the descendants of German settlers in Romania and Russia. Not surprising, these huge immigration waves were accompanied by a political debate over the quantity and types of migrants, which can be adopted.

This paper is following recent research in population economics, assessing the labor market performance of these immigrants. On the basis of a stochastic earnings frontier, income profiles of East Europeans migrants are compared with those of inhabitants. The estimation of earnings frontiers allows for quantifying the maximal income which can be earned with a given level of human capital. Furthermore, individual differences between potential and actual income are estimated and put into relationship to some hypothetical factors of influence.

One of the most important results of this study is the empirical support for the assimilation process. East Europeans with German extraction, who count for a large part of the newly immigrated persons, show a significantly steeper earnings profile than natives. Starting with considerably lower wages immediately after arrival, only ten years later immigrants have adjusted to natives. Notice, however, that there are substantial differences in the parameters of the potential earning function: For example, return on schooling is greater for inhabitants, whereas apprenticeships or university degrees turned out to be more positive for migrants.

The observed evidence in favor of the assimilation hypothesis is in sharp contrast to the group of guest workers (Turks, Yugoslavs, Italians, ...). For these persons, who typically live in Germany for 25 or more years, no assimilation process could be observed (*Licht and Steiner, 1993, Pischke, 1993*). Of course, further research is necessary to confirm these differences, but obviously an immigration policy which is in favor of cultural neighbors should be preferred.

With regard to the wedge between potential and actual income, the stochastic frontier estimations are in line with other studies analyzing labor markets (see e.g. *Daneshvary et al., 1992, Hunt-McCool, 1993*). On an average about 75%-80% of the potential income can be realized as market earning. The difference between natives and East Europeans amounts to 2%, which seems insignificant. This last result is even more surprising than the rapid assimilation process, because newly arrived job searchers should have less information about the host countries labor market than natives.

As for the explaining factors of this wedge between potential and actual wage, to be employed at a small firm is clearly negative for workers. The market power of small firms seems sufficient to pay their employees beyond the value of their human capital endowment and therefore below their productivity. Somewhat surprising is the efficiency-increasing influence from the marital status, where married persons approach further to their earnings frontier than non-married. The opposite sign was expected because of a diminished mobility. Children living in one's household lowers income efficiency only for immigrants. In general, only a small part of earning inefficiency can be explained, leaving room for further speculation.

Summing up, the positive labor market performance of immigrants from Eastern Europe is providing support for further reception of these types of migrants. They could substantially contribute to higher growth rates and help stabilizing the welfare system. The cultural and ethnic similarity to native Germans are further reasons towards a corresponding immigration policy. Some doubts remain, however, if the success of the for-

mer immigrants 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 don't 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 be aware of this problem and look for appropriate solutions.

References

Aigner, D., Lovell, C., Schmidt, P. (1977), Formulation and Estimation of Stochastic Frontier Production Models, Journal of Econometrics 6, pp. 21-37.

Althammer, J., Wenzler, S. (1996), Intrafamiliale Zeitallokation, Haushaltsproduktion und Frauenerwerbstätigkeit. Ein mikroökonometrisches Modell zur empirischen Bestimmung des wirtschaftlichen Werts der Hausarbeit, in: Jahrbücher für Nationalökonomie und Statistik 215, pp. 398-418.

Bauer, T., Zimmermann, K.F. (1995), Arbeitslosigkeit und Löhne von Aus- und Übersiedlern, in: *Steiner, V., Bellmann, L. (eds.),* Mikroökonomik des Arbeitsmarktes, Beiträge zur Arbeitsmarkt- und Berufsforschung 192, Nürnberg.

Berger, A.N., Humphrey, D.B. (1997), Efficiency of Financial Institutions: International Survey and Directions for Future Research, European Journal Operational Research, forthcoming.

Borjas, G.J. (1985), Assimilation, Changes in Cohort Quality, and the Earnings of Immigrants, Journal of Labor Economics 4, pp. 463-489.

Borjas, G.J. (1994), The Economics of Immigration, Journal of Economic Literature 32, pp. 1667-1717.

Chiswick, B.R. (1978), Americanization and the Earnings of foreign-born Men, Journal of Political Economy 86, pp. 897-921.

Chiswick, B.R. (1994), The Performance of Immigrants in the United States Labor Market, in: *Giersch, H. (ed.),* Economic Aspects of International Migration, pp. 95-114, Berlin: Springer.

Daneshvary, N., Herzog, H.W. jr., Hofler, R.A., Schlottmann, A.M. (1992), Job Search and Immigrant Assimilation: An Earnings Frontier Approach, Review of Economics and Statistics 74, pp. 482-492.

Dustmann,C. (1993), Earnings Adjustment of Temporary Migrants, Journal of Population Economics 7, pp. 153-168.

Dustmann, C. (1996), The Social Assimilation of Immigrants, Journal of Population Economics 9, pp. 37-54.

Farrell, M.J. (1957), The Measurement of Productive Efficiency, Journal of the Royal Statistical Society, A120, pp. 253-281.

Fried, H.O., Lovell, C.A.K., Schmidt, S.S. (1993), The Measurement of Productive Efficiency: Techniques and Applications, Oxford: Oxford University Press.

Greene, W.H. (1990), A Gamma-Distributed Stochastic Frontier Model, Journal of Econometrics 46, pp. 141-163.

Greene, W.H. (1993), The Econometric Approach to Efficiency Analysis, in: *Fried, H.O. et al. (eds.),* The Measurement of Productive Efficiency: Techniques and Applications, pp. 68-119, Oxford: Oxford University Press.

Herzog, H.W. jr., Hofler, R.A., Schlottmann, A.M. (1985), Life on the Frontier: Migrant Information, Earnings and Past Mobility, Review of Economics and Statistics 67, pp. 373-382.

Hofler, R.A., Polachek, S. (1985), A New Approach for Measuring Wage Ignorance in the Labor Market, Journal of Economics and Business 37, pp. 267-276.

Hunt-McCool, J.C., Warren, R.S. jr. (1993), Earnings Frontiers and Labor Market Efficiency, in: *Fried, H.O. (ed.),* The Measurement of Productive Efficiency: Techniques and Applications, Oxford: Oxford University Press, pp. 197-209.

Jondrow, J., Lovell, C.A.K., Materov, I.S., Schmidt, P. (1982), On the Estimation of Technical Inefficiency in the Stochastic Frontier Production Function Model, Journal of Econometrics 19, pp. 233-238.

Licht, G., Steiner, V. (1993), Assimilation, Labour Market Experience, and Earnings Profiles of Temporary and Permanent Immigrant Workers in Germany, mimeo ZEW Mannheim.

Mincer, J. (1974), Schooling, Experience and Earnings, New York: Columbia University Press.

Pischke, J.-S. (1993), Assimilation and the Earnings of Guestworkers in Germany, mimeo Massachusetts Institute of Technology.

Reifschneider, D., Stevenson, R. (1991), Systematic Departures from the Frontier: A Framework for Analysis of Farm Inefficiency, International Economic Review 32, pp. 715-723.

Robinson, M.D., Wunnava, P.V. (1989), Measuring Direct Discrimination in Labor Markets Using a Frontier Approach: Evidence from CPS Female Earnings Data, Southern Economic Journal 56, pp. 212-218.

Schulz,, E., Seiring, K. (1994), Integration deutscher Zuwanderer in den westdeutschen Arbeitsmarkt, DIW Wochenbericht 35, pp. 609-617.

Schupp, J., Wagner, G. (1995), Die Zuwanderer-Stichprobe des Sozio-ökonomischen Panels (SOEP), DIW Vierteljahreshefte zur Wirtschaftsforschung 64, pp. 16-25.

Appendix

Table A- 1

Distribution of Earnings Efficiency

	Inhabitants		Immigrants	
	Half-Normal	**Exponential**	**Half-Normal**	**Exponential**
< 0.50	3.0%	2.7%	6.6%	4.4%
0.50 - 0.60	4.3%	2.1%	8.8%	2.8%
0.60 - 0.70	13.1%	4.5%	14.3%	8.2%
0.70 - 0.80	36.5%	15.6%	26.9%	14.8%
0.80 - 0.90	37.9%	54.9%	33.5%	47.8%
0.90 - 1	5.3%	20.2%	9.9%	22.0%
Average Efficiency	0.768	0.826	0.744	0.812

Earnings Efficiency estimated as $EFF_i = \exp(-u_i)$

Table A- 2

Estimation Results

	Inhabitants			Immigrants		
	OLS	**ML - Half Normal**	**ML - Exponential**	**OLS**	**ML - Half Normal**	**ML - Exponential**
CONST	1.379	1.708	1.697	2.453	2.734	2.680
	(16.524)	(20.740)	(21.564)	(12.08)	(15.275)	(15.353)
AGE	0.025	0.025	0.024	-0.010	-0.011	-0.011
	(8.815)	(8.475)	(8.169)	(-1.845)	(-2.159)	(-2.181)
SCHOOL	0.062	0.065	0.065	0.017	0.028	0.025
	(9.212)	(9.713)	(10.152)	(1.172)	(2.115)	(1.967)
TRAINING	0.050	0.048	0.055	0.225	0.174	0.155
	(1.281)	(1.288)	(1.527)	(3.517)	(3.183)	(2.742)
EXPERIENCE	0.039	0.032	0.028	0.016	0.015	0.016
	(9.309)	(7.489)	(6.583)	(2.071)	(2.181)	(2.403)
EXPERIENCE^2	-0.113	-0.098	-0.088	-0.013	-0.009	-0.012
$*10^2$	(-16.450)	(-14.204)	(-12.900)	(-0.681)	(-0.557)	(-0.732)
JOBLESS	-0.041	-0.040	-0.039	-0.006	-0.006	-0.004
	(-6.452)	(-6.635)	(-6.635)	(0.276)	(-0.312)	(-0.193)
IMMIGRATION	-	-	-	0.073	0.075	0.073
				(4.592)	(5.635)	(5.464)
R^2	0.449			0.221		
σ_v^2	0.089	''.044	0.046	0.084	0.023	0.033
		(9.463)	(12.868)		(2.839)	(4.214)
λ		2.799			6.936	
		(4.723)			(1.908)	
θ			4.940			4.484
			(15.139)			(6.702)
observations	1099	1099	1099	182	182	182

Dependent variable is ln of hourly (gross) earnings. t-ratios in parentheses.

Beiträge in der Volkswirtschaftlichen Diskussionsreihe seit 1993

Im Jahr 1993 erschienen:

Beitrag Nr. 83:	Manfred Stadler	Innovation, Growth, and Unemployment. A Dynamic Model of Creative Destruction
Beitrag Nr. 84:	Alfred Greiner Horst Hanusch	Cyclic Product Innovation or: A Simple Model of the Product Life Cycle
Beitrag Nr. 85:	Peter Welzel	Zur zeitlichen Kausalität von öffentlichen Einnahmen und Ausgaben. Empirische Ergebnisse für Bund, Länder und Gemeinden in der Bundesrepublik Deutschland
Beitrag Nr. 86:	Gebhard Flaig Manfred Stadler	Dynamische Spillovers und Heterogenität im Innovationsprozeß. Eine mikroökonometrische Analyse
Beitrag Nr. 87:	Manfred Stadler	Die Modellierung des Innovationsprozesses. Ein integrativer Mikro-Makro-Ansatz
Beitrag Nr. 88:	Christian Boucke Uwe Cantner Horst Hanusch	Networks as a Technology Policy Device - The Case of the "Wissenschaftsstadt Ulm"
Beitrag Nr. 89:	Alfred Greiner Friedrich Kugler	A Note on Competition Among Techniques in the Presence of Increasing Returns to Scale
Beitrag Nr. 90:	Fritz Rahmeyer	Konzepte privater und staatlicher Innovationsförderung
Beitrag Nr. 91:	Peter Welzel	Causality and Sustainability of Federal Fiscal Policy in the United States
Beitrag Nr. 92:	Friedrich Kugler Horst Hanusch	Stock Market Dynamics: A Psycho-Economic Approach to Speculative Bubbles
Beitrag Nr. 93:	Günter Lang	Neuordnung der energierechtlichen Rahmenbedingungen und Kommunalisierung der Elektrizitätsversorgung
Beitrag Nr. 94:	Alfred Greiner	A Note on the Boundedness of the Variables in Two Sector Models of Optimal Economic Growth with Learning by Doing
Beitrag Nr. 95:	Karl Morasch	Mehr Wettbewerb durch strategische Allianzen?
Beitrag Nr. 96:	Thomas Kuhn	Finanzausgleich im vereinten Deutschland: Desintegration durch regressive Effekte
Beitrag Nr. 97:	Thomas Kuhn	Zentralität und Effizienz der regionalen Güterallokation
Beitrag Nr. 98:	Wolfgang Becker	Universitärer Wissenstransfer und seine Bedeutung als regionaler Wirtschafts- bzw. Standortfaktor am Beispiel der Universität Augsburg
Beitrag Nr. 99:	Ekkehard von Knorring	Das Umweltproblem als externer Effekt? Kritische Fragen zu einem Paradigma -
Beitrag Nr. 100:	Ekkehard von Knorring	Systemanalytischer Traktat zur Umweltproblematik

Beitrag Nr. 101:	Gebhard Flaig Manfred Stadler	On the Dynamics of Product and Process Innovations A Bivariate Random Effects Probit Model
Beitrag Nr. 102:	Gebhard Flaig Horst Rottmann	Dynamische Interaktionen zwischen Innovationsplanung und -realisation
Beitrag Nr. 103:	Thomas Kuhn Andrea Maurer	Ökonomische Theorie der Zeit
Beitrag Nr. 104:	Alfred Greiner Horst Hanusch	Schumpeter´s Circular Flow, Learning by Doing and Cyclical Growth
Beitrag Nr. 105:	Uwe Cantner Thomas Kuhn	A Note on Technical Progress in Regulated Firms
Beitrag Nr. 106:	Jean Bernard Uwe Cantner Georg Westermann	Technological Leadership and Variety A Data Envelopment Analysis for the French Machinery Industry
Beitrag Nr. 107:	Horst Hanusch Marcus Ruf	Technologische Förderung durch Staatsaufträge Das Beispiel Informationstechnik

Im Jahr 1994 erschienen:

Beitrag Nr. 108:	Manfred Stadler	Geographical Spillovers and Regional Quality Ladders
Beitrag Nr. 109:	Günter Lang Peter Welzel	Skalenerträge und Verbundvorteile im Bankensektor. Empirische Bestimmung für die bayerischen Genossenschaftsbanken
Beitrag Nr. 110:	Peter Welzel	Strategic Trade Policy with Internationally Owned Firms
Beitrag Nr. 111:	Wolfgang Becker	Lebensstilbezogene Wohnungspolitik - Milieuschutzsatzungen zur Sicherung preiswerten Wohnraumes
Beitrag Nr. 112:	Alfred Greiner Horst Hanusch	Endogenous Grwoth Cycles - Arrow´s Learning by Doing
Beitrag Nr. 113:	Hans Jürgen Ramser Manfred Stadler	Kreditmärkte und Innovationsaktivität
Beitrag Nr. 114:	Uwe Cantner Horst Hanusch Georg Westermann	Die DEA-Effizienz öffentlicher Stromversorger Ein Beitrag zur Deregulierungsdiskussion
Beitrag Nr. 115:	Uwe Canter Thomas Kuhn	Optimal Regulation of Technical Progress In Natural Monopolies with Inclomplete Information
Beitrag Nr. 116:	Horst Rottman	Neo-Schumpeter-Hypothesen und Spillovers im Innovationsprozeß - Eine empirische Untersuchung
Beitrag Nr. 117:	Günter Lang Peter Welzel	Efficiency and Technical Progress in Banking. Empirical Results for a Panel of German Co-operative Banks
Beitrag Nr. 118:	Günter Lang Peter Welzel	Strukturschwäche oder X-Ineffizienz? Cost-Frontier-Analyse der bayerischen Genossenschaftsbanken
Beitrag Nr. 119:	Friedrich Kugler Horst Hanusch	Preisbildung und interaktive Erwartungsaggeration
Beitrag Nr. 120:	Uwe Cantner Horst Hanusch Georg Westermann	Detecting Technological Performances and Variety An Empirical Approach to Technological Efficiency and Dynamics

Beitrag Nr. 121:	Jean Bernard Uwe Cantner Horst Hanusch Georg Westermann	Technology and Efficiency Patterns A Comparative Study on Selected Sectors from the French and German Industry

Im Jahr 1995 erschienen:

Beitrag Nr. 122:	Gebhard Flaig	Die Modellierung des Einkommens- und Zinsrisikos in der Konsumfunktion: Ein empirischer Test verschiedener ARCH-M-Modelle
Beitrag Nr. 123:	Jörg Althammer Simone Wenzler	Intrafamiliale Zeitallokation, Haushaltsproduktion und Frauenerwerbstätigkeit
Beitrag Nr. 124:	Günter Lang	Price-Cap-Regulierung Ein Fortschritt in der Tarifpolitik?
Beitrag Nr. 125:	Manfred Stadler	Spieltheoretische Konzepte in der Markt- und Preistheorie Fortschritt oder Irrweg?
Beitrag Nr. 126:	Horst Hanusch	Die neue Qualität wirtschaftlichen Wachstums
Beitrag Nr. 127:	Wolfgang Becker	Zur Methodik der Wirkungsanalyse von Maßnahmen der Verkehrsaufklärung
Beitrag Nr. 128:	Ekkehard von Knorring	Quantifizierung des Umweltproblems durch Monetarisierung?
Beitrag Nr. 129:	Axel Olaf Kern	Die "optimale" Unternehmensgröße in der deutschen privaten Krankenversicherung - eine empirische Untersuchung mit Hilfe der "Survivor-Analyse"
Beitrag Nr. 130:	Günter Lang Peter Welzel	Technology and Efficiency in Banking. A "Thick Frontier"-Analysis of the German Banking Industry
Beitrag Nr. 131:	Tina Emslander Karl Morasch	Verpackungsverordnung und Duales Entsorgungssystem Eine spieltheoretische Analyse
Beitrag Nr. 132:	Karl Morasch	Endogenous Formation of Strategic Alliances in Oligopolistic Markets
Beitrag Nr. 133:	Uwe Cantner Andreas Pyka	Absorptive Fähigkeiten und technologische Spillovers - Eine evolutionstheoretische Simulationsanalyse
Beitrag Nr. 134:	Ekkehard von Knorring	Forstwirtschaft und externe Effekte - Krisenmanagement durch Internalisierung? -
Beitrag Nr. 135:	Friedrich Kugler Horst Hanusch	Wie werden Einzel- zu Kollektiventscheidungen? Zur Aggregrationsproblematik beim Übergang von der Mikro- zur Makroebene aus volkswirtschaftlicher Sicht
Beitrag Nr. 136:	Peter Welzel	Quadratic Objective Functions from Ordinal Data. Towards More Reliable Representations of Policy-makers´ Prefrerences
Beitrag Nr. 137:	Uwe Cantner Andreas Pyka	Technologieevolution Eine Mikro-Makro-Analyse
Beitrag Nr. 138:	Friedrich Kugler Horst Hanusch	Mikroökonomische Fundierung eines konnektionistischen Portfoliomodells
Beitrag Nr. 139:	Jürgen Peters	Inter-Industry R&D-Spillovers between Vertically Related Industries: Incentives, Strategic Aspects and Consequences
Beitrag Nr. 140:	Alfred Greiner Willi Semmler	Multiple Steady States, Indeterminancy and Cycles in a Basic Model of Endogenous Growth

Beitrag Nr. 141:	Uwe Cantner Andreas Pyka	Absorptive Capacities and Technological Spillovers II Simulations in an Evolutionary Framework
Beitrag Nr. 142:	Uwe Cantner Georg Westermann	Localized Technological Progress and Industry Structure An Empirical Approach
Beitrag Nr. 143:	Uwe Cantner	Technological Dynamics in Asymmetric Industries R&D, Spillovers and Absorptive Capacity
Beitrag Nr. 144	Wolfgang Becker Jürgen Peters	R&D-Competition between Vertical Corporate Networks: Structure, Efficiency and R&D-Spillovers

Bisher im Jahr 1996 erschienen:

Beitrag Nr. 145	Günter Lang	Efficiency, Profitability and Competition. Empirical Analysis for a Panel of German Universal Banks
Beitrag Nr. 146	Fritz Rahmeyer	Technischer Wandel. Gradualismus oder Punktualismus?
Beitrag Nr. 147	Karl Morasch	Strategic Allicances - A Substitute for Strategic Trade Policy?
Beitrag Nr. 148	Uwe Cantner Horst Hanusch Andreas Pyka	Routinized Innovations - Dynamic Capabilities in a Simulation Study
Beitrag Nr. 149	Jörg Althammer Simone Wenzler	Wie familienfreundlich ist die Reform des Kindeslastenausgleichs? Eine wohlfahrtsökonomische Analyse der familienpolitischen Wirkungen des Jahressteuergesetzes 1996
Beitrag Nr. 150	Fritz Rahmeyer	Privatisierung und Deregulierung der Deutschen Bundesbahn
Beitrag Nr. 151	Jürgen Peters	Messung und Bewertung des Innovationsverhaltens im deutschen Automobilzuliefersektor Ergebnisse einer empirischen Untersuchung
Beitrag Nr. 152	Horst Hanusch	Die Europäische Währungsunion - Politische Vision und wirtschaftliche Realität -
Beitrag Nr. 153	Andreas Pyka	Informal Networking
Beitrag Nr. 154	Günter Lang	Wettbewerbsverhalten deutscher Banken Eine Panelanalyse auf Basis der Rosse-Panzar Statistik
Beitrag Nr. 155	Friedrich Kugler Jörg Sommer Horst Hanusch	Capital Markets from an Evolutionary Perspective: The State Preference Model Reconsidered