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**Working Paper**

## Training in East Germany: An evaluation of the effects on employment and wages

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Universität Konstanz

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Abstract

Support of training has been one of the most important instruments of active labor market policy in East Germany. This paper attempts an evaluation of the effects of training on future employment and future wages of trainees. The analysis distinguishes between measures within and outside of the firm of the employee and whether the trainee receives public income maintenance. After describing the labor market developments in East Germany, we illustrate the evaluation problem. Then, we estimate a simultaneous model for participation in training, employment, and wages. Taking account of selection effects before participation, our findings mostly suggest positive effects of training on employment or wages. In this respect, public income support is only successful when training takes place in external institutions but not in the firm where the person is employed.

Keywords : East Germany, evaluation of training, employment probability, wage, selection bias, labor market policy

JEL-Classification : J20, J60, C33

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# 1 Introduction

Since unification in October 1990, the East German labor market has undergone fundamental changes. Unemployment occurred for the first time in 40 years and the structure of the active labor market population has changed considerably. On the one hand, this development induced large financial transfers from West to East Germany, partly through labor market policies. On the other hand, labor market policies themselves promoted structural changes in the East German labor market. One of the main instruments of labor market policy in East Germany was the implementation of qualification (training) programs. In the first year after unification, these programs were considered necessary to adjust the qualifcational structure of the East German labor force to the requirements of a western style economy. A great variety of different institutions and programs for publicly supported occupational training were created, partly by means of new regulations in the work support act ("Arbeitsförderungsgesetz") which were specifically designed for East Germany. In the meanwhile, the objective of labor market policy has changed and qualification measures in East Germany are apparently considered to be an important tool in fighting unemployment.

Despite the importance of labor market policies in East Germany and the massive financial transfers involved, so far only a small number of studies attempts to evaluate the effects of such programs. With the availability of survey-based data sets like the German Socio-Economic Panel (GSOEP) East or the Labor Market Monitor (LMM) East (the latter is used for this study), a microeconomic evaluation is feasible. A typical evaluation study investigates the impact of participation in training (or other programs) on success criteria at the individual level such as future employment status, future duration of unemployment spells, or future earnings and wages.

A basic problem when evaluating social programs lies in how to handle methodologically the potential selection bias involved, see Björklund (1989) for a survey. Usually, participants in social programs are not a representative subsample. They typically differ from non-participants both in observable (e.g. age) and unobservable (e.g. motivation) characteristics, see Heckman and Hotz (1989). Therefore, the success of a program can neither simply be evaluated by a comparison of the outcome (employment, earnings, etc.) between participants and non-participants nor by a simple comparison of the participant's situation before and after the participation in the program. For a causal evaluation of the program effects, one has to compare the situation of the individual after participation with the situation of the same individual in the hypothetical case of not having participated. The latter is not observable and the basic evaluation problem lies in estimating what would have been the situation in the hypothetical case of not having participated. Such an estimation must be based on information for non-participants and sophisticated methods are needed to find or artificially construct an adequate control (comparison) group. Neglecting selectivity issues (participants can differ from non-participants in many ways) may very well result in incorrect judgements about the effects of the program.

Most of the existing evaluation studies for East Germany investigate the effects of training programs which seems due to the fact, that more data concerning training are available compared to other types of labor market policies. However, a comparison of these studies is difficult since they are based on different data, use different econometric or statistical methods, or study different time periods.

Hübler (1994a) examines the determinants of training and job-search behavior and their effects on working time. He uses the first four waves of the LMM covering the time span from 1990 to 1991. His main findings concerning determinants and effects of training are the following. A higher level of schooling decreases the probability of participation. Distinguishing between measures within and outside of the firm, where the trainee is employed, women compared to men and workers with longer tenure at a firm exhibit a lower probability of participation in qualification measures in the firm. Furthermore, he finds that women seem to reduce their search activity after training. Unfortunately, Hübler only investigates the period of one year and, thus, he cannot discuss further dynamic aspects of the problem. This is also true for the otherwise very comprehensive study of Pannenberg (1995). He uses the GSOEP East from 1990 to 1992 and finds positive effects of training on reemployment prospects and earnings after completion of the program.

In Fitzenberger and Prey (1995), we are concerned with the effects of training on the future employment probability of trainees in East Germany. Based on the first six waves of the LMM from 1990 to 1992, we analyze the effects of two types of training: training within a firm and training in an institution outside of the firm, where the worker is employed. When taking account of selection effects by comparing the labor market history of participants before the program with that of non-participants (preprogram effects), we find that training outside of the firm shows a considerable positive effect on the employment probability during the sample period, whereas training in the firm shows small positive effects in the short run and no positive effects at all in the long run. The report Prey, Fitzenberger, and Franz (1996) provides a survey on labor market policies in Germany. The effects of active labor market policies are illustrated for East Germany and for the state of Sachsen, separately, building on results in Fitzenberger and Prey (1995).

Whereas the studies described so far use an econometric approach in order to resolve the evaluation problem, Eichler and Lechner (1996) and Lechner (1995a, 1996a, 1996b) take a very different route. These studies are based on the GSOEP East for 1990 to 1994 and evaluate the effects of different types of training in East Germany. Lechner provides an excellent treatment of the evaluation problem from the perspective of the statistical analysis of treatment effects and discusses the assumptions involved when attempting causal inference on program effects. For his analysis, he develops a statistical matching algorithm to find the adequate control group for participants in training. He matches participants with non-participants based on observable (exogenous) variables (among them is employment status before program participation) and on the estimated propensity to participate. In Lechner (1995a), he studies the effects of qualification outside of the firm, including both publicly subsidized and privately financed types of off-the job training, and does not

find positive employment or earnings effects. Regarding on-the-job training only, Lechner (1996b) finds no employment effects but large and positive earnings effects. If training is publicly sponsored through the provision of income maintenance during program participation, Lechner (1996a) and Eichler and Lechner (1996) do not find any significant effects in the short run. These results mostly draw a negative picture of the effects of training on individual employment and earnings, which is in sharp contrast to results in Fitzenberger and Prey (1995) and others, as well as to the results presented in this study. Although the GSOEP data contain very detailed information about the labor market history of individuals, the number of trainees is fairly small, especially compared to the numbers available in the LMM. In fact, Lechner's results typically consist of insignificant effects involving fairly large standard error estimates.

This study tries to resolve the aforementioned evaluation problems building on econometric methods. Our analysis is based on the time period between November 1990 to November 1994 using the LMM. The data set contains information on about almost 15,000 individuals who were representative for East Germany's active labor market population in 1990. We evaluate econometrically the effects of qualification measures on future employment and future wages while accounting for selection bias and panel mortality by estimating a dynamic simultaneous random-effects probit and tobit model. Because of the considerable increase of part-time work, especially among women, we decided to choose hourly wages instead of earnings as an outcome of our investigation. In the LMM, information about (regular) working hours is only available on a yearly basis which forced us to restrict the analysis to five waves of the panel survey. Nevertheless, this approach has the advantage, that now the points of time under investigation are equidistant. We disaggregate the qualification measures into measures that take place in the firm where a person is employed and measures in external institutions. Furthermore, we differentiate whether the participant received income maintenance support ("Unterhaltsgeld") by the Federal Labor Office during the program, or not. Our results mostly draw a positive picture of the effects of training. We can confirm and illustrate the results on employment effects in Fitzenberger and Prey (1995) where a more restricted approach was taken.

The remainder of the paper is organized as follows: Section 2 describes main features and developments in the East German labor market since unification with an emphasis on the development and implementation of qualification measures. Section 3 discusses the general evaluation problem with specific reference to descriptive statistics for East Germany from the Labor Market Monitor. Section 4 introduces the econometric approach used for the empirical analysis and presents the estimated model. The estimation results are further illustrated by graphical simulations of the effects of participation in qualification. Section 5 summarizes the main findings of this study and concludes.



## 2 Labor Market Trends in East Germany

This section gives a brief overview about main trends of the East German labor market which has undergone fundamental changes since the breakdown of the former German Democratic Republic. It pays special attention to the implementation of active labor market policies and to the types of training programs that are supported by the BA.

### 2.1 Employment, Wages, and the Labor Force

The situation in the East German labor market right after the breakdown of the GDR was very untypical for western style economies. There did not exist (open) unemployment, jobs were created or maintained by the authorities to meet political goals and not economic considerations, and female labor force participation was very high. In the first year of transition, a large part of the economy was severely hit by the loss of its traditional eastern trading partners, and by the sudden exposure to western competition. Thus, unemployment rose. Labor market participation decreased and migration and commuting to West Germany as well as early retirement schemes ("Altersübergang": AUEG, "Vorruhestand": VRG) reduced the active labor market population. Nevertheless, unemployment increased further. In many firms, workers could be only kept as short-time workers ("Kurzarbeiter"), supported by the Federal Bureau of Labor, the "Bundesanstalt für Arbeit" (BA). To reduce the pressure on the labor market, the BA started large labor market programs and implemented various instruments of active labor market policy (ALMP). Unemployment reached its peak of 1.17 million unemployed in 1992. This corresponds to an unemployment rate of 14.8 % (base: civil labor force). Since then, the number of unemployed has decreased moderately whereas the unemployment rates are increasing further, up to 16.0 % in 1994.

Earnings in East Germany started at a comparatively low level (in absolute terms) in July 1990, with gross monthly earnings in the industrial sector of 35% (69.7 % in October 1994) of their West German counterparts, cf. IW (1995, p. 137). On the one hand, wages were judged to be well above market clearing levels, see for instance Akerlof et al. (1991). On the other hand, there existed strong political pressure to increase East German earnings in order to reduce the disparity in standards of living between East and West and to avoid massive outflows of the East German labor market population, thereby worsening the unemployment problem in West Germany. Reducing the gap between East and West German wages was one of the main objectives of unions when negotiating East German wages. Even today, six years after unification, the development of wages in East Germany is still often tied to West German growth rates. In addition, some prices that had been regulated, were freed up in the course of the transition process, and led to high growth rates in consumer prices. For instance, the consumer price index for rents (private employees' households) in East Germany rose to 404 % in 1994 (with the index in 1990 set to 100 %), cf. SVR (1995, p. 459). These extraordinary price increases for standard living

expenses put additional pressure on wages. As a result, centrally bargained wages in East Germany have been increased almost automatically, following rather political objectives than economic rules.

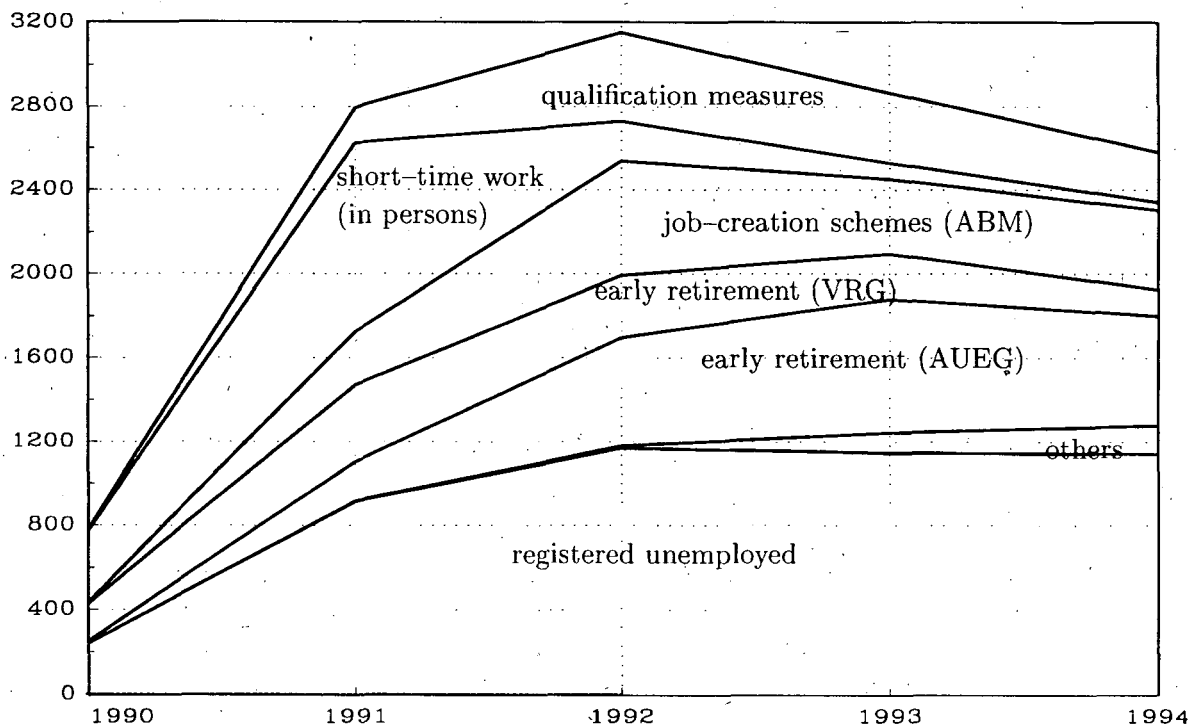
Labor market participation rates in 1989 were at 64.0% for men and 53.0% for women compared to West German participation rates of 59.8% and 37.1%, respectively. Four years later, in 1994, labor market participation rates in East Germany came down to 56.6% for men and 48.3% for women, cf. IW (1995, table 11). What happened was that already in 1990, many firms collapsed. Plants were closed and workers were laid off, or, in the luckier cases, workers were forced into short-time work. People started to migrate to the west or to commute to West German firms located near the old border. The East German labor force was reduced further by people leaving the active labor population into early retirement ("Altersübergangsgeld": AUEG, or "Vorruhestandsgeld": VRG) which was heavily subsidized by the BA. In addition, the massive unemployment led to the discouragement of workers, especially women and to their drop out of the active labor force.

## 2.2 Active Labor Market Policy and Training

During the first months after unification, the BA financed mainly short-time work which was the instrument that could be implemented most quickly. During the period from the third quarter in 1990 to the end of 1991, on average 1.6 million workers per quarter were working short-time with a peak of 1.96 million workers in the second quarter 1991, cf. Hagen et al. (1992, p.6). Among these people, a considerable number were in fact working zero hours. The instrument short-time work was supposed to act only for the first months after unification until other, more productivity orientated instruments could be implemented. This refers particularly to qualification measures ("Fortbildung und Umschulung") and job-creation schemes ("Arbeitsbeschaffungsmaßnahmen"). At the same time, early retirement schemes were implemented to ease retirement for elderly people who lost their jobs in the first years of transition. The costs to the BA for the main labor market policies (Qualification measures, short-time work, ABM) amounted to a total of 21.7 billion DM in 1992, almost 8 % of East Germany's GDP. Figure 1 shows the development of non-employment in East Germany. It can be seen that the peak of non-employment was at 3.2 million persons in 1992, and that the participation in labor market programs has decreased since then, whereas registered unemployment has remained at a high level.

Most of the instruments implemented in East Germany had been "traditional" instruments of ALMP in West Germany. They are regulated by the Work Support Act ("Arbeitsförderungsgesetz") which we refer to as AFG in the remainder. It was adjusted to the needs of the East German transition in various ways, partly by reducing requirements for entitlement or financial support, and partly by creating new instruments, for example wage subsidies paid for the employment of unemployed people according to §249h. Support of occupational education in the AFG contains various instruments, especially

Figure 1: Registered Unemployed, Early Retirement, and Person-Equivalent Participants in Labor Market Programs (in 1000 persons)



Source: IAB (1995), S. 249, IW (1995), Table 133.

Persons (or person-equivalent participants) are added up, so that the number of people in each non-employment state is shown by the difference of the lines. *Job-creation schemes* refer to "Allgemeine Arbeitsbeschaffungsmaßnahmen", *short-time work* is calculated as workers-equivalent and not as hours worked, *others* combines instruments such as support for construction workers laid off during bad weather, special wage subsidies according to §249h AFG-law, or measures for the disabled *qualification measures* refers to full-time training programs only, AUEG = Altersübergangsgeld, VRG = Vorruhestandsgeld.

support of vocational training ("Förderung der beruflichen Ausbildung"), institutional support, or support of qualification measures ("Fortbildung und Umschulung", FuU). The latter refers to qualification measures that presuppose completed occupational education or some years of professional experience. Participation in this qualification measure may lead either to an update or upgrade of existing occupational education or to a new occupational degree that significantly improves the trainee's labor market prospects. The qualification measure may take place in the firm as well as in external institutions and can be full-time or part-time. Its duration has to be more than two weeks and is restricted to a maximum duration (generally two years for full-time FuU). Financial support is only granted, if the participation in the qualification was supposed to significantly increase reemployment prospects of an unemployed person or to avoid the immediate threat ("unmittelbare Bedrohung") of unemployment for an employed person. Immediate threat in the AFG-terminology means that the employer had already given notice to the employee

or that the firm's bankruptcy proceedings had been started. For East Germany this definition was weakened during the transformation process. There, "threat" had not to be "immediate" which basically implied the interpretation that the threat of unemployment was globally assumed for East Germany (this interpretation was applied until the end of 1995). Another very important point for East Germany was that the range of institutions to be accepted for support was widened considerably. This led to a very large number of training institutions and enterprises in the first year after unification. The BA itself reported coordination problems between the local labor offices and these educational institutions combined with problems concerning the quality standards of the training courses. As a consequence, the BA had to implement further controls on the institutions that received grants, cf. Brinkmann and Völkel (1992, pp. 268 ff.).

Financial support for qualification measures (FuU) according to AFG may include covering the costs of the program or even covering living expenses ("Unterhaltsgeld") for the participant during the qualification measure. The payment of "Unterhaltsgeld", which in the remainder we refer to as Income Maintenance, IM, is usually tied to full-time measures (with some exceptions). Since 1992, IM could also be granted to participants in part-time measures when combined with other labor market programs like short-time work or job-creation programs. The IM amounts to 67 % of the difference between the participant's last gross monthly earnings minus an average of the usual deductions for participants with children or spouses in need of care and 60 % for others. The payments of IM made up a considerable and increasing fraction of the BA's expenses for occupational education in East Germany. For instance, in 1992, the BA spent 11.28 billion DM for occupational education in East Germany, cf. IW (1995, p.134), and more than half of this for IM (6.0 billion DM, cf. ANBA (1995, p. 315)). In 1994, overall expenses for ALMP decreased and expenses for occupational education were at 7.03 billion DM. At this time, more than 65 % of this amount was spent on income maintenance.

The importance and size of transfers that were spent on qualification measures motivate this study. It is the question of this paper whether participation in a qualification measure can lead to better individual (re-)employment prospects and/or to higher wages of participants. We are especially interested in comparing those qualification measures that are publicly supported by the BA with income maintenance and those measures that are not supported with IM. The latter include both training measures in external institutions and on-the-job training, privately financed by the enterprise. In some cases they may be also supported by the BA institutionally or through setting-in allowances (*Einarbeitungszuschüsse*), but we are not able to distinguish these cases from completely private-financed training over the time period considered. Thus, we have to concentrate on the distinction between IM-supported and not-IM-supported qualification measures. Fortunately, the data set we use for our investigation allows us to further differentiate between measures that take place in a firm where the participant is employed and measures in external institutions.

### 3 Evaluation Problem

Training has been an important part of active labor market policy (ALMP) in East Germany during the transformation process, which suggests that it is considered an effective means to improve the trainees' labor market prospects – unless one presumes that ALMP is only hiding unemployment without addressing the problem at its roots. Taking the former more positive perspective, a comprehensive evaluation has to solve the following problems. First, what are the objectives of individual trainees and of ALMP? Second, does participation in training – be it supported by means of income maintenance or not – improve the labor market situation of the trainee in a causal way (narrow success criterion)? Third, do the actual participants in a program being part of ALMP belong to the group of individuals the policy is targeted at? And fourth, does the success of a training measure justify the private and public costs involved? This paper concentrates on the first three issues. However, our analysis has immediate consequences on the last question since positive effects of training on the individual level (evaluated here) are necessary to render the last question meaningful. This section discusses the evaluation problem and illustrates the methodological issues involved by means of some descriptive evidence regarding the experience in East Germany.

#### Qualification Measures: Objectives and Success Criteria

The main criteria considered to evaluate the success of training on the individual level are future employment and future wages (or earnings) after participation. The estimation of the effects of training on these variables raises difficult methodological questions which are subject of an intense debate in the evaluation literature, see among others Björklund (1989), LaLonde (1986), and Heckman and Smith (1995). Typically, a descriptive comparison of employment rates and earnings between former trainees and the group of individuals not having participated (**naive control group**: persons who did not participate in any kind of training during the time period considered) in some kind of training does not allow for causal inference on whether training increased (or decreased) future employment rates or future wages.

When ALMP takes the form of supporting training, participants in training programs should belong to the specific group of people ALMP is targeted at, for instance temporarily or permanently disadvantaged parts of the active labor force, cf. Blaschke and Nagel (1995). During the transformation process in East Germany, old skills became obsolete due to the structural change in the economy. At the beginning of the transformation process in East Germany (1990–1991), ALMP was aimed at improving the general skill level of the labor force then mainly being employed. Later in the transformation process unemployment increased significantly and then ALMP was mainly aimed at improving labor market prospects of unemployed individuals.

Our empirical analysis in section 4 uses the Labor Market Monitor (LMM) for East Germany. Based on these data, tables 1 and 2 provide some descriptive evidence for the naive control group and for four different types of trainees, cf. table 6 in the appendix for definitions. We consider two basic types of qualification measures:

- (i) Qualification in an institution, which is not the firm, where the person is employed (**QS**) and
- (ii) Qualification in a firm where the person is employed (**QB**)

and we distinguish further, whether during participation the individual received public income maintenance (**PIM**) according to the AFG-Law or not (**NIM**). For the following discussion, we denote the groups of individuals participating over the course of the LMM in each of the four types of qualification measures (**QS-PIM**, **QB-PIM**, **QS-NIM**, and **QB-NIM**) by the abbreviation of the type, see the definitions in table 6 in the appendix. Further, we distinguish whether a person did participate sometime in the past (Long-Run postprogram effect) or finished a qualification measure since the last interview (Short-Run postprogram effect).

### **Descriptive Evidence on Postprogram Comparisons**

In November 1991 (wave 4) former participants in qualification measures outside of the firm receiving income maintenance (**QS-PIM-Long-Run**) exhibit an employment rate of 42.5%. In November 1992 (wave 6), it was 43.2% and in November 1993 (wave 7) 53.2%. In comparison, the employment rate of the naive control group was 85.6% in November 1991, 77.9% in November 1992 and 82.4% in November 1993. These numbers imply that employment rates for former participants in **QS-PIM** were up to 40 percentage-points lower than for individuals who never participated in any qualification measure. One might notice in table 1 that women are overrepresented among participants in **QS-PIM** and thus, one might want to distinguish the analysis between men and women. Nevertheless, the result remains the same, cf. table 2. However, these numbers do not allow for the conclusion that **QS-PIM** reduces employment rates.

### **Obtaining an adequate Control Group**

In order to evaluate the effect of training properly, one would have to compare the situation of the individual after participation in **QS-PIM** with the situation of the same individual in the hypothetical case of not having participated. It is in the nature of the problem that the second hypothetical situation cannot be observed. The evaluation problem consists of obtaining an estimate for the hypothetical situation of not having participated. Only if employment rates of former participants in **QS-PIM** lie above the estimated employment rates in the hypothetical situation of not having participated, then one can conclude that **QS-PIM** raises future employment rates. In fact, the validity of an evaluation hinges on the validity of the estimate of the success criterion in the hypothetical situation of not having been subject to the measure whose effects are to be evaluated.

Table 1: Descriptive Statistics on Sample Selection for the naive control group and different groups of participants at qualification measures in waves 4, 6, and 7 (It is possible that one person appears in different groups of participants)

Groups in Waves 4, 6, 7	Number of In- dividuals			Sex (Women) <sup>b</sup>			Age (Ave in years)		
	Wave			Wave			Wave		
	4	6	7	4	6	7	4	6	7
Naive Control Group	5248	5248	5248	47.7	47.7	47.7	43.3	44.3	45.3
QS-PIM-HH-Long-Run	283	92	42	67.5	65.2	59.5	37.3	38.0	37.9
QS-PIM-HH-Short-Run	118	50	42	67.8	70.0	59.5	37.0	39.3	37.9
QS-PIM-Long-Run	281	568	706	60.5	63.2	64.8	37.0	38.2	39.1
QB-PIM-HH-Long-Run	24	5	1	70.8	60.0	100	37.5	35.0	42.0
QB-PIM-HH-Short-Run	8	4	1	75.0	50.0	100	37.8	33.5	42.0
QB-PIM-Long-Run	64	92	110	39.1	43.5	44.5	38.4	38.6	39.7
QS-NIM-HH-Long-Run	382	152	49	52.4	55.9	51.0	38.9	40.1	39.7
QS-NIM-HH-Short-Run	112	102	49	54.5	58.8	51.0	39.5	40.5	39.7
QS-NIM-Long-Run	1235	1469	1606	48.0	47.3	47.4	39.3	40.2	41.3
QB-NIM-HH-Long-Run	416	155	69	50.5	54.2	60.8	39.1	40.7	41.0
QB-NIM-HH-Short-Run	136	84	69	44.9	50.0	60.8	39.6	41.2	41.0
QB-NIM-Long-Run	1202	1521	1658	46.1	47.0	47.0	39.4	40.2	41.3
Groups in Waves 4, 6, 7	Employed <sup>b</sup>						Wage Rate <sup>c</sup>		
	3 <sup>a</sup>	4	5 <sup>a</sup>	6	6 <sup>a</sup>	7	4	6	7
Naive Control Group	85.9	85.6	82.6	77.9	77.9	82.4	7.25	8.99	8.82
QS-PIM-HH-Long-Run	76.6	67.3	62.1	43.8	62.5	35.7	7.14	8.29	8.27
QS-PIM-HH-Short-Run	64.0	51.7	51.0	26.5	62.5	35.7	7.29	7.75	8.27
QS-PIM-Long-Run	36.5	42.5	34.1	43.2	35.8	53.2	8.39	9.24	8.85
QB-PIM-HH-Long-Run	82.6	72.7	75.0	75.0	100	100	6.69	8.67	9.00
QB-PIM-HH-Short-Run	75.0	75.0	66.7	66.7	100	100	6.67	8.50	9.00
QB-PIM-Long-Run	74.6	75.0	63.8	64.7	59.5	68.1	8.00	8.95	8.69
QS-NIM-HH-Long-Run	95.1	96.2	91.4	92.7	93.6	85.4	8.98	10.28	10.90
QS-NIM-HH-Short-Run	97.2	95.5	90.2	93.1	93.6	85.4	8.89	10.64	10.90
QS-NIM-Long-Run	94.3	92.6	92.5	89.8	92.7	92.8	8.92	10.89	11.09
QB-NIM-HH-Long-Run	93.1	94.9	91.5	95.5	94.1	97.0	8.99	10.02	10.70
QB-NIM-HH-Short-Run	97.0	98.5	91.7	98.8	94.1	97.0	9.76	9.95	10.70
QB-NIM-Long-Run	93.4	92.8	91.1	90.8	91.6	92.1	8.85	10.65	10.81

a: For "waves" 3<sup>a</sup>, 5<sup>a</sup>, and 6<sup>a</sup>, the employment rates correspond to the groups defined in waves 4, 6, and 7, respectively.

b: in %

c: average in DM (constant prices, Second Half 1990/First Half 1991 = 100)

Table 2: Employment Rates and Earnings by Sex and by former Participation in Qualification in waves 4, 6, and 7

Groups in Waves 4, 6, 7	Employment Rates (in %)					
	Men			Women		
	Wave			Wave		
	4	6	7	4	6	7
Naive Control Group	90.4	82.8	90.4	80.1	72.5	73.8
QS-PIM-Long-Run	52.9	54.6	67.7	36.3	36.5	45.9
QS-NIM-Long-Run	94.7	92.4	69.4	90.4	87.0	66.7
QB-PIM-Long-Run	76.9	74.3	95.6	72.7	54.5	90.2
QB-NIM-Long-Run	94.9	93.0	95.5	90.4	88.4	88.7

Groups in Waves 4, 6, 7	Wage Rate <sup>a</sup>					
	Men			Women		
	Wave			Wave		
	4	6	7	4	6	7
Naive Control Group	7.84	9.54	9.30	6.48	8.28	8.19
QS-PIM-Long-Run	9.07	9.80	9.55	7.77	8.76	8.35
QS-NIM-Long-Run	9.45	11.20	11.32	8.37	10.54	10.86
QB-PIM-Long-Run	8.00	9.00	8.78	8.00	8.89	8.59
QB-NIM-Long-Run	9.48	11.12	11.16	8.09	10.12	10.43

a: average in DM (constant prices, Second Half 1990/First Half 1991 = 100)

When evaluating ALMP, it has to be noted that such a policy is typically targeted at individuals with particularly bad labor market prospects, i.e. it is unlikely that the labor market prospects of the naive control group provide a good estimate for the labor market prospects of participants in QS-PIM in the hypothetical situation of not having participated. Comparing the naive control group with the former participants is typically subject to a sample selection bias. An adequate evaluation for causal inference must find (or define) a control (comparison) group providing an adequate estimate of the success criterion in the hypothetical case of not having participated. Thus, an adequate control group is a group of individuals corresponding to the group of participants with respect to all observable and unobservable aspects which influence the success criterion. A sample selection bias in the comparison between participants and the control group can occur with respect to observable and unobservable characteristics, cf. Heckman and Hotz (1989).

Above, we suggested that the naive control group defined above might not be such a good control group for the participants in QS-PIM. How can this issue be investigated further? One possibility is to compare the success criterion for the participants and the control group under consideration *before* participation. This idea used in form of a specification



test by Heckman and Hotz (1989, "HH"). They advocate a *preprogram-test*,<sup>1</sup> which is described in detail in section 4.1, to evaluate the validity of an econometric estimate of program effects. The idea of the HH-preprogram-test is that the success criterion for the group of participants and for the control group should be equal (apart from statistical variation) before participation. Only if the control group is equal to the group of participants before participation, is it plausible that the control group provides an adequate estimate of the success criterion in the hypothetical situation of not having participated. Despite its plausibility, the use of this (specification) test requires, however, some unverifiable identification assumptions, which basically amount to the restriction that time should not affect participants and the control group in a different (unobservable) fashion.

### Further Descriptive Evidence on Preprogram and Postprogram Comparisons

To study preprogram effects, we define the group of persons who will participate in a qualification measure in the future and did not so in the past (HH-Long-Run Preprogram Effect) and the group of persons who will participate prior to the next interview and did not so in the past (HH-Short-Run Preprogram Effect). For our problem at hand, table 1 shows that employment rates of future participants in QS-PIM are considerably below the employment rates of the naive control group when participation happens at some time in the future (QS-PIM-HH-Long-Run) and in particular when participation starts before the next interview (QS-PIM-HH-Short-Run). Employment Rates for QS-PIM-HH-Long-Run are 67.3% in November 1991, 43.8% in November 1992, and 35.7% in November 1993, for QS-PIM-HH-Short-Run<sup>2</sup> 51.7%, 26.5%, and 35.7%, and for the naive control group 85.6%, 77.9%, and 82.4%, respectively. This comparison shows that participants in QS-PIM are not a random draw from the naive control group with respect to their employment rates and therefore the naive control group does not appear to provide an adequate control group. The fact that participants in QS-PIM have lower employment rates (and lower wages if employed, cf. also table 1) before participation could be the result of the orientation of ALMP towards individuals with bad labor market prospects, especially for the later waves of the LMM. In fact, this could be viewed as a success in itself, since it is not a priori clear that ALMP reaches those individuals whom it is designed for.

Table 1 comprises descriptive statistics on some important variables for the naive control group and all four types of participants in qualification measures (QS-PIM, QB-PIM, QS-NIM, QB-NIM). It should be noted in the following that the group QB-PIM consists only of a very small number of individuals, i.e. public IM focuses on qualification measures outside of the firm. In contrast, the group QS-NIM is fairly large. Table 1 indicates to what extent former or future participants do not appear representative with respect to

<sup>1</sup>This specification test is often used, cf. among others Fitzenberger and Prey (1995), Friedlander and Robins (1995), and Lechner (1995a).

<sup>2</sup>For November 1993, wave 7, HH-Long-Run and HH-Short-Run coincide, since wave 8 is the last wave of the LMM.

some observable variables. On the one hand, participants in QS or QB receiving IM (PIM) exhibit considerably lower average employment rates and lower average wages than the naive control group both before and after the qualification measure. On the other hand, participants in QS or QB not receiving IM (NIM) typically exhibit considerably higher average employment rates and higher average wages than the naive control group both before and after the qualification measure. It is therefore implausible that the naive control group represents by itself an adequate control group for any of the four types of qualification measures. However, the differences might be due to observable characteristics which are important for employment rates or wages. For instance, the percentage of women is higher for those participants receiving IM compared to the naive control group. Distinguishing between men and women in table 2 shows that also for the two sexes separately, former participants who received IM exhibit lower employment rates and lower wages than the naive control group and that the opposite is true for former participants not having received IM. For the first waves, the share of individuals with higher occupational degrees among participants is higher than for the naive control group. For later waves, this is only true for participants not receiving IM. Participants are also younger on average than the naive control group. These findings reinforce the impression that the naive control group does not provide an adequate control group.

#### **Approaches to Resolve the Evaluation Problem**

A natural next step is to control for some of the observable and unobservable differences by means of an econometric model. The idea is that an econometric regression function defines an appropriate control group (reference level) after participation and a participation dummy picks up the differences between participants and control group. However, section 4 shows that our econometric strategy is not completely successful in this respect, i.e. for some specifications we find significant preprogram-dummies (coefficients on HH-Dummies) indicating that, even after controlling econometrically for observable and unobservable characteristics, differences before participation remain, thus it is unlikely that in such cases econometric conditioning defines an appropriate control group after participation. Then, we reinterpret the coefficient estimate on the preprogram dummies as a measure of the size of the selection bias. The success of training is evaluated relative to the latter "selection reference level" and not just relative to the conditional value on the estimated regression function.

While focusing on an econometric nonexperimental evaluation approach in this paper, it has to be mentioned that the evaluation literature in fact discusses two basic approaches for obtaining an adequate control group. One school of thought, e.g. LaLonde (1986) or Ashenfelter and Card (1988), believes that only controlled social experiments, where participants and control group are drawn randomly from the same group of individuals provide adequate control groups of non-participants. Another school of thought considers econometric and statistical methods as a fruitful strategy to make use of nonexperimental data for an evaluation of participation effects. In order to create or define an adequate

control group, it is necessary for these methods to account for any kind of selection bias as part of the estimation approach, cf. Heckman and Hotz (1989). Controlled experiments are often viewed as the superior solution to the evaluation problem and a considerable amount of research (see Friedlander and Robins (1995), Heckman and Hotz (1989), and LaLonde (1986)) assesses the merits and weaknesses of nonexperimental evaluation methods by applying them to experimental data and contrasting the results to the estimates produced by the experimental method. However, Heckman and Smith (1995) doubt an a priori superiority of experimental methods. They show that experiments can also involve a selection bias in the control group. For instance, a so-called substitution bias occurs when members of the control group, who were randomly rejected from participation, might try to participate in a similar measure at another occasion. Since no experimental data is available for East Germany, this paper focuses on nonexperimental evaluation methods. However, the discussion on social experiments has been very fruitful for the development of nonexperimental methods.

## 4 Econometric Investigation

This section presents our econometric analysis based on the Labor Market Monitor (LMM) East. Our estimation framework attempts to encompass the methodological considerations in section 3. Since our data set is quite large and since we distinguish between four different types of qualification measures both for men and women, we were, however, not able to estimate one comprehensive model due to computational restrictions. Estimation is based on a FORTRAN program written for our purpose since conventional econometric software packages did not prove powerful enough for the size of the problem at hand. Detailed descriptions of the data set used and of estimation results can be found in the appendix. The following discussion refers to more results than reported in the appendix. Without explicitly saying this each time, they are available upon request.

### 4.1 Estimation Approach

We model the indicator (dummy) variables employment status, panel attrition, participation in qualification (training), and the variable wage within a simultaneous random-effects probit and tobit model, cf. Lechner (1995b) for a recent comprehensive treatment of such models and Flaig et al. (1993) for a similar application involving estimation of a simultaneous dynamic employment probit. The underlying latent variables themselves depend on various regressors and on an individual random effect which is invariant over time and which is supposed to take account of permanent unobserved heterogeneity across individuals. The relationship between the observable dummy variable  $Y_{it,j}$  for an individual  $i$  at time  $t$  and the underlying latent variable  $Y_{it,j}^*$  is given as follows

$$Y_{it,j} = \begin{cases} 1 & \text{if } Y_{it,j}^* \geq 0 \\ 0 & \text{otherwise} \end{cases} \quad (1)$$

where  $j \in \{A, Q, E\}$  and “A”: attrition equation (panel mortality), “E”: employment equation and “Q” participation in qualification measure. Our empirical analysis tries to explain panel attrition,  $Y_{it,A} \equiv A_{it}$ , participation in qualification,  $Y_{it,Q} \equiv Q_{it}$ , employment status,  $Y_{it,E} \equiv E_{it}$  and the wage  $Y_{it,W} \equiv W_{it}$ , where the wage is only observed when the individual is employed resulting in the following generalized tobit structure

$$W_{it} = \begin{cases} Y_{it,W}^* & \text{if } E_{it} = 1 \\ NA & \text{if } E_{it} = 0 \end{cases} \quad (2)$$

where “NA” stands for “not available” and  $Y_{it,W}^*$  denotes the latent wage, i.e. the wage the individual would earn if employed. The attrition dummy,  $A_{it}$ , indicates whether a complete observation vector for the qualification, for the employment, and for the wage equation is available for individual  $i$  at time  $t$  ( $A_{it} = 1$  available), thus, we allow for the case that an observation is unavailable for one wave but is again available for the next wave. This allows us to keep a considerable number of observations, which seems important given the severity of panel mortality, but it restricts the way how to model attrition.<sup>3</sup> The employment dummy,  $E_{it}$ , describes the employment status, where  $E_{it} = 1$  indicates employment and  $E_{it} = 0$  represents all non-employment states which we simply call “unemployment”. Obviously, it would be of great interest to differentiate between the different types of “unemployment” states. This is, however, beyond the scope of this paper. The wage variable,  $W_{i,t}$ , denotes the net real wage obtained as the ratio of monthly earnings deflated by the CPI and the reported hours worked.

The dummy variable,  $Q_{it}$ , capturing participation in a qualification measure is modelled as an endogenous variable by means of a separate probit equation. We consider the four possibilities QS-PIM, QB-PIM, QS-NIM, and QB-NIM, referred to in section 3 as the four types of qualification measures (and also described in detail in table 6 in the appendix). It is not feasible to model all types of qualification measures within a comprehensive simultaneous probit and tobit model together with attrition, employment, and wages. Therefore, we choose to evaluate the four types of qualification measures separately in the following way. Building on the descriptive analysis in section 3, we base our analysis for each of the four scenarios on a data set which is the union of two types of individuals: The first type is the naive control group, i.e. the group of individuals never participating in any of the four qualification measures over the course of the LMM. And the second type is the group of individuals who did participate in the respective qualification measure at some instant during the course of the LMM. We build such a data set for each of the four types of qualification measures and estimate our model for each type separately. In fact, we also do this separately for men and women. Admittedly, this strategy has two major disadvantages. First, we neglect interaction effects between the four different types of qualification measures, since individuals participating in one type of qualification measure

<sup>3</sup>Lechner (1993) chooses a different way to account for attrition in the LMM. He does not use observations of people who do reply after not having replied in the past. This leaves him with less observations in the equation of interest but allows for a more flexible way of modelling attrition also as a function of past outcomes of the variables in the equation of interest.

might have participated in another type at some other time. And second, the four different scenarios result in different estimated models for the naive control group.

Our model is built up recursively. Given a person has not attrited,  $A_{it} = 1$ , we model next whether the individual participates in the respective qualification measure, and only if the individual is not participating,  $Q_{it} = 0$ , we consider the employment and wage information. Thus, we allow for three labor market states, employed,  $E_{it} = 1$  and  $Q_{it} = 0$ , unemployed,  $E_{it} = 0$  and  $Q_{it} = 0$ , and participating in qualification,  $Q_{it} = 1$ . In the latter case, we discard the information on employment status and wage from the questionnaire. However, when explaining participation in a qualification measure in the qualification probit, the information on lagged employment status is also used for those individuals having participated in qualification in the previous period.

Given the recursive structure described above, the following table summarizes the contributions to the likelihood function where “NA” stands again for “not available”, i.e. this variable is not considered in the likelihood function for such an individual.

Table 3: Structure of Contributions to Likelihood Function

$A_{it}$	$Q_{it}$	$E_{it}$	$W_{it}$
0	NA	NA	NA
1	1	NA	NA
1	0	0	NA
1	0	1	1

Each of the latent variables  $Y_{it,j}^*$ ,  $j \in \{A, Q, E, W\}$ , is assumed to depend on the set of regressor variables in the following way

$$Y_{it,j}^* = X'_{it,j} \beta_j + \epsilon_{it,j} \quad (3)$$

where  $X_{it,j}$  represents the vector of regressors,  $\beta_j$  the corresponding coefficient vector, and  $\epsilon_{it,j}$  the error term. We assume the error vector  $(\epsilon_{it,j})_{t=0,\dots,T; j \in \{A, Q, E, W\}}$  to be independently and identically distributed over the individuals,  $i = 1, \dots, N$ , but we allow the components of the error vector for a given individual to be correlated over time and across equations. The correlation is supposed to be captured by an individual specific random factor such that  $\epsilon_{it,j}$  can be decomposed in the following way

$$\epsilon_{it,j} = \rho_{j,t} \alpha_i + u_{it,j} \quad (4)$$

where  $\alpha_i$  represents the individual random effect (the factor) and  $u_{it,j}$  an additional unsystematic random component which is independently and identically distributed over  $t$  and  $j$ . Without loss of generality, we can assume  $Var(u_{it,j}) = Var(\alpha_i) = 1$  for  $j \in \{A, Q, E\}$  and let the coefficient  $\rho_{j,t}$  be estimated.  $\rho_{j,t}$  measures the strength of the individual effect in equation  $j$  at time  $t$  and can be different across  $j$  and  $t$ . The variance of the random component  $u_{it,W}$ , denoted by  $Var(u_{it,W}) \equiv \sigma_{W,t}^2$ , in the wage equation needs to be estimated as well. For the likelihood function, it is useful to define  $z_{it,j}$  by

$$z_{it,j} \equiv X'_{it,j} \beta_j + \rho_{j,t} \alpha_i$$

For instance, we obtain for the probability that the dummy variable  $Y_{it,j}$  takes a value equal to unity

$$P(Y_{it,j} = 1 | X_{it,j}, \alpha_i) = \Phi(z_{it,j}) \quad (5)$$

where  $\Phi$  denotes the cumulative standard normal distribution function.

The derivation of the likelihood function makes use of the recursive nature of the model. The employment and qualification probabilities are allowed to depend on the previous employment status. This necessitates explaining the employment status in period 0,  $E_{i,0}$ , i.e., in fall 1989. There are several approaches suggested in the literature to handle such an initial condition problem, see Heckman (1981). We choose to model  $Y_{i0,E}^*$  as a linear "static" function of presample information. Since fall 1989 was the "hour zero" of German unification, it appears reasonable to assume there to be a "true" initial state. In fact, out of 8751 persons in our joint samples (men and women, all types of qualification measures), 8552 were employed in fall 1989.

Now, we are at the point to present in detail the four probit equations and the tobit equation:

#### Initial Condition Employment Probit

$$Y_{i0,E}^* = X'_{i0,E} \beta_0 + \rho_{E,0} \alpha_i + u_{i0,E} \equiv z_{i0,E} + u_{i0,E} \quad (6)$$

and

$$P(E_{i0} = 1 | X_{i0,E}, \alpha_i) = \Phi(z_{i0,E}) \quad (7)$$

#### Attrition Probit

$$Y_{it,A}^* = X'_{it,A} \beta_A + \rho_{A,t} \alpha_i + u_{it,A} \equiv z_{it,A} + u_{it,A} \quad (8)$$

and

$$P(A_{it} = 1 | X_{it,A}, \alpha_i) = \Phi(z_{it,A}) \quad (9)$$

#### Participation in Qualification Probit

$$Y_{it,Q}^* = \gamma_Q E_{i,t-1} + X'_{it,Q} \beta_Q + \rho_{Q,t} \alpha_i + u_{it,Q} \equiv z_{it,Q} + u_{it,Q} \quad (10)$$

and

$$P(Q_{it} = 1 | X_{it,Q}, \alpha_i) = \Phi(z_{it,Q}) \quad (11)$$

#### Employment Probit

$$Y_{it,E}^* = \gamma_E E_{i,t-1} + X'_{it,E} \beta_E + \rho_{E,t} \alpha_i + u_{it,E} \equiv z_{it,E} + u_{it,E} \quad (12)$$

and

$$P(E_{it} = 1 | X_{it,E}, \alpha_i) = \Phi(z_{it,E}) \quad (13)$$

### Wage Tobit

$$Y_{it,W}^* = X'_{it,W} \beta_W + \rho_{W,t} \alpha_i + u_{it,W} \equiv z_{it,W} + u_{it,W} \quad (14)$$

and

$$f(W_{it} | X_{it,W}, \alpha_i) = \sigma_{W,t}^{-1} \varphi(\sigma_{W,t}^{-1} (W_{it} - z_{it,W})) \quad (15)$$

where  $f$  denotes the density of the wage and  $\varphi$  the density of the standard normal distribution.

We make the following distributional assumptions: For all  $i = 1, \dots, N$ ,  $t, t' = (0), 1, \dots, 5$ ,  $t \neq t'$ , and  $j \in \{A, E, Q, W\}$ ,  $\alpha_i, u_{it,A}, u_{it,Q}, u_{it,E}, u_{it,W}$  follow a multivariate normal distribution and are uncorrelated (i.i.d.) across individuals with  $Var(\alpha_i) = Var(u_{it,j'}) = 1$ , for  $j' \in \{A, Q, E\}$ ,  $Var(u_{it,W}) = \sigma_{W,t}^2$ ,  $Cov(u_{it,j}, u_{it',j}) = Cov(u_{it,j}, u_{it,j'}) = Cov(u_{it,j}, u_{it',j'}) = Cov(\alpha_i, u_{it,j}) = 0$  for  $j \neq j'$ .<sup>4</sup>

The one-factor formulation of the dependency in the error term of individual  $i$  makes the model tractable, since only a standard one-dimensional integration is involved to obtain the individual contributions to the likelihood function. However, this restricts the dependency structure which is allowed for the error vector. Simulation methods<sup>5</sup> do not seem feasible for our problem at this point due to the complexity of the estimation and the number of observations. The problem is mitigated by allowing  $\rho_{j,t}$  to vary with  $t$ .<sup>6</sup>

By means of conditioning on the random effect and other endogenous (past and present) dummy variables, we obtain a recursive system and the probabilities become simple cumulative normals as described in equations 7, 9, 11, and 13, and a simple normal density as in equation 15. The model assumes that the random effect accounts for a potential selectivity bias due to attrition, qualification, and employment in the respective other equations, and that therefore, conditional on the random effect,  $\alpha_i$ , we have an i.i.d. error structure, cf. also Lechner (1995b, section 3.3). For instance, conditional on the set of regressors, on the individual random effect, and on past employment status, participation in qualification and employment are independent of attrition, i.e., for  $k = 0, 1$ ,

$$P(Q_{it} = k | A_{it}, X_{it,Q}, E_{i,t-1}, \alpha_i) = P(Q_{it} = k | X_{it,Q}, E_{i,t-1}, \alpha_i)$$

and

$$P(E_{it} = k | A_{it}, X_{it,E}, E_{i,t-1}, \alpha_i) = P(E_{it} = k | X_{it,E}, E_{i,t-1}, \alpha_i)$$

<sup>4</sup>At some point of our analysis, we were trying to allow for heteroscedasticity of the unsystematic part of the error term,  $u_{it,j}$ , in the probit equations by allowing for wave specific variances (only for one wave, the variance was set equal to unity as a necessary normalization). Even though formally identified, estimation of these models proved impossible due to numerical convergence problems.

<sup>5</sup>See e.g. Börsch-Supan and Hajivassiliou (1993) and Lechner (1993).

<sup>6</sup>For one multinomial simultaneous probit with, for example,  $T = 3$ , this allows for a completely arbitrary correlation structure and different total error variances.

Now, the contribution of individual  $i$  to the likelihood function is given by<sup>7</sup>

$$\begin{aligned}
L_i = \int_{-\infty}^{\infty} & \underbrace{\{\Phi(z_{i0,E})\}^{E_{i0}} [1 - \Phi(z_{i0,E})]^{1-E_{i0}}}_{\text{Initial condition}} \times \prod_{t=1}^5 \underbrace{\{\Phi(z_{it,A})\}^{A_{it}} [1 - \Phi(z_{it,A})]^{1-A_{it}}}_{\text{Attrition equation}} \times \\
& \underbrace{\{\Phi(z_{it,Q})\}^{A_{it}Q_{it}} [1 - \Phi(z_{it,Q})]^{A_{it}(1-Q_{it})}}_{\text{Qualification equation}} \times \\
& \underbrace{\{\Phi(z_{it,E})\}^{A_{it}(1-Q_{it})E_{it}} [1 - \Phi(z_{it,E})]^{A_{it}(1-Q_{it})(1-E_{it})}}_{\text{Employment equation}} \times \\
& \underbrace{\{\sigma_{W,t}^{-1} \varphi(\sigma_{W,t}^{-1}(W_{it} - z_{it,W}))\}^{A_{it}(1-Q_{it})E_{it}}}_{\text{Wage Equation}} \} \varphi(\alpha_i) d\alpha_i
\end{aligned}$$

This formulation assumes that the contribution of the qualification probit can only be used when  $A_{it} = 1$ , that of the employment probit when  $A_{it} = 1$  and  $Q_{it} = 0$  and that of the employment tobit when  $A_{it} = 1$ ,  $Q_{it} = 0$ , and  $E_{it} = 1$ . Estimation of the asymptotic variance-covariance matrix of the parameters reported in this paper is based on  $\hat{V} = OPG^{-1}$  where  $OPG$  denotes the outer product matrix of the gradient of the likelihood function evaluated at its maximum.<sup>8</sup>

### Capturing the Effects of Qualification Measures on future Employment and on future Wages

We decompose the effect of the qualification measure considered into two components, namely a dummy variable capturing the temporary (QM-Short-Run) effect and another dummy variable capturing the permanent (QM-Long-Run) effect on the future employment probability or on future wages. Thus, we set the short-run dummy equal to unity when participation ended since the last interview considered in the estimation, and we set the long-run dummy equal to unity when participation occurred at some time in the past.

It is not straightforward to determine current participation in a qualification measure from the data set. In our definition,  $Q_{it}$  indicates whether a qualification measure ends in the time period preceeding the next interview. Thus,  $Q_{it} = 1$  implies that participation has started or is going to start within the period preceeding the next interview, or that the person has participated in qualification since the last interview but it is unclear whether qualification has ended by the time of the current interview. Unfortunately, we are unable to use information on the length of the participation in a qualification measure.

<sup>7</sup>When evaluating the likelihood function, the random effect  $\alpha_i$  has to be "integrated out". The numerical integration is done by means of Gauss-Hermitian quadrature techniques, cf. Butler and Moffitt (1982).

<sup>8</sup>For the model with the impact coefficients of the random effect,  $\rho_{j,t}$ , in one equation being the same for all waves, we were also able to base inference on  $\hat{V}_1 = -H^{-1}$  and  $\hat{V}_2 = H^{-1} OPG H^{-1}$ , cf. White (1982) and Hübner (1994b), where  $H$  denotes the Hessian of the likelihood function evaluated at its maximum. The qualitative nature of the results did not depend on the variance estimate used. However, for the estimations discussed in this section, which involve wave specific  $\rho_{j,t}$ 's, the estimated Hessian could not be inverted for numerical reasons even though there were no apparent convergence problems.



### Heckman-Hotz-Preprogram Test

In addition to modelling a separate probit equation for the qualification measure considered, we test and control for a potential selection bias by means of two dummy variables HH-Long-Run and HH-Short-Run. Following the suggestion of Heckman and Hotz (1989) for their preprogram test (see section 3), we set HH-Long-Run equal to unity if a person will participate in the qualification measure considered at some time in the future and did not participate in the past. The short-run preprogram dummy HH-Short-Run is defined in order to capture preprogram effects at the point of time immediately preceding the start of a qualification measure. Participants of training programs were often found to have had a particularly bad labor market experience in the period immediately preceding participation, cf. e.g. Ashenfelter and Card (1985) for earnings. We set HH-Short-Run equal to unity if a person starts participating in the qualification measure considered before the next interview and did not participate in the past. It could be argued, that given our data set, we are limited in controlling for future participation in a qualification measure, i.e., that we neglect future participation in a qualification measure after November 1994. However, it is participation in a qualification measure during the time period of our data set, which we try to model and whose effects we try to study.

With the preprogram variables, we are explicitly controlling for the selection bias before participation in qualification. If the model has controlled properly for selection bias, the estimated coefficients of these regressors should not be significantly different from zero. But, if we find significant coefficients for HH-Long-Run and HH-Short-Run in the employment probit and the wage tobit, we conclude that trainees are different from non-trainees regarding their employment probabilities or their (potential) wage, respectively, in a way which is unobservable for the econometrician. Rather than stopping here and acknowledging that our econometric model did not quite do the job, we reinterpret the significant preprogram effect as the average "selection reference level" of the participants, i.e. the amount by which employment or wages of future participants differed before the start of the program from non-participants even after controlling econometrically for the set of regressors and an unobserved random effect. We suggest that the program effect has to be evaluated relative to this "selection reference level" measured by the preprogram dummies. We would like to view this interpretation as a *regression based difference-in-differences*<sup>9</sup> estimator. This is analogous to the standard difference-in-differences estimator, where the program effect is evaluated by contrasting before-after-differences of participants and non-participants, since in the econometric model the regression function captures the before-after-difference both for participants and non-participants. However, such an interpretation raises the issue of econometric endogeneity of the HH-dummy variables due

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<sup>9</sup>The difference-in-differences estimator is a popular statistical tool in the evaluation literature, cf. among others Card and Sullivan (1986) and Heckman and Hotz (1989). If  $\bar{y}_j^k$  is the average success criterion for the group of participants ( $k = p$ ) and non-participants ( $k = n$ ) at the time before ( $j = b$ ) and after completion ( $j = a$ ) of the program, the difference-in-differences estimator evaluates the program effect as the difference of the average before-after-difference of participants ( $\bar{y}_a^p - \bar{y}_b^p$ ) and non-participants ( $\bar{y}_a^n - \bar{y}_b^n$ ). The attractiveness of this estimator derives from contrasting average within-group-differences such that individual specific and time invariant effects cancel, cf. Heckmann and Hotz (1989).

to the recursive structure of the model, which we could, in principle, address by means of an instrumental variable approach. The latter is, however, beyond the scope of this paper.

## 4.2 Estimation Results

We estimate the simultaneous random-effects probit and tobit model described in section 4.1 separately for each of the four types of qualification measures, QS-PIM, QB-PIM, QS-NIM, and QB-NIM. The data set used for each model consists of the naive control group, i.e. the group of individuals never participating in one of the four qualification measures over the course of the LMM, and the group of individuals participating in the type of qualification measure considered by the respective model sometime during the course of the LMM. Table 6 in the appendix contains a detailed description of the variables used in our analysis.

In our previous paper, Fitzenberger and Prey (1995), we found significant differences in the employment dynamics between men and women in East Germany corresponding to the general perception in the literature, cf. Bielenski, Brinkmann, and Kohler (1994). Our results showed that future employment prospects of employed women were *ceteris paribus* not much smaller than for employed men, but for unemployed women and men the difference proved to be much larger. Thus, we choose here to estimate each of the four models considered both for men and women separately which results in eight different models.

Our estimation results are based on the five waves of the LMM yielding equidistant time points, namely, wave 0 (Nov. 1989), wave 1 (Nov. 1990), wave 4 (Nov. 1991), wave 6 (Nov. 1992), wave 7 (Nov. 1993), and wave 8 (Nov. 1994). However, we also use information on participation in a qualification measure and for other pertinent variables available from the waves between these annual time points. Since the complete LMM is not available at equidistant time points, a simultaneous probit and tobit model for all waves allowing for state dependence in employment cannot be formulated consistently using the framework presented in section 4.1. Also it just happens that the hours information needed to calculate hourly wages is only available for the November waves.<sup>10</sup>

In the remainder of this section, we describe briefly the estimates for the probit and tobit equations and the test results for our eight models reported in tables 7 to 10 in the appendix. Section 4.3 provides graphical illustrations of our estimated models in form of simulations. Although restricted to a specific scenario, we believe that these simulations of the effects of participation in qualification on future employment and future wages provide a clearer picture of the estimated model compared to simply analyzing coefficient estimates, which live in the space of latent variables.

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<sup>10</sup>Though inconsistent, we believe, however, that if hours information were available for all waves, a model based on all eight waves (and wave zero) could be a reasonable representation of the data. In fact, in Fitzenberger and Prey (1995), we estimated a simultaneous probit model based on the first six waves (and wave zero) of the LMM at non-equidistant time points.

## Initial Condition and Employment Probits

The initial condition probit for employment status in November 1989 is not very informative for men. Even though the estimates differ considerably across the four models (ideally, they should coincide) none of the differences seem significant. Only the fact of being married seems to exhibit a positive influence on employment probabilities in November 1989, whereas age and the individual random effect prove to be insignificant. Also for women, the initial condition estimates do not appear to differ considerably across the four models and the random effect proves insignificant, but we find a significant effect both for age and the married-dummy. The estimated age profile is concave and peaks between age 30 and 34. The fact of being married decreases the employment probability for women. Overall, the estimates reflect the fact that in November 1989 almost the entire labor force in East Germany was employed.

Considering the dynamic probit estimates for employment in the later waves, the estimated four models are quite similar both for men and women. As to be expected, there is strong state dependence in employment, i.e. the probability of being employed in the next period is considerably higher when employed in this period. We also find a concave age profile and significant effects of the occupational degree, of the time dummies, and of the dummy indicating short-time work in the previous period (negative effect). The estimated time trends both for men and women prove negative and highly nonlinear, with the strongest effect occurring in wave 6 (November 92). However, the considerably lower employment rates in the last two waves, cf. table 4, are accounted for by lagged employment status. The coefficients on the random effect indicate positive correlation of the error term in the employment equation with the error term in the attrition and wage equations, since the coefficient estimates are significantly positive in all three equations. In the qualification equation, we either find significantly positive or insignificant coefficients on the random effect. For men, the impact of the random effect in the employment equation peaks in wave 6 and it is also significantly higher afterwards compared to wave 1 and 4, cf. table 8, thus, the unobservable individual characteristics become more important over time. For women, the impact exhibits a somewhat more irregular behavior with no clear time trend. In fact, constancy over time cannot be rejected for three out of four models, cf. table 10.

There are further noteworthy differences between men and women. Overall, the sectoral dummies are not significant for men but for women, even though the sectors "commerce" (negative effect) and "traffic, post, railways" (positive effect) are significant for both sexes. A public sector job increases the future employment probability for women but not for men. Relative to individuals with low skill levels, intermediate occupational degrees ("Facharbeiter", "Meister") increase employment prospects significantly for both sexes, whereas higher degrees (Fachschule, University) prove beneficial only for women.

Turning to the focus of this paper, how does participation in one of the four types of qualification measures affect future employment? The long-run effects of all measures (except for QB-PIM-Men) are insignificant, i.e. in the long run former participants do exhibit the same employment probabilities as their counterparts in the naive control group

having the same characteristics as considered in our model. For QB-PIM-Men the long-run effect is in fact significantly negative. Some measures exhibit significant short-run effects which translate into dynamic adjustment over time. For QS-NIM (women) and QB-NIM (men and women), we find significant positive short-run postprogram effects on employment, and for QS-PIM (men and women) and QB-PIM (women) these short-run effects turn out to be significantly negative.

However, for QS-PIM (men and women) we find highly significant negative preprogram effects and for QB-NIM (women) significant positive preprogram effects.<sup>11</sup> Thus, we conclude that for these three cases there are still significant selection effects operating which are not captured by our econometric model. To make use of the estimated coefficients on the preprogram dummies, we interpret them as the selection reference level. Then, success of participation has to be assessed relative to this level. For QS-PIM, our findings indicate that in the short run the selection effect is worse than in the long run, corresponding to previous results in the literature that, in the period immediately preceding training, trainees had a particularly bad labor market experience, cf. Ashenfelter and Card (1985) for earnings. Since the short-run effect is more likely to be plagued by endogeneity issues with respect to the decision to participate, we take the long-run preprogram effect (HH-Long-Run) as the reference level. Relative to this long-run preprogram level, QS-PIM is highly effective both for men and women. In fact, it allows individuals to catch up from bad employment prospects to the average employment prospects of the individuals in the naive control group with the same characteristics, cf. Zweimüller and Winter-Ebmer (1996) for a similar result for Austria. To the contrary, QB-NIM-Women exhibits a positive short-run effect but a strongly negative long-run effect on employment relative to the long-run preprogram situation. However, the former temporary effect mitigates this negative long-run effect due to lagged employment status. For QB-NIM-Men, we also find a positive temporary effect but no significant preprogram effect. This difference illustrates the result for QB in Fitzenberger and Prey (1995), where we pooled the two sexes and participants receiving or not receiving IM. In that study, we found for QB the same result as here for QB-NIM-Women, i.e. the negative long-run effect of QB on employment is actually only operating for women not receiving IM.

### Qualification Probit

The results for the qualification equation differ by the type of qualification measure considered. On the one hand, the estimated coefficients on lagged employment status show that being employed significantly decreases the probability of participating in QS-PIM or QB-PIM thus indicating that ALMP reaches individuals with bad labor market experience. On the other hand, with regard to participation in QS-NIM or QB-NIM lagged employment status proves insignificant for men and significantly positive for women. All qualification equations exhibit a concave age profile and highly nonlinear time trends with participation peaking for all types in wave 6.<sup>12</sup> Participation is always significantly higher

<sup>11</sup>The effects of QB-PIM are of considerable size and qualitatively similar to QS-PIM. Maybe, due to the small number of individuals in QB-PIM, the effects prove insignificant.

<sup>12</sup>Due to the small number of participants in QB-PIM, the qualification equations exhibit some numerical

when individuals hold an occupational degree, and in most cases individuals with the highest degrees are the most likely to participate. This result indicates that individuals with a high skill level also had to adjust their human capital in the course of the transformation process. The coefficients on the random effect are mostly positive but quite irregular. Wave specific coefficients on the random effect are in most cases not supported by the data, with the exception of QS-PIM-Women.

### Attrition Probit

We chose a very parsimonious static specification for the attrition equation. The results are quite uniform. The propensity of retention is a concave function of age peaking around age 40 both for men and women. There is a strong negative time trend reflecting severe panel mortality over time and the random effect exhibits positive, highly significant coefficients, which tend to increase over time. Thus, over time unobservable characteristics gain importance in explaining attrition.

### Wage Tobit

The estimated wage equations exhibit a familiar concave age profile peaking around age 35 both for men and women. The results on the time effects are very peculiar at first glance. In contrast to aggregate figures<sup>13</sup>, we find that, after controlling for the other regressor variables, wages of men exhibit a negative time trend and wages of women were only increasing until wave 6 and declining afterwards. However, these results must be evaluated in light of the wave specific estimates of the impact of the random effect  $\rho_{W,t}$  and the variance of the unsystematic component of the error term  $\sigma_{W,t}^2$ . Both for men and women the importance of the individual specific random effect was increasing significantly over time, which at the same time is related to better unobservable employment prospects through the correlation between the error term of the employment and the wage equation incorporated by the random effect. Also both for men and women, the unsystematic variance of wages,  $\sigma_{W,t}^2$ , was decreasing significantly over time.<sup>14</sup>

Two potential explanations emerge which could reconcile the econometric evidence with the aggregate experience of real wages rising until wave 6 and remaining fairly constant afterwards. First, rising wages can be explained by increased employment shares of people with characteristics conducive to higher wages. When contrasting the estimated employment and wage equations, this appears true for some but by no means for all regressor variables, take the schooling and occupational degrees for men as an example. Also, we find significant positive time trends similar to the aggregate both for men and women when estimating a pooled tobit model neglecting the panel nature of the data or a random-effects

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problems. However, these did not appear to affect the validity of the estimates in the other equations. We checked this by estimating the model with a much more parsimonious qualification equation.

<sup>13</sup>Table 4 in the appendix shows that average real wages were increasing over time. This result is also still present in the respective simple pooled generalized tobit (employment and wages) estimates obtained without a random effect structure.

<sup>14</sup>This corresponds to the decline of the aggregate wage dispersion in levels which would be reinforced in logarithms with increasing average wage levels, cf. table 4 in the appendix

specification not allowing for wave specific  $\rho_{W,t}$  and  $\sigma_{W,t}$ . This leads us directly to the second potential explanation, namely, the increasing correlation of the error term in the employment and wage equation over time implying that “high-employment” probability workers became to a larger extent “high-wage” workers over time. This effect could reflect the increasing importance of individual characteristics (unobservable in the data) which are used when employers decide whether a person is (still) employable at the going wage rate. The wage rate itself was increased more or less exogenously, cf. the discussion in section 2 and Franz (1992).

Turning again to the focus of this paper, what are the effects of participation in qualification on wages? There are significantly negative long-run effects of QS-PIM for men and significantly positive effects of QS-NIM and QB-NIM both for men and women. However, the estimates on the preprogram dummies indicate that there are still selection effects operating for QS-PIM both for men and women (negative selection reference level) and for QS-NIM and QB-NIM for women (positive selection reference level). Considering these preprogram effects, we conclude that QS-PIM, QS-NIM, and QB-NIM increase future wages in the long run for women by an amount between 4% and 5% but only QB-NIM for men by about 7%.<sup>15</sup> For QS-PIM, QS-NIM, and QB-NIM, the short-run effects seem more unreliable going partly into the opposite direction. In the case of QB-PIM, the picture is different with a decrease for men and an increase (though barely significant) for women. However, due to the small number of individuals participating in QB-PIM, one should be extremely cautious about results concerning this measure.

### Further Specification Tests

The results of various specification tests are given in tables 8 and 10, some of which were already discussed above. We performed a test whether a random-effects (RE) specification is necessary, where we contrast the coefficient estimates of the random-effects specification with the respective simple pooled probit and generalized tobit (employment and wages) without the random effect.<sup>16</sup> The test is very intuitive, since we test whether allowing for an individual random effect (unobserved heterogeneity) has a significant effect on the estimated coefficients of interest. The random-effects specification is confirmed for all estimated models and, in fact, the qualitative nature of the results change for a considerable number of regressor variables.

### 4.3 Simulation Results

To illustrate the effect of a QM on the individual employment chances and real (net) hourly wages, we simulated the effects for a woman or man with specific characteristics

<sup>15</sup>In the case of QS-NIM for men, the positive long-run impact is estimated to lie around 1% which does not, however, prove significant ( $t\text{-stat}=0.4$ ).

<sup>16</sup>This is implemented as a Durbin-Wu-Hausman test, cf. Davidson and McKinnon (1993, p. 390). A simple Wald-test on the coefficients of the random effect is inappropriate, since the estimated model is not well specified under  $H_0$  when all  $\rho_{j,t}$  are zero. One should also note that the likelihood function is symmetric around the vector  $\rho=0$ .

and displayed the person's employment and hourly wages, see figures 2 to 5 in the appendix A.3. Our person considered was employed in November 1989, 40 years old in November 1990, married, skilled (completed apprenticeship), and if employed, we assume the average sectoral effects on her or his employment history. Furthermore, we assume that she or he participates in a qualification measure which starts after November 1991 (wave 4) and ends before November 1992 (wave 6). Then the employment and wage dynamics between November 1989 and November 1994 are displayed by the broken line in the figures. Without any selection bias, this could be compared with the development for a person who did not participate in a qualification measure, the solid line (which we call the *baseline case* henceforth). And, finally, the dotted line represents employment and wages for the same person as the participating one but it follows the path as if the person would have been selected for the program but finally did/could not participate. Only the latter line represents the right control for the effects of the qualification measure although it is artificially constructed and not observable in reality. It shows what would have happened to the person if she or he would not have participated in the qualification measure, and thus, the difference between the actual employment/wage, represented by the broken line, and the potential employment/wage without the qualification measure, represented by the dotted line, determines the success or failure of the program. The difference between the potential employment/wage development and the baseline case defined by the regression estimates stands for the kind of selectivity of the trainee. If the course of the dotted line lied beneath the baseline, the trainee belonged to a negative "selection" concerning her or his labor market chances, and vice versa. In such cases where there is only the solid line displayed (e.g. QB-PIM, wages), significant effects of the qualification measure do not exist, neither before nor after the program.

Technically, the broken line is computed with the QM-Effect-Short-Run set to one in November 92 and the QM-Effect-Long-Run set to unity since then. The HH-Short-Run Dummy is one in 11/91 and the HH-Long-Run Dummy is unity from 11/90 to 11/91. This reveals the complete pre- and postprogram effects of the qualification measure. In contrast, none of these qualification dummies are in action for the baseline case, the solid line. The selection level of the trainee, represented by the dotted line is computed with only the pre-training dummy HH-Long-Run set to unity as in the training case<sup>17</sup>, but no post-training effects in action.

The simulations for the effects of each of the four types of qualification measures on the individual employment probability and the real hourly wages are displayed both for this "typical" man (figures 2 and 3) and woman (figures 4 and 5). A conflict arises when trying to simulate the effects of qualification measures. It is a question whether all estimated coefficients should be allowed to influence the outcome or whether insignificant coefficients should be set to zero. The first method exaggerates some effects but reveals the directions

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<sup>17</sup>One reason for this is that the short-run effect is more likely to be plagued by endogeneity with respect to the participation decision. The other reason is our perception that the long-run preprogram effect captures basic characteristics that determine a future trainee's employment prospects in general, and may therefore be a better indicator for the employment-relevant selectivity of the group of future trainees.

which all the simulated effects tend to follow. The second way totally neglects insignificant pre- or postprogram qualification effects, thus concentrating on the "pure" results. We decided to display only the effects of significant coefficients. The reason is that the general picture becomes clearer in light of the number of the different models estimated.

There are some general and obvious points that can be made from the simulations. First, comparing the employment probability without considering a qualification measure (solid line) of the man and the woman it becomes clear that the probability to become employed is higher for men than for women and the development seems to stabilize for the man in November 1992 whereas the decrease in the (re-) employment probability continues for the woman. Second, real net hourly wages are much lower for women than for men.

### Simulated Employment Effects

Looking at the simulated preprogram employment probabilities in figures 2 to 5 in appendix A.3, one striking pattern emerges. Only in the case of QS-PIM, the participating men and women are a "negative selection" concerning their employment chances (in the case of women participating in QB-PIM, the selection dummies are negative, too, but not significant). There is also a strong negative short-run preprogram effect, i.e. the probability that persons participating in such a qualification measure in an external institution are not employed before the program is much higher than with other types of qualification measures. This is not very surprising as support from income maintenance is supposed to be conditional on unemployment before the program or on a threat of unemployment. Nevertheless, the result here points to a well targeted policy of the BA. In the case of women participating in qualification measures in the firm who do not receive income maintenance, QB-NIM, the women belong to a significantly positive selection concerning their employment probabilities. In all other cases, the participants do not differ significantly from the baseline case in their unobservable preprogram characteristics.

The postprogram effect of the qualification measures on the employment probabilities differ as well. In those cases where a significant selection bias is present (QS-PIM-men, QS-PIM-women, and QB-NIM-women), the success or failure of the program has to be judged by the difference between the broken line (measuring the direct qualification effect) and the dotted line (measuring the selection effect) in figures 2, 4, and 5. This net effect is negative in the short-run for IM-supported qualification measures in external institutions but positive in the long run. Although belonging to a negative selection, the participants of this kind of qualification almost reach the employment probability of non-participants (baseline case). To the contrary, women participating in qualification measures in the firm who do not receive IM (QB-NIM-women), belong to a positive selection in the labor market (positive preprogram HH-effect), and the qualification measure only temporarily increases their employment probability. In the long run, the qualification measure even decreases their employment chances relative to their preprogram level and the probability of becoming reemployed falls to that of the baseline case. In the cases where no significant



selection effect is present, the effects of the qualification measures are either positive (QB-NIM-men, QS-NIM-women), negative (QB-PIM-men, QB-PIM-women) or do not exist (QS-NIM-men).

Nevertheless, considering all qualification measures, they can be categorized in the following way: public support in form of income maintenance seems to be well targeted and successful when qualification takes place in external institutions. But it has even negative employment effects with qualification measures in the firm (QB-PIM). When the participants are not supported by IM, qualification measures influence positively the participants employment prospects in the short-run, but in the long run there remains no effect. Female participants in a qualification measure in the firm cannot improve their employment prospects. They already belong to a positive selection concerning their employment chance, and participating even worsens their stand compared to the preprogram level. But when participating in qualification measures outside the firm, they do not significantly differ from the baseline case of no participation, and they can improve their employment prospects through training in the short run. To the contrary, male participants in qualification measures in the firm without support of income maintenance can increase their employment chances in the short run, whereas measures in external institutions (without IM-support) do not have any significant employment effect for males.

### Simulated Wage Effects

It can be argued, that a person's aim of participating in a qualification measure is not only to improve her or his employment probability but also to increase future wages. Jobs might even be riskier but more profitable after training. The simulated wage effects of the qualification measures considered are displayed to the right of the employment effects in figures 2 and 3 for men and in figures 4 and 5 for women. Again, the cases where selectivity occurs (QS-PIM-men, QS-PIM-women, QB-NIM-women, and QS-NIM-women), are indicated by the presence of a dotted line. It is the case that participants are a negative selection where qualification measures take place in external institutions and where participants receive publicly financed income maintenance (QS-PIM). The participating men and women would have earned less than the non-participants anyway because their unobservable characteristics "qualify" them as a bad selection concerning wages. However, after training only women can increase their wages above their selectivity level and even reach the course of the wages of a person who does not participate in a qualification measure, neither in the past nor in the future (the baseline case). Men's wages are even reduced below the selection level and return only to that level after training without any gain in wages.

Female participants in training which is not financially supported with IM belong to a high wage group compared to the baseline. No matter whether the qualification measure takes place in the firm or in an external institution, women gain financially from training in the long run. This result is very similar for men, apart from the fact that there is no selection effect in action: both qualification measures in the firm and in external institutions, not

supported with income maintenance, increase the participant's wage. The only case where no effect on wages can be found is the case of training in the firm which is supported with IM.

For all types of not-IM-supported qualification measures, wage effects are significantly positive and of considerable magnitude. To the contrary, with IM-supported qualification measures only women gain in wages if the measure takes place in an external institution – apart from this, no wage effects can be found.

Summarizing the effects of training as they are displayed in the simulations for a 40-year-old married person yields the result that publicly supported training measures in external institutions seem to increase the participants probability to become/remain employed but do not turn into considerable wage increases. Qualification measures in the firm that are supported by the BA with granting income maintenance to the participants even show a negative impact on employment and no effect on wages. The situation is reversed with qualification measures that are not publicly supported by IM. There, employment effects are even negative (QB-NIM-women) or not significantly different from the baseline in the long run, but the participation in qualification results in considerably higher wages compared to the pre-training level and compared to non-participating individuals.

## 5 Conclusions

This paper is concerned with labor market trends and labor market policy in East Germany during the transformation period 1990 to 1994. The analysis focuses on the effects of training on the future employment probability and future real hourly wages of trainees while distinguishing between measures within and outside of the firm of the employee and whether public income maintenance is received. Based on data from the Labor Market Monitor, we illustrate the methodological issues involved when attempting an evaluation study. The evaluation problem consists of finding an appropriate estimate for the hypothetical state of non-participation in training which the effects for participants can be compared with. Using descriptive evidence, we find considerable selection effects, when comparing simple descriptive statistics between former participants and non-participants. The two groups typically differ in various observable characteristics and considerable pre-program effects seem to operate, namely, future participants in qualification measures without income maintenance support exhibit on average a more positive employment and wage record than non-participants. On the contrary, future participants in qualification measures with income maintenance support exhibit a more negative employment and wage record than non-participants. Thus, on average the group of non-participants does not provide an appropriate estimate which the effects for participants can be compared with.

We then estimate a simultaneous model of participation, employment, and wages, but our model is only partly successful in taking account of the selection effects which are present in the descriptive statistics. Ideally, the estimated equation should define the “control

group", i.e. the level which the program effect can be compared with, given all observable and unobservable characteristics considered. For some of the qualification measures under investigation, significant preprogram effects remain in the estimated equations, even after controlling for observable and unobservable characteristics. We interpret these preprogram effects as the reference level, which the program effect should be compared with.

Based on these considerations, we mostly estimate positive effects of qualification measures be it on future employment or future wages. Our findings indicate that measures involving public income maintenance for programs that take place in external institutions are targeted at persons with bad labor market experience (confirming the descriptive evidence) and tend to have stronger effects on employment, whereas measures without income maintenance tend to exhibit a stronger effect on future wages. A qualification measure in the firm of the employee without income maintenance exhibits no positive long-run effects on employment for men and even negative long-run effects on employment for women, but there is a significantly positive impact on wages.

Our results differ from findings obtained by Eichler and Lechner (1996) and Lechner (1995a, 1996) as discussed in the introduction. A topic for future research could be to apply the different methodological approaches to the same data set in order to determine whether the differences depend on data sets or on methods. Another important topic is to determine whether the positive effects of training found in this paper justify the private and public costs involved.

## A Appendix

### A.1 Data Set: Labor Market Monitor

The data used for the evaluation of training programs stem from the "Arbeitsmarktmonitor Ost" which we call Labor Market Monitor (LMM). The Labor Market Monitor is a panel survey starting in November 1990 and ending in November 1994. It was commissioned from the research institute of the federal labor office, the "Institut für Arbeitsmarkt- und Berufsforschung" and covers 14993 individuals living in East Germany, a representative sample of the active labor market population in 1990. The LMM contains questions about personal characteristics such as age, marital status, or educational attainment, about labor market states like employment status, experience with unemployment, etc., about the firm where a person is employed, and about personal opinions about economic and social developments. The time between each wave varies over the period 1990 to 1994. Within the first year, the LMM was taken four times, in November 1990, March 1991, July 1991, and November 1992. Then the next two waves came after a time period of half a year, in May 1992 and in November 1992, and eventually, the seventh and the eighth wave came in November 1993 and November 1994. The first questionnaire also asked retrospectively about labor market status and size and sector of the firm in November 1989 so that some basic information about this year "Zero" is available as well. Panel mortality is a serious problem with the LMM. Only 3,354 individuals of those 10,751 who had answered in November 1990, still answered in November 1994. Some information about the panel and some variables that were used in the paper can be found in table 4.

Table 4: Labor Market Monitor: Panel Attrition and Description of Central Variables

	Time of Interview							
	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6	Wave 7	Wave 8
	Nov 90	Mar 91	Jul 91	Nov 91	May 92	Nov 92	Nov 93	Nov 94
Number of persons who answered correctly:								
(1) ... in each wave	10751	7929	7300	7956	10956	9763	8351	7549
(2) ... in each wave and in wave 1	10751	7929	7300	7787	6902	6647	5549	4939
(3) ... balanced panel	10751	7929	6734	5985	5145	4653	3919	3354

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Time of Interview								
	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6	Wave 7	Wave 8
	Nov 90	Mar 91	Jul 91	Nov 91	May 92	Nov 92	Nov 93	Nov 94
Important Variables based on (2): Fractions, Mean Values (MV), Standard Deviations (Std.)								
SEX female (in %)	50.7	50.6	51.0	51.7	52.1	51.6	52.6	53.0
AGE years MV	39.1	38.3	38.7	41.4	42.1	42.9	43.5	44.1
AGE Std.	13.3	12.2	12.0	13.1	13.1	13.0	12.4	12.1
self employed or employees (in %)	73.6	77.9	76.6	67.2	62.9	61.9	62.9	65.7
Registered Unemployed (in %)	5.4	7.9	10.2	8.6	10.6	13.0	10.6	9.8
Highest occupational degree (in % – Difference zu 100%: Not answered / Others)								
partially skilled craftsman	3.8	3.0	3.0	3.1	3.2	3.3	2.5	2.3
master craftsman	48.7	48.8	48.3	47.2	49.4	49.2	46.7	44.9
specialized voc. school	6.0	6.4	6.3	6.4	6.9	7.1	6.8	6.7
university degree	17.2	18.9	19.4	19.2	18.5	18.7	18.8	17.9
no degree	9.4	10.6	11.1	10.8	13.8	13.6	15.0	16.4
	6.5	5.5	5.3	5.8	7.1	6.8	6.3	5.6
real monthly net income, if employed, in DM for 1991, deflated by previous-month's CPI of East Germany, Source: Deutsche Bundesbank monthly reports								
MV	1140	1099	1180	1193	1312	1457	1508	1526
Std.	480	646	624	520	553	627	649	658
Real hourly net wage rate, if employed, in DM for second half 1990/first half of 1991, hours information only available for waves 1, 4, 6, 7, and 8								
MV	7.45	–	–	7.93	–	9.64	9.68	9.86
Std.	5.14	–	–	4.08	–	4.80	3.91	3.95

Table 5: Number of Observations in the Estimates

	Attrition 1	Initial Cond. 1	Qualification 1	Employment 1	0
<p>MEN: Qualification Measure in an External Institution, publicly financed by the BA with Provision of Income Maintenance (QS-PIM) Number of individuals: 3032</p>					
November 1989	-	3013	-	-	-
November 1990	2491	-	12	2285	194
November 1991	1510	-	67	1284	159
November 1992	1162	-	71	890	201
November 1993	862	-	36	734	92
November 1994	760	-	30	658	72
<p>MEN: Qualification Measure in the Firm, publicly financed by the BA with Provision of Income Maintenance (QB-PIM) Number of individuals: 2809</p>					
November 1989	-	2791	-	-	-
November 1990	2290	-	2	2120	168
November 1991	1316	-	2	1189	125
November 1992	994	-	5	817	172
November 1993	717	-	3	649	65
November 1994	628	-	0	574	54
<p>MEN: Qualification Measure in an External Institution, NOT publicly financed by the BA with Provision of Income Maintenance (QS-NIM) Number of individuals: 3704</p>					
November 1989	-	3681	-	-	-
November 1990	3122	-	140	2795	187
November 1991	1996	-	159	1684	153
November 1992	1564	-	141	1207	216
November 1993	1183	-	72	1022	89
November 1994	1037	-	25	925	87
<p>MEN: Qualification Measure in the Firm, NOT publicly financed by the BA with Provision of Income Maintenance (QB-NIM) Number of individuals: 3690</p>					
November 1989	-	3669	-	-	-
November 1990	3093	-	120	2790	183
November 1991	1983	-	143	1689	151
November 1992	1549	-	127	1220	202
<i>continued on next page</i>					

<i>continued from previous page</i>					
	Attrition	Initial Cond.	Qualification	Employment	
	1	1	1	1	0
November 1993	1178	-	68	1032	78
November 1994	1029	-	16	938	75
<p>WOMEN: Qualification Measure in an External Institution, publicly financed by the BA with Provision of Income Maintenance (QS-PIM) Number of individuals: 3040</p>					
November 1989	-	2889	-	-	-
November 1990	2388	-	19	2036	333
November 1991	1489	-	113	1044	332
November 1992	1187	-	176	690	321
November 1993	974	-	78	607	289
November 1994	846	-	43	566	237
<p>WOMEN: Qualification Measure in the Firm, publicly financed by the BA with Provision of Income Maintenance (QB-PIM) Number of individuals: 2557</p>					
November 1989	-	2415	-	-	-
November 1990	1973	-	5	1697	271
November 1991	1132	-	5	905	222
November 1992	855	-	9	614	232
November 1993	671	-	4	491	176
November 1994	572	-	1	425	146
<p>WOMEN: Qualification Measure in an External Institution, NOT publicly financed by the BA with Provision of Income Maintenance (QS-NIM) Number of individuals: 3448</p>					
November 1989	-	3290	-	-	-
November 1990	2750	-	154	2304	292
November 1991	1788	-	166	1360	262
November 1992	1428	-	160	969	299
November 1993	1183	-	105	849	229
November 1994	1049	-	45	805	199
<p>WOMEN: Qualification Measure in the Firm, NOT publicly financed by the BA with Provision of Income Maintenance (QB-NIM) Number of individuals: 3373</p>					
November 1989	-	3218	-	-	-
November 1990	2707	-	122	2292	293
November 1991	1750	-	152	1340	258
<i>continued on next page</i>					

<i>continued from previous page</i>					
	Attrition	Initial Cond.	Qualification	Employment	
	1	1	1	1	0
November 1992	1386	-	112	999	275
November 1993	1142	-	88	835	219
November 1994	997	-	40	769	188

Table 6: Definition of Samples and Variables

Variable	Definition
<i>Sample Definitions:</i>	
QS-PIM	includes all individuals who have either never participated in any of the qualification measures within the period November 1990 to November 1994 or have participated in a qualification measure in <i>an external institution with the provision of income maintenance from the labor office.</i>
QB-PIM	includes all individuals who have either never participated in any of the qualification measures within the period November 1990 to November 1994 or have participated in a qualification measure in <i>the firm with the provision of income maintenance from the labor office.</i>
QS-NIM	includes all individuals who have either never participated in any of the qualification measures within the period November 1990 to November 1994 or have participated in a qualification measure in <i>an external institution without the provision of income maintenance from the labor office.</i>
QB-NIM	includes all individuals who have either never participated in any of the qualification measures within the period November 1990 to November 1994 or have participated in a qualification measure in <i>the firm without the provision of income maintenance from the labor office.</i>
<i>Dependent Variables:</i>	
$A_{it} \equiv Y_{it,A}$	1 if the whole set of variables used in the employment and qualification equations is available in each wave 0 otherwise
$E_{it} \equiv Y_{it,E}$	1 if person is employed or self-employed, 0 if person is unemployed (officially registered as well as not-registered), or participating in a qualification measure or housewife or househusband
$W_{it} \equiv Y_{it,W}$	real hourly net wage: if person is employed or self-employed and reports positive net monthly earnings and regular working hours (this variable is deflated by the East Germany's CPI),

*continued on next page*



continued from previous page	
Variable	Definition
	0 if person is unemployed (officially registered as well as not-registered), or participating in a qualification measure or housewife or househusband or does not report positive net monthly earnings and regular working hours
$Q_{it} \equiv Y_{it,Q}$	1 if person is currently participating in training within the firm where the person is employed or in a qualification measure in an external institution. 0 otherwise
Female	1 if female 0 if male
<i>Occupational Qualification: reference category = not having completed a higher occupational education than a partial apprenticeship</i>	
Facharbeiter	1 if person reports that his/her highest professional qualificational degree is "Facharbeiter", which corresponds to having completed a full apprenticeship (craftsman) 0 otherwise
Meister	1 if person reports that his/her highest professional degree is "Meister" which is a master craftsman 0 otherwise
Fachschule	1 if person has a degree from a specialized vocational school 0 otherwise
University	1 if person has a university degree 0 otherwise
<i>Marital Status: reference category = unmarried, widow(er), or divorced</i>	
Married	1 if person is married 0 otherwise
<i>Sectoral Employment: reference category = agriculture</i>	
$E_{i,t-1} * Sec_k$	1 if person was employed at time of the last interview and working in sector k, with k equal to: 2 mining, gas, energy 3 construction 4 metal and electrics 5 other manufacturing 6 commerce 7 traffic, post, railways 89 banking, insurances, other services Dummies are constructed such that coefficients sum up to zero 0 otherwise
$E_{i,t-1} * Public$	1 if person was employed at time of the last interview in a firm which belonged to the public sector
continued on next page	

continued from previous page	
Variable	Definition
$E_{i,t-1} * Short$	0 otherwise 1 if person was employed at time of the last interview but working short-time 0 otherwise
$DUM_{W_t}$	wave dummies, with $W_4$ referring to the fourth wave of the LMM (November 1991), $W_6$ referring to the sixth wave of the LMM (November 1992), $W_7$ referring to the seventh wave of the LMM (November 1993), and $W_8$ referring to the eighth wave of the LMM (November 1994).
<i>Qualification Measures:</i>	
HH-Long-Run	1 if person will participate in a qualification measure (QS-PIM, QB-PIM, QS-NIM, QB-NIM) sometime in the future, has not done so before, and is not currently participating 0 otherwise
HH-Short-Run	1 if person will participate in a qualification measure (QS-PIM, QB-PIM, QS-NIM, QB-NIM) before the next interview, has not done so before, and is not currently participating 0 otherwise
QM-Effect-Short-Run	1 if, since the last interview, the person has finished a qualification measure (QS-PIM, QB-PIM, QS-NIM, QB-NIM) 0 otherwise
QM-Effect-Long-Run	1 if, sometime in the past, the person finished a qualification measure (QS-PIM, QB-PIM, QS-NIM, QB-NIM) 0 otherwise

## A.2 Estimation Results

Table 7: Estimation Results for Men

Specification	QS-PIM	QB-PIM	QS-NIM	QB-NIM
Variable	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)
Initial condition:				
Intercept	2.5762 (3.0)	2.3866 (2.7)	1.9443 (2.5)	1.9667 (2.4)
Age/10	-.1297 (.3)	-.0484 (.1)	.1661 (.4)	.1834 (.4)
Age <sup>2</sup> /100	.0057 (.1)	-.0029 (.0)	-.0203 (.4)	-.0282 (.5)
Married	.6043 (3.1)	.5762 (2.9)	.3871 (2.3)	.5539 (3.1)
$\rho_{E,0}$	.1322 (1.1)	.0717 (.5)	.0719 (.7)	.1091 (1.0)
Attrition Equation				
Intercept	-2.9287 (14.7)	-2.5494 (11.8)	-3.1495 (16.9)	-2.9933 (15.9)
Age/10	2.6051 (26.4)	2.4453 (23.1)	2.7256 (29.1)	2.6151 (27.5)
Age <sup>2</sup> /100	-.3263 (27.2)	-.3060 (23.7)	-.3430 (29.9)	-.3285 (27.9)
Linear Trend	-.8037 (21.8)	-.9136 (22.2)	-.6908 (50.9)	-.6948 (39.4)
$\rho_{A,W1}$	.2337 (39.4)	.2489 (38.6)	.2595 (45.3)	.2450 (43.7)
$\rho_{A,W4}$	1.3803 (51.2)	1.3005 (49.0)	1.4954 (60.7)	1.3765 (48.5)
$\rho_{A,W6}$	2.3135 (56.2)	2.3291 (61.7)	2.5594 (80.0)	2.3430 (61.0)
$\rho_{A,W7}$	2.5403 (48.1)	2.6623 (50.3)	2.4091 (66.3)	2.4281 (50.0)
$\rho_{A,W8}$	3.1638 (46.0)	3.4047 (48.3)	2.7930 (60.7)	2.8136 (51.7)
Qualification equation :				
Intercept	-2.5641 (4.7)	-5.2040 (.7)	-3.2130 (7.3)	-3.0745 (6.7)
$E_{i,t-1}$	-.9403 (9.5)	-1.5416 (2.4)	.0987 (.8)	.2434 (1.2)
Age/10	.5405 (1.8)	2.1016 (.7)	.4824 (2.7)	.4327 (2.2)
Age <sup>2</sup> /100	-.1006 (2.8)	-.3046 (.8)	-.0830 (3.9)	-.0672 (2.9)
Facharbeiter	.1382 (.7)	-	.6372 (2.6)	.2711 (1.9)
Meister	.2950 (1.2)	-	1.0172 (4.1)	.5581 (3.6)
Fachschule	.6312 (2.9)	-	1.2483 (5.0)	.7540 (5.1)
University	.7206 (3.2)	-	1.3537 (5.5)	.9135 (6.3)
$DUM_{W4}$	.7873 (4.1)	-1.0775 (.1)	.1931 (2.5)	.2609 (3.1)
$DUM_{W6}$	.9581 (4.6)	.4546 (.1)	.2005 (1.9)	.2894 (2.7)
$DUM_{W7}$	.4394 (1.3)	-.0878 (.0)	-.0614 (.3)	-.1200 (.7)
$DUM_{W8}$	.6955 (1.9)	-	-.2533 (1.1)	-.8769 (2.8)
$\rho_{Q,W1}$	.2832 (2.1)	.3506 (.1)	.0491 (1.0)	.0816 (1.4)
$\rho_{Q,W4}$	.2090 (1.8)	.9276 (.3)	.1629 (2.6)	.1006 (1.4)
$\rho_{Q,W6}$	.0972 (.6)	.0857 (.2)	.2007 (2.1)	.1350 (1.4)
$\rho_{Q,W7}$	.2598 (1.0)	.2405 (.1)	.1935 (1.2)	.2923 (2.1)
$\rho_{Q,W8}$	.0466 (.1)	-4.0484 (.0)	-.0193 (.1)	.3651 (1.7)

Table 7: Estimation Results for Men &lt;continued&gt;

Specification Variable	QS-PIM Coeff. (t-stat)	QB-PIM Coeff. (t-stat)	QS-NIM Coeff. (t-stat)	QB-NIM Coeff. (t-stat)
Employment equation:				
Intercept	-2.4723 (6.9)	-2.9917 (7.6)	-2.8515 (8.0)	-2.7364 (7.7)
$E_{i,t-1}$	1.4252 (17.0)	1.5675 (16.4)	1.6670 (21.6)	1.5588 (18.4)
$E_{i,t-1} \times Sec_2^{a,b}$	-.0032 (.0)	-.0264 (.3)	.0608 (.6)	-.0086 (.1)
$E_{i,t-1} \times Sec_3^{a,c}$	.0862 (1.3)	.0941 (1.3)	.1123 (1.7)	.0990 (1.5)
$E_{i,t-1} \times Sec_4^{a,d}$	.0183 (.3)	.0467 (.8)	-.0584 (1.1)	-.0087 (.2)
$E_{i,t-1} \times Sec_5^{a,e}$	.0276 (.4)	.0613 (.8)	.0524 (.8)	.0517 (.8)
$E_{i,t-1} \times Sec_6^{a,f}$	-.2126 (2.6)	-.1772 (2.1)	-.2637 (3.7)	-.2514 (3.4)
$E_{i,t-1} \times Sec_7^{a,g}$	.2246 (2.3)	.1175 (1.2)	.2346 (2.6)	.2525 (2.8)
$E_{i,t-1} \times Sec_{8,9}^{a,h}$	-.0369 (.5)	-.0549 (.7)	-.0209 (.3)	-.0697 (1.0)
$E_{i,t-1} \times Public$	-.0272 (.4)	.0079 (.1)	-.0449 (.7)	-.0331 (.5)
$E_{i,t-1} \times Short$	-.5410 (6.3)	-.5365 (5.4)	-.5116 (6.3)	-.5392 (6.5)
Age/10	1.3439 (7.9)	1.5543 (8.1)	1.4630 (8.6)	1.4619 (8.6)
Age <sup>2</sup> /100	-.1846 (9.4)	-.2113 (9.6)	-.1982 (10.2)	-.2006 (10.2)
Facharbeiter	.2632 (3.0)	.2791 (3.0)	.2661 (3.0)	.2962 (3.5)
Meister	.2927 (2.5)	.3210 (2.6)	.2591 (2.3)	.2950 (2.6)
Fachschule	.0900 (.8)	.1826 (1.5)	.1064 (1.0)	.1927 (1.7)
University	.0563 (.5)	.2163 (1.8)	.1881 (1.8)	.2326 (2.2)
Married	.3846 (6.6)	.3722 (5.6)	.3504 (6.2)	.3483 (6.0)
$DUM_{W4}$	-.1206 (1.3)	-.1133 (1.1)	-.1091 (1.4)	-.1041 (1.3)
$DUM_{W6}$	-.9338 (6.7)	-1.0781 (6.0)	-.7777 (6.8)	-.8200 (6.7)
$DUM_{W7}$	-.3477 (1.5)	-.6168 (2.1)	-.3377 (1.9)	-.5290 (2.5)
$DUM_{W8}$	-.3696 (1.6)	-.5746 (1.9)	-.3757 (2.0)	-.3979 (1.9)
HH-Long-Run	-.2717 (1.8)	-.0058 (.0)	.1592 (1.1)	.1602 (.9)
HH-Short-Run	-.7510 (3.9)	-.6461 (.7)	.1340 (.4)	-.2362 (1.0)
QM-Effect-Short-Run	-.5039 (3.3)	.8684 (1.1)	.1900 (1.6)	.5209 (3.8)
QM-Effect-Long-Run	.0075 (.1)	-.3849 (2.1)	.0613 (.8)	.0142 (.2)
$\rho_{E,W1}$	.2404 (4.6)	.3118 (5.4)	.2988 (5.7)	.3095 (5.8)
$\rho_{E,W4}$	.2423 (2.3)	.2794 (2.2)	.2476 (2.5)	.2311 (2.3)
$\rho_{E,W6}$	.8589 (4.8)	.9623 (4.3)	.6735 (4.2)	.8099 (4.4)
$\rho_{E,W7}$	.4759 (2.0)	.6823 (2.2)	.4226 (2.0)	.7049 (2.6)
$\rho_{E,W8}$	.5162 (2.1)	.6443 (2.1)	.3870 (1.8)	.4634 (2.0)

<sup>a</sup> Reference category: agriculture – Dummies are constructed such that coefficients

sum up to zero.

<sup>b</sup> sec2: mining, gas, energy

<sup>c</sup> sec3: construction

<sup>d</sup> sec4: metal and electrical manufacturing

<sup>e</sup> sec5: other manufacturing

<sup>f</sup> sec6: commerce

<sup>g</sup> sec7: traffic, post, railways

<sup>h</sup> sec89: banking, insurance, other services

Table 7: Estimation Results for Men &lt;continued&gt;

Specification Variable	QS-PIM Coeff. (t-stat)	QB-PIM Coeff. (t-stat)	QS-NIM Coeff. (t-stat)	QB-NIM Coeff. (t-stat)
Wage equation:				
Intercept	3.0626 ( 60.2)	3.0591 ( 56.1)	2.9579 ( 61.7)	3.0396 ( 63.7)
Age/10	.1480 ( 5.9)	.1487 ( 5.5)	.1951 ( 8.3)	.1512 ( 6.4)
Age <sup>2</sup> /100	-.0212 ( 7.2)	-.0212 ( 6.7)	-.0261 ( 9.5)	-.0210 ( 7.5)
Facharbeiter	.0527 ( 4.0)	.0470 ( 3.5)	.0497 ( 3.5)	.0548 ( 4.1)
Meister	.1150 ( 7.4)	.1014 ( 6.3)	.1085 ( 6.9)	.1335 ( 8.8)
Fachschule	.1646 ( 10.8)	.1541 ( 9.8)	.2112 ( 13.5)	.2084 ( 13.9)
University	.3919 ( 26.6)	.4260 ( 28.0)	.3946 ( 26.1)	.3999 ( 27.8)
$DUM_{W4}$	-.0377 ( 2.2)	-.0380 ( 2.0)	-.0233 ( 1.5)	-.0236 ( 1.5)
$DUM_{W6}$	-.0228 ( 1.0)	-.0321 ( 1.3)	.0236 ( 1.3)	.0368 ( 2.0)
$DUM_{W7}$	-.0847 ( 3.5)	-.1102 ( 3.8)	-.0305 ( 1.6)	-.0086 ( .4)
$DUM_{W8}$	-.0917 ( 3.6)	-.1193 ( 3.9)	-.0140 ( .7)	-.0151 ( .7)
HH-Long-Run	-.0675 ( 2.4)	-.0202 ( .1)	.0278 ( 1.4)	-.0208 ( 1.2)
HH-Short-Run	-.0081 ( .1)	.1007 ( .5)	.0158 ( .4)	.0534 ( 1.3)
QM-Effect-Short-Run	-.1108 ( 1.9)	.1028 ( .8)	-.0340 ( 2.2)	-.0120 ( .8)
QM-Effect-Long-Run	-.0695 ( 4.3)	-.0628 ( 1.5)	.0374 ( 4.4)	.0671 ( 8.0)
$\rho_{W,W1}$	.0394 ( 4.4)	.0309 ( 3.3)	.0398 ( 4.9)	.0418 ( 5.2)
$\rho_{W,W4}$	.1208 ( 8.0)	.1190 ( 7.1)	.1031 ( 7.3)	.1041 ( 7.1)
$\rho_{W,W6}$	.2370 ( 11.1)	.2322 ( 9.7)	.2090 ( 11.4)	.1899 ( 10.6)
$\rho_{W,W7}$	.2627 ( 11.3)	.2676 ( 10.0)	.2373 ( 12.0)	.2099 ( 10.1)
$\rho_{W,W8}$	.2752 ( 11.1)	.2874 ( 9.8)	.2319 ( 10.8)	.2242 ( 11.3)
$\sigma_{W,W1}$	.3383 (173.6)	.3402 (169.1)	.3425 (185.6)	.3359 (191.8)
$\sigma_{W,W4}$	.3398 (109.8)	.3408 (109.4)	.3485 (126.9)	.3556 (134.6)
$\sigma_{W,W6}$	.2964 ( 71.0)	.2962 ( 67.0)	.3172 ( 86.3)	.3106 ( 88.3)
$\sigma_{W,W7}$	.2597 ( 64.5)	.2579 ( 60.3)	.2944 ( 93.8)	.2872 ( 76.8)
$\sigma_{W,W8}$	.2611 ( 64.5)	.2666 ( 62.3)	.2891 ( 70.6)	.2778 ( 68.8)

Table 8: Specification Test Results for Men

Specification	QS-PIM	QB-PIM	QS-NIM	QB-NIM
Number of individuals	3032	2809	3704	3690
Test of RE specification $\chi^2$	22177.9	8715.1	40580.3	17924.5
Degrees of freedom	61	56	61	61
Test of Linear Time Trend in Qualification Equation				
$\chi^2$	18.3	-	11.4	25.9
Degrees of freedom	3	-	3	3
Test of Linear Time Trend in Employment Equation				
$\chi^2$	22.3	16.0	22.2	20.5
Degrees of freedom	3	3	3	3
Test of Linear Time Trend in Wage Equation				
$\chi^2$	2.057	1.76	5.5	7.6
Degrees of freedom	3	3	3	3
Test of sector specific effect of $E_{i,t-1}$ in Employment Equation				
$\chi^2(7)$	15.1	9.3	25.2	22.4
Test of wave specific effect of $\rho_{A,t}$ in Attrition Equation				
$\chi^2(4)$	2878.0	3121.2	6810.5	3381.9
Test of wave specific effect of $\rho_{Q,t}$ in Qualification Equation				
$\chi^2(4)$	1.2	0.09	3.5	3.3
Test of wave specific effect of $\rho_{E,t}$ in Employment Equation				
$\chi^2(4)$	13.8	11.1	6.4	11.5
Test of wave specific effect of $\rho_{W,t}$ in Wage Equation				
$\chi^2(4)$	191.6	159.7	209.9	170.0
Test of wave specific effect of $\sigma_{W,t}$ in Wage Equation				
$\chi^2(4)$	821.0	760.2	394.8	552.0
LOG-Likelihood	-11051.1	-11703.9	-17937.7	-17753.7

Table 9: Estimation Results for Women

Specification	QS-PIM		QB-PIM		QS-NIM		QB-NIM	
Variable	Coeff. (t-stat)		Coeff. (t-stat)		Coeff. (t-stat)		Coeff. (t-stat)	
Initial condition:								
Intercept	1.5225	(2.7)	1.3764	(2.3)	1.0799	(2.0)	1.2258	(2.2)
Age/10	.4610	(1.6)	.5546	(1.8)	.7458	(2.7)	.6713	(2.4)
Age <sup>2</sup> /100	-.0767	(2.2)	-.0867	(2.4)	-.1104	(3.3)	-.1021	(3.0)
Married	-.4282	(3.9)	-.5363	(4.4)	-.5188	(4.6)	-.5080	(4.5)
$\rho_{E,0}$	.0144	(.3)	-.0475	(.9)	.0267	(.5)	.0140	(.3)
Attrition Equation								
Intercept	-4.1140	(21.0)	-3.8883	(17.0)	-4.6624	(22.8)	-4.5097	(23.5)
Age/10	3.1427	(30.8)	3.1391	(26.7)	3.3644	(31.5)	3.3641	(33.7)
Age <sup>2</sup> /100	-.4009	(31.1)	-.3993	(27.1)	-.4284	(31.9)	-.4280	(33.9)
Linear Trend	-.6616	(26.3)	-.8845	(22.6)	-.4988	(41.1)	-.6198	(32.6)
$\rho_{A,W1}$	.2865	(39.7)	.3228	(44.1)	.3015	(45.3)	.2969	(48.0)
$\rho_{A,W4}$	1.1315	(44.3)	1.1874	(47.3)	1.3080	(43.0)	1.2477	(51.4)
$\rho_{A,W6}$	2.0226	(56.2)	2.0965	(56.3)	2.2413	(46.3)	2.0415	(61.3)
$\rho_{A,W7}$	2.5120	(47.0)	2.7389	(51.0)	2.1612	(40.6)	2.4656	(53.5)
$\rho_{A,W8}$	2.8078	(46.1)	3.3526	(52.1)	1.9732	(48.3)	2.6690	(52.9)
Qualification equation :								
Intercept	-2.1225	(4.8)	-8.3856	(.0)	-3.2377	(8.6)	-4.3189	(9.8)
$E_{i,t-1}$	-.8439	(10.9)	-.7010	(1.9)	.2556	(2.3)	.6681	(4.1)
Age/10	.3329	(1.4)	1.6227	(1.1)	.6516	(3.3)	.7767	(3.8)
Age <sup>2</sup> /100	-.0793	(2.6)	-.2179	(1.2)	-.1037	(4.2)	-.1080	(4.2)
Facharbeiter	.3951	(3.1)	3.2471	(.0)	.2921	(2.5)	.6098	(3.9)
Meister	.7390	(3.6)	3.2144	(.0)	.4966	(2.8)	.7510	(4.0)
Fachschule	.3929	(2.9)	3.2144	(.0)	.6994	(5.9)	.8864	(5.6)
University	.5176	(3.2)	3.5552	(.0)	1.0760	(8.9)	.9815	(6.0)
$DUM_{W4}$	.7705	(6.3)	-.9886	(.7)	.2197	(3.0)	.2036	(2.5)
$DUM_{W6}$	1.0857	(7.6)	.4574	(.9)	.1776	(1.9)	.0931	(.8)
$DUM_{W7}$	.2176	(1.1)	-.0764	(.1)	.0135	(.1)	-.0983	(.7)
$DUM_{W8}$	.6233	(2.7)	-75.2224	(.0)	-.0634	(.4)	.1095	(.6)
$\rho_{Q,W1}$	-.0412	(.4)	.3344	(1.3)	.1214	(2.4)	.0583	(1.1)
$\rho_{Q,W4}$	.3380	(3.9)	.9769	(1.4)	.0777	(1.2)	.1883	(2.7)
$\rho_{Q,W6}$	.1638	(1.5)	.1028	(.3)	.2317	(2.6)	.2266	(2.2)
$\rho_{Q,W7}$	.4709	(3.1)	.2781	(.6)	.2394	(2.2)	.3639	(3.0)
$\rho_{Q,W8}$	-.1226	(.6)	25.1684	(.0)	-.1053	(.7)	-.1524	(.8)

Table 9: Estimation Results for Women &lt;continued&gt;

Specification Variable	QS-PIM Coeff. (t-stat)	QB-PIM Coeff. (t-stat)	QS-NIM Coeff. (t-stat)	QB-NIM Coeff. (t-stat)
Employment equation:				
Intercept	-1.8096 (5.2)	-2.1088 (5.1)	-2.3335 (6.5)	-2.1894 (6.0)
$E_{i,t-1}$	1.6179 (26.6)	1.8213 (24.9)	1.7951 (28.3)	1.8052 (28.4)
$E_{i,t-1} \times Sec_2^{a,b}$	.2113 (1.6)	.1140 (.8)	.1239 (1.0)	.1387 (1.2)
$E_{i,t-1} \times Sec_3^{a,c}$	.0446 (.4)	.1549 (1.1)	.1656 (1.5)	.1151 (1.1)
$E_{i,t-1} \times Sec_4^{a,d}$	-.0230 (.3)	-.1046 (1.2)	-.0823 (1.1)	-.1692 (2.4)
$E_{i,t-1} \times Sec_5^{a,e}$	-.2124 (3.7)	-.2048 (3.1)	-.2036 (3.6)	-.1720 (3.1)
$E_{i,t-1} \times Sec_6^{a,f}$	-.1691 (3.1)	-.1502 (2.4)	-.1330 (2.4)	-.1089 (2.0)
$E_{i,t-1} \times Sec_7^{a,g}$	.2554 (2.1)	.3279 (2.4)	.2519 (2.2)	.2287 (2.1)
$E_{i,t-1} \times Sec_{8,9}^{a,h}$	.0645 (1.1)	.0849 (1.3)	.1212 (2.1)	.1699 (2.9)
$E_{i,t-1} \times Public$	.1275 (2.2)	.0891 (1.4)	.0800 (1.4)	.1126 (2.0)
$E_{i,t-1} \times Short$	-.6207 (8.5)	-.5848 (7.0)	-.6704 (9.4)	-.7105 (9.9)
Age/10	.9169 (5.2)	1.0307 (5.0)	1.1378 (6.2)	1.0207 (5.6)
Age <sup>2</sup> /100	-.1330 (6.2)	-.1472 (5.9)	-.1583 (7.2)	-.1444 (6.5)
Facharbeiter	.1692 (2.7)	.1569 (2.3)	.1819 (2.8)	.1701 (2.6)
Meister	.5128 (4.1)	.3846 (2.7)	.4781 (3.8)	.3068 (2.6)
Fachschule	.3957 (5.3)	.3868 (4.7)	.3951 (5.2)	.3784 (4.9)
University	.5542 (5.1)	.4989 (3.7)	.4626 (4.6)	.3794 (3.6)
Married	-.0286 (.6)	-.1502 (2.4)	-.0772 (1.5)	-.0534 (1.0)
$DUM_{W4}$	-.2820 (3.8)	-.2160 (2.3)	-.2303 (3.3)	-.1497 (2.0)
$DUM_{W6}$	-.5254 (5.1)	-.5323 (3.7)	-.5150 (5.9)	-.4065 (4.2)
$DUM_{W7}$	-.1953 (1.4)	-.2331 (1.0)	-.2265 (1.9)	-.1572 (1.1)
$DUM_{W8}$	-.2647 (1.7)	-.3983 (1.6)	-.3607 (3.0)	-.3479 (2.3)
HH-Long-Run	-.3654 (4.0)	-.2113 (.6)	.1475 (.9)	.2912 (2.1)
HH-Short-Run	-.7629 (5.4)	-.3246 (.5)	.0401 (.2)	-.0021 (.0)
QM-Effect-Short-Run	-.2813 (2.9)	-.9125 (2.7)	.4876 (3.7)	.5535 (4.3)
QM-Effect-Long-Run	-.0354 (.5)	.0198 (.1)	-.0317 (.5)	-.0052 (.1)
$\rho_{E,W1}$	.3575 (7.0)	.3563 (6.0)	.3301 (6.0)	.3109 (6.1)
$\rho_{E,W4}$	.1070 (1.4)	.1404 (1.4)	.1309 (1.7)	.0961 (1.2)
$\rho_{E,W6}$	.3095 (2.7)	.3218 (2.0)	.2755 (2.4)	.2825 (2.3)
$\rho_{E,W7}$	.0532 (.4)	.1238 (.6)	.0843 (.6)	.0660 (.4)
$\rho_{E,W8}$	.2132 (1.4)	.3029 (1.4)	.3259 (2.4)	.3266 (1.9)

<sup>a</sup> Reference category: agriculture – Dummies are constructed such that coefficients sum up to zero.

<sup>b</sup> sec2: mining, gas, energy

<sup>c</sup> sec3: construction

<sup>d</sup> sec4: metal and electrical manufacturing

<sup>e</sup> sec5: other manufacturing

<sup>f</sup> sec6: commerce

<sup>g</sup> sec7: traffic, post, railways

<sup>h</sup> sec89: banking, insurance, other services



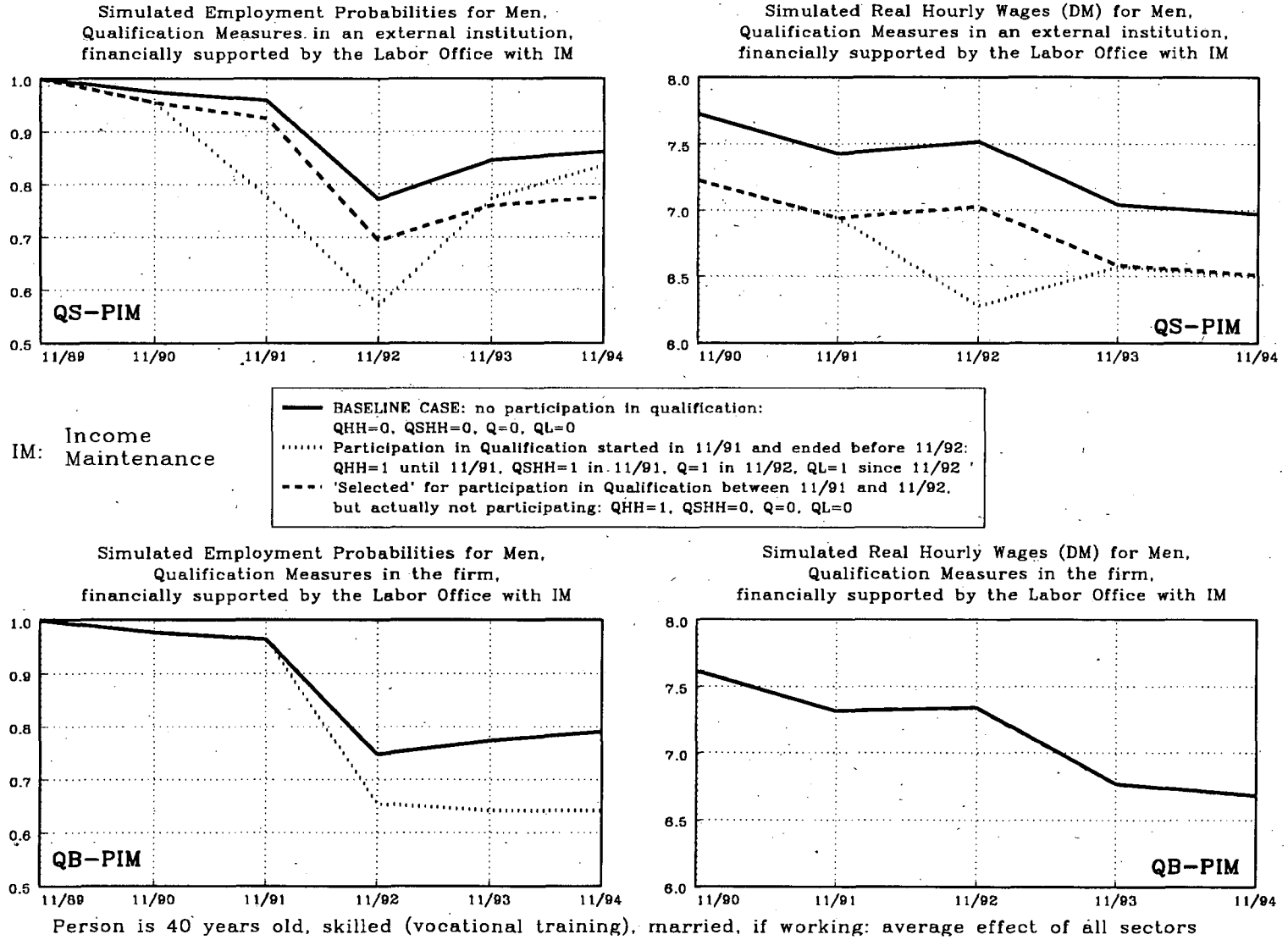
Table 9: Estimation Results for Women &lt;continued&gt;

Specification Variable	QS-PIM Coeff. (t-stat)	QB-PIM Coeff. (t-stat)	QS-NIM Coeff. (t-stat)	QB-NIM Coeff. (t-stat)
Wage equation:				
Intercept	2.9285 (41.9)	3.0282 (39.7)	2.8753 (47.2)	2.9209 (48.8)
Age/10	.1144 (3.2)	.0581 (1.5)	.1417 (4.6)	.1101 (3.6)
Age <sup>2</sup> /100	-.0156 (3.6)	-.0087 (1.8)	-.0189 (5.0)	-.0148 (4.0)
Facharbeiter	.0088 (.7)	.0057 (.4)	.0129 (1.1)	.0168 (1.4)
Meister	.0760 (3.4)	.0646 (2.7)	.0310 (1.6)	.0645 (3.3)
Fachschule	.2453 (17.0)	.2485 (17.2)	.2286 (18.2)	.2495 (19.9)
University	.4818 (29.1)	.5333 (30.4)	.4910 (36.2)	.5003 (36.8)
$DUM_{W4}$	-.0279 (1.4)	-.0487 (2.2)	-.0265 (1.7)	-.0226 (1.4)
$DUM_{W6}$	.1111 (4.6)	.0568 (1.8)	.0868 (5.0)	.0919 (4.7)
$DUM_{W7}$	.0083 (.2)	-.0528 (1.2)	.0578 (2.7)	.0285 (1.2)
$DUM_{W8}$	.0083 (.3)	-.0639 (1.4)	.0778 (4.0)	.0622 (2.6)
HH-Long-Run	-.0402 (1.9)	-.1056 (1.0)	.0484 (2.4)	.0485 (2.7)
HH-Short-Run	.0478 (1.0)	.0755 (.5)	.0430 (1.3)	.0016 (.0)
QM-Effect-Short-Run	-.1123 (2.7)	-.3097 (1.7)	.0055 (.3)	-.0042 (.2)
QM-Effect-Long-Run	-.0002 (.0)	-.0094 (.2)	.0916 (10.3)	.0970 (12.0)
$\rho_{W,W1}$	.0235 (2.1)	.0249 (2.0)	.0340 (3.6)	.0283 (3.0)
$\rho_{W,W4}$	.0776 (3.7)	.1033 (4.6)	.1084 (6.8)	.1117 (6.7)
$\rho_{W,W6}$	.1347 (5.5)	.1747 (5.8)	.1814 (10.2)	.1757 (9.0)
$\rho_{W,W7}$	.2045 (5.6)	.2395 (5.6)	.2196 (8.5)	.2228 (7.9)
$\rho_{W,W8}$	.2111 (7.5)	.2560 (6.0)	.2011 (10.0)	.1953 (8.2)
$\sigma_{W,W1}$	.3389 (137.0)	.3374 (125.8)	.3257 (143.6)	.3263 (156.7)
$\sigma_{W,W4}$	.3422 (97.8)	.3229 (82.5)	.3298 (118.5)	.3284 (101.6)
$\sigma_{W,W6}$	.3099 (64.2)	.3017 (52.8)	.2878 (67.7)	.2977 (67.5)
$\sigma_{W,W7}$	.3091 (59.8)	.2974 (57.2)	.2968 (89.3)	.2970 (72.1)
$\sigma_{W,W8}$	.2786 (34.9)	.2649 (32.7)	.2687 (50.0)	.2645 (44.9)

Table 10: Specification Test Results for Women

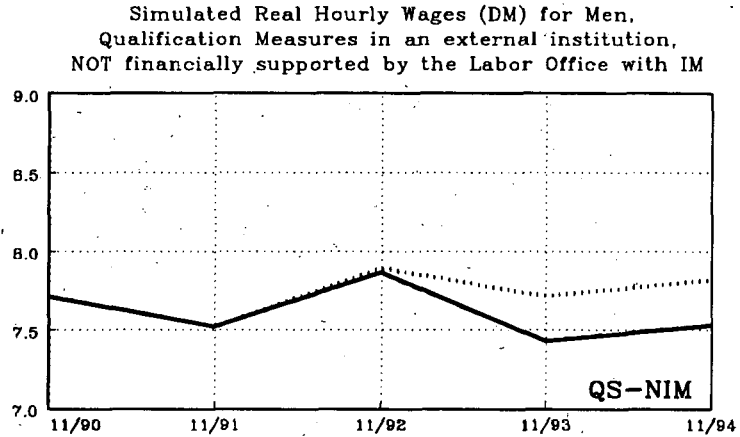
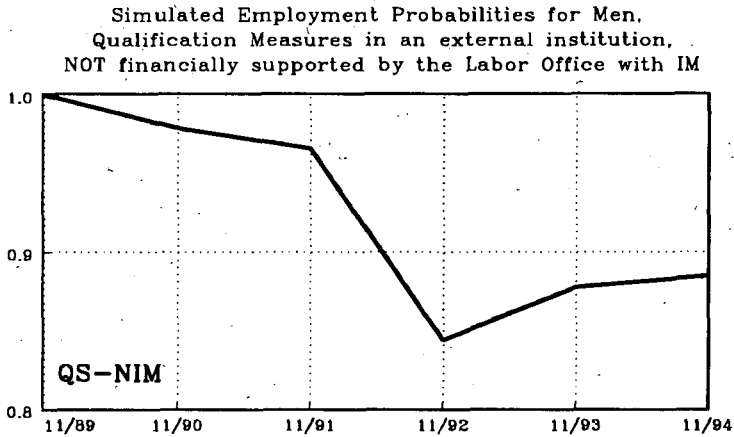
Specification	QS-PIM	QB-PIM	QS-NIM	QB-NIM
Number of individuals	3040	2557	3448	3373
Test of RE specification $\chi^2$	6967.8	18627.2	22322.8	18743.3
Degrees of freedom	61	60	61	61
Test of Linear Time Trend in Qualification Equation				
$\chi^2$	56.5	1.5	11.6	7.7
Degrees of freedom	3	3	3	3
Test of Linear Time Trend in Employment Equation				
$\chi^2$	16.6	4.9	16.6	6.6
Degrees of freedom	3	3	3	3
Test of Linear Time Trend in Wage Equation				
$\chi^2$	20.1	10.1	19.1	17.4
Degrees of freedom	3	3	3	3
Test of sector specific effect of $E_{i,t-1}$ in Employment Equation				
$\chi^2(7)$	28.8	24.1	35.4	34.2
Test of wave specific effect of $\rho_{A,t}$ in Attrition Equation				
$\chi^2(4)$	2504.1	2389.1	2113.8	3277.6
Test of wave specific effect of $\rho_{Q,t}$ in Qualification Equation				
$\chi^2(4)$	12.0	1.1	4.8	8.9
Test of wave specific effect of $\rho_{E,t}$ in Employment Equation				
$\chi^2(4)$	11.0	4.1	6.9	7.0
Test of wave specific effect of $\rho_{W,t}$ in Wage Equation				
$\chi^2(4)$	77.5	59.1	134.6	109.8
Test of wave specific effect of $\sigma_{W,t}$ in Wage Equation				
$\chi^2(4)$	119.1	147.1	227.1	185.9
LOG-Likelihood	-15484.2	-11340.7	-18173.5	-17253.3

Figure 2: Simulated Employment Probabilities and Real Hourly Wages (DM) for Men, Receiving Income Maintenance (PIM) During the Qualification Measure



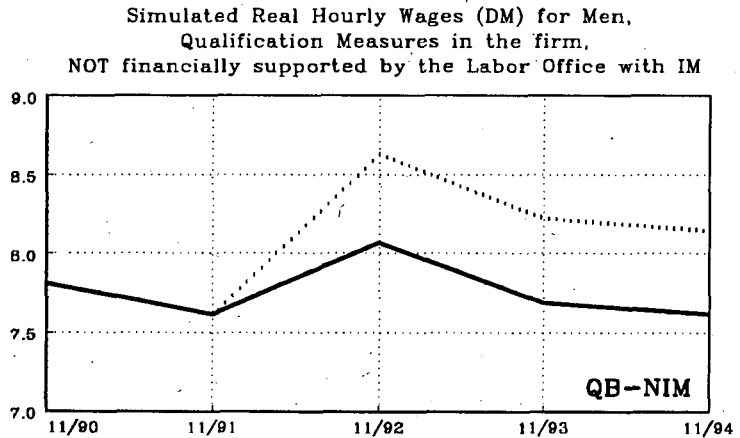
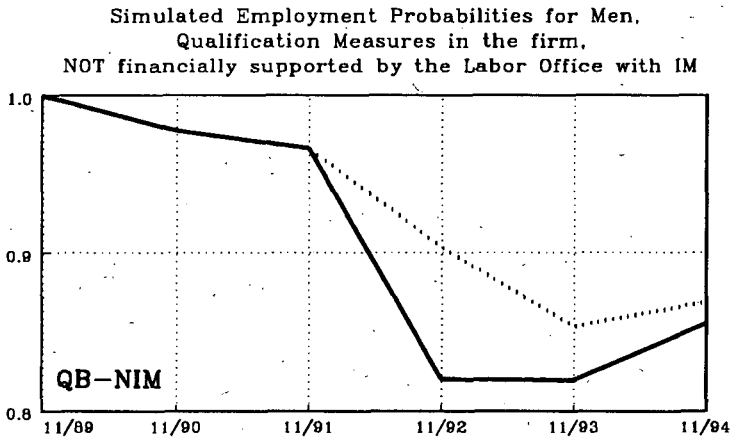
IM: Income Maintenance

Person is 40 years old, skilled (vocational training), married, if working: average effect of all sectors



IM: Income Maintenance

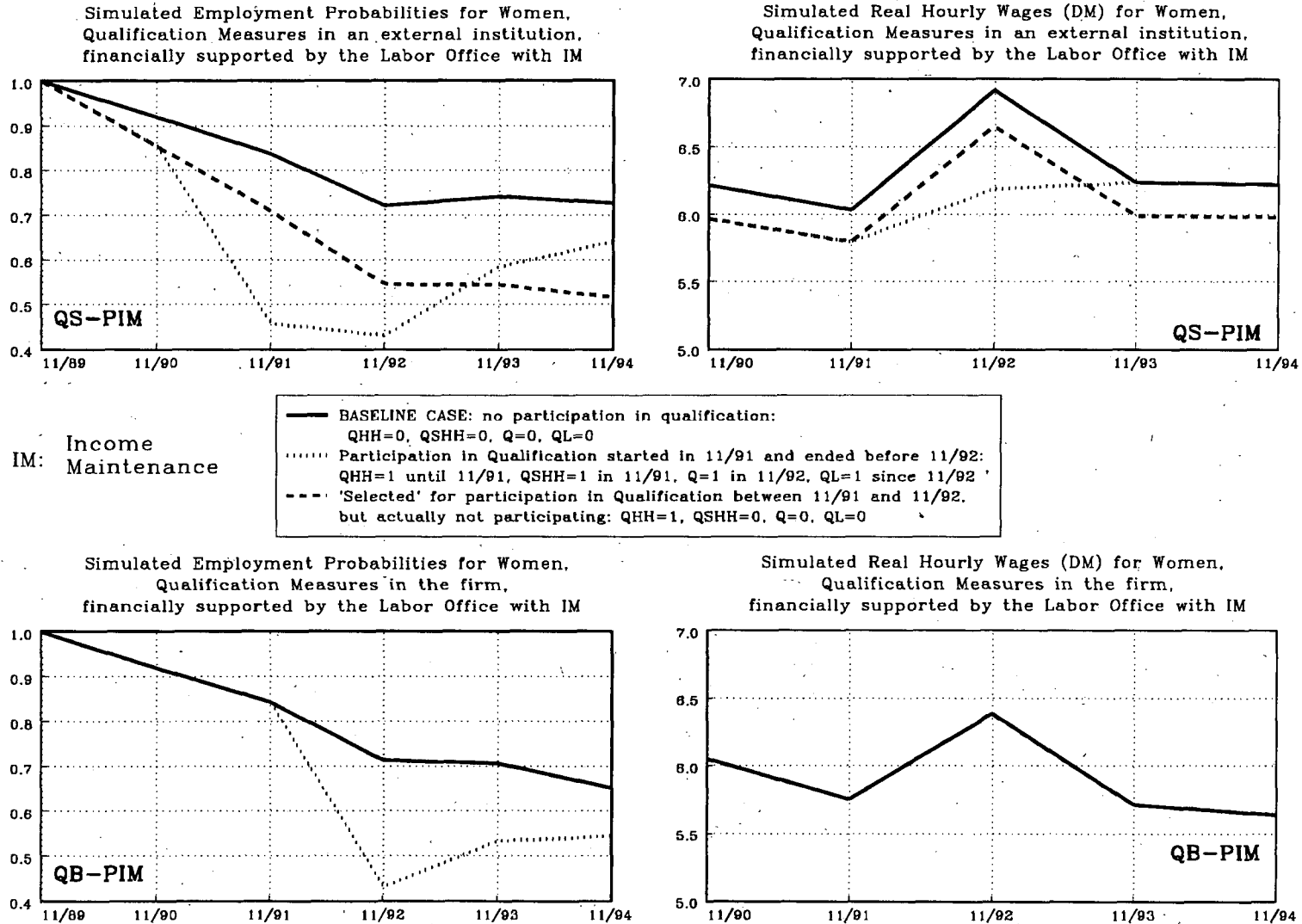
— BASELINE CASE: no participation in qualification:  
QHH=0, QSHH=0, Q=0, QL=0  
..... Participation in Qualification started in 11/91 and ended before 11/92:  
QHH=1 until 11/91, QSHH=1 in 11/91, Q=1 in 11/92, QL=1 since 11/92  
- - - 'Selected' for participation in Qualification between 11/91 and 11/92,  
but actually not participating: QHH=1, QSHH=0, Q=0, QL=0



Person is 40 years old, skilled (vocational training), married, if working: average effect of all sectors

Figure 3: Simulated Employment Probabilities and Real Hourly Wages (DM) for Men, not Receiving Income Maintenance (NIM) During the Qualification Measure

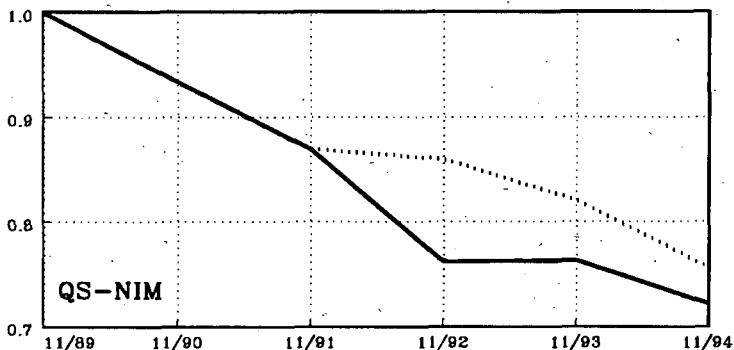
Figure 4: Simulated Employment Probabilities and Real Hourly Wages (DM) for Women, Receiving Income Maintenance (PIM) During the Qualification Measure



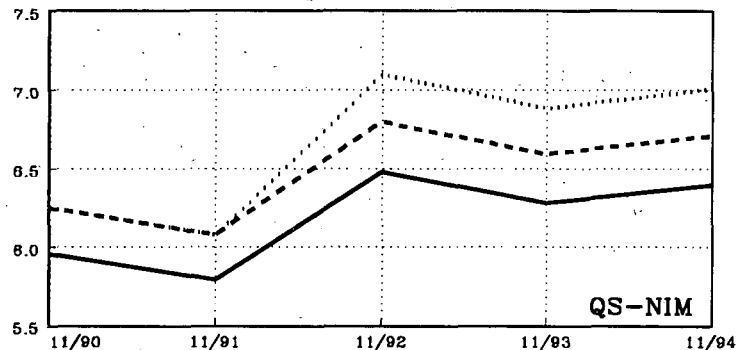
IM: Income Maintenance

Person is 40 years old, skilled (vocational training), married, if working: average effect of all sectors

Simulated Employment Probabilities for Women,  
Qualification Measures in an external institution,  
NOT financially supported by the Labor Office with IM



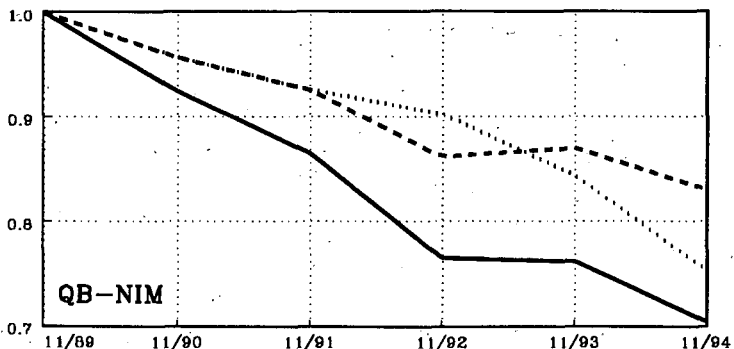
Simulated Real Hourly Wages (DM) for Women,  
Qualification Measures in an external institution,  
NOT financially supported by the Labor Office with IM



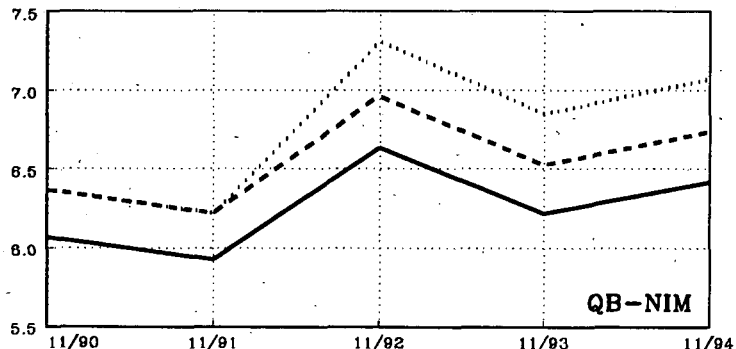
IM: Income Maintenance

— BASELINE CASE: no participation in qualification:  
QHH=0, QSHH=0, Q=0, QL=0  
 ..... Participation in Qualification started in 11/91 and ended before 11/92:  
QHH=1 until 11/91, QSHH=1 in 11/91, Q=1 in 11/92, QL=1 since 11/92  
 - - - 'Selected' for participation in Qualification between 11/91 and 11/92,  
but actually not participating: QHH=1, QSHH=0, Q=0, QL=0

Simulated Employment Probabilities for Women,  
Qualification Measures in the firm,  
NOT financially supported by the Labor Office with IM



Simulated Real Hourly Wages (DM) for Women,  
Qualification Measures in the firm,  
NOT financially supported by the Labor Office with IM



Person is 40 years old, skilled (vocational training), married, if working: average effect of all sectors

Figure 5: Simulated Employment Probabilities and Real Hourly Wages (DM) for Women, not Receiving Income Maintenance (NIM) During the Qualification Measure

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