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Estonian Wage Structure and Private Sector Differentials

ABSTRACT: *During the Soviet period, the structure of wages in all of the Soviet republics was compressed. A central question for the transition in Estonia is whether wage differentials will begin to reflect real differences in human capital and sectorial shifts in production. Thus, wage determinants in Estonia are examined during the early stages of its transition toward a market economy. In addition, wage determinants are tested to determine if there are any differences between the state and nonstate sectors as well as whether wages are higher in the nonstate sector even after controlling for selection bias.*

The findings are that while being male positively affects wages in both sectors, being Russian positively affects wages only in the private sector. Higher education has a greater positive impact on wages in the nonstate sector. There is a positive return for working in the nonstate sector, and it actually increases—from 20 to 28 percent—when controlling for selection.

In Estonia, as in the other republics of the Soviet Union, wages used to be highly compressed. This compression meant that although everyone was not paid the same wage, individual characteristics such as education made little difference in the wages that people received. While Soviet policy-makers realized as early as Stalin's time that some degree of wage differen-

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tiation was important for incentives, the wage structure remained fairly compressed throughout the Soviet period.

This article focuses on the sector of employment and the effect it had on the extent to which individual characteristics—such as gender, nationality, and education—influenced wage rates. The focus of this article continues by examining the extent to which normal economic ideas about wage structure increasingly held true in Estonia in the early stages of the marketization of its economy.

Anderson and Vöormann (1990), using evidence from the 1979 Estonia Survey and the National Longitudinal Survey of Youth, showed that the compression of the wage structure was greater in Estonia than in the United States. They found that incomes in 1979 were more closely correlated with levels of education in the United States than in Estonia, and, for women in particular, that college education had a much larger effect on income in the United States than in Estonia.

In some ways, however, the Soviet wage structure was similar to that of market economies. Gaddy (1991) and many others have documented that the average monthly earnings of Soviet women were less than those of Soviet men. Gaddy estimates that, in the Soviet Union as a whole, women's earnings were roughly 70 percent of men's wages. Gaddy also found that, in the Soviet Union, average monthly wages varied widely across branches of economic activity, even when characteristics such as age and education were taken into account. Recent studies by the World Bank (1992) confirmed these patterns for Estonia.

Understanding these general characteristics of the Soviet wage structure, one can ask many questions about wages in Estonia after perestroika. First, what does the wage structure look like now? What economic or demographic factors influence a person's monthly earnings?

One factor—which is only now becoming relevant—is the sector of employment. That is, whether a person works in a state enterprise or a nonstate enterprise may very well influence his or her earnings. This factor is especially important when analyzing the impact of an economic and political transition. The wage structure in state enterprises is likely to continue to reflect the past, while the wage structure in nonstate enterprises should change more rapidly and should be indicative of developments in the future overall wage structure.

First, an examination was made of the wage structure in Estonia in 1991 by looking at the economic and demographic determinants of wages for the survey respondents as a whole. Then an examination studied if the sector of employment made a difference in the wages. A test was conducted to determine whether the "private" or nonstate sector paid higher wages than the

state sector, even after taking into account the variables of age, gender, and education.

To understand the difference between these sectors more completely, the equations written for the wage structure of the two sectors are calculated separately. These equations allow one to determine if wage compression is greater in the state than in the nonstate sector.

A discussion of the different conditions in the two sectors, however, suggests that another factor, sector selection, may influence the results. That is, people who decide to work in the nonstate sector may be systematically different from people who take positions in the nonstate sector. This analysis concludes with a discussion about how individuals decide on their sector of employment, and another set of wage equations shows the wage structure after the choice of sector has been taken into account.

Table 1 lists the variables used in this article and their mean values. The sample for this analysis includes all the individuals for whom we could determine the sector of employment in their current job or most recent job, if not currently working. In the statistical analysis, the natural logarithm of monthly earnings was used as the dependent variable. This is a typical way to proceed in economic analyses of earnings. The average monthly earnings for this sample were 381 rubles.

As explained in the first article in this series, all the respondents to the survey completed general secondary education. Of the respondents, 1.4 percent received a vocational degree, 20 percent completed a *tekhnikum* (specialized secondary) degree, and 53 percent completed some higher education. These educational variables were used to test for returns to individual characteristics, that is, returns to "human capital" investments. In other words, to what extent had acquisition of additional education resulted in higher wage rates?

The initial study examined the effects of two demographic variables—gender and nationality—on wage rates. The gender variable shows whether there is an advantage to being a man, and the nationality variable shows whether there is an advantage to being an Estonian or a Russian that cannot be accounted for by other characteristics. This sample was 36 percent male and 27 percent Russian.

Finally, variables were included to indicate the economic branch of employment. This was done to test whether there was an advantage to working in a particular branch. It was also done to control for the branch in which a person worked when the effects of other characteristics were examined. The most heavily represented branches in this sample were agriculture and forestry (branch 6) and education (branch 9), each accounting for around 13 percent of the respondents.

Table 1

Description of Variables

Name	Variable description	Mean of variable in full sample
Dependent:	Natural logarithm of monthly wages in rubles	5.943
Log income sector	Dummy which equals one for individuals working in the nonstate sector	0.114
Independent:		
Risk	Dummy which equals one for individuals who answered "yes" to the question: Would you be willing to work in a private enterprise if it could give you a much higher salary, even if it meant that you would have a greater risk that at some time you could lose your job?	0.668
Control	Dummy which equals one for individuals who chose the statement: What happens to me is my own doing.	0.607
Command	Dummy which equals one for individuals who chose the statement: When I make plans, I am almost certain that I can make them work.	0.352
Initiative	Dummy which equals one for individuals who chose the statement: I usually take initiative rather than waiting for other people to solve problems.	0.686
Male	Dummy which equals one for men	0.357
Russian	Dummy which equals one for individuals who answered the survey in Russian	0.268
Family savings	Category numbers which represent increasing levels of family savings in rubles	2.826
Dependents	Number of dependents in the household	1.240
Vocational education	Dummy which equals one for individuals whose highest level of completed education is a vocational degree	0.014

Specialized secondary education	Dummy which equals one for individuals whose highest level of completed education is a secondary specialized two-year degree	0.200
Higher education	Dummy which equals one for individuals who have completed some amount of higher education	0.533

Branch variables are all dummies which equal one if the individual's current job is in the given branch

Branch 1	Heavy industry	0.086
Branch 2	Light industry	0.115
Branch 3	Construction	0.056
Branch 4	Transportation	0.036
Branch 5	Communications	0.016
Branch 6	Agriculture and forestry	0.129
Branch 7	Trade and public catering	0.062
Branch 8	Household services	0.055
Branch 9	Education	0.127
Branch 10	Public health and social services	0.074
Branch 11	Science	0.031
Branch 12	Culture and art	0.043
Branch 13	State bureaucracy and military	0.069
Branch 14	Information processing and finance	0.079
Branch 15	Other	0.022

Note: Full sample for *Log Income* is derived from the 1,735 valid observations on this variable. Full sample for all other variables is derived from the 1,831 observations which are valid for the probit regression on *Sector*.

Wage Structure

The first column in Table 2 presents a simple wage regression. First, looking at education, we can determine that the coefficients on the vocational and *tekhnikum* education variables are not significant. This means that we cannot conclude that attending a vocational school or *tekhnikum* after completion of studies in a general secondary school confers any advantage in wages. However, continuing to higher education does result in higher wage rates. The coefficient on the higher education variable suggests that there is a 30 percent return for having higher education after secondary school.¹

These findings coincide with conclusions reached by the World Bank (1992) about wages in Estonia in 1991. The World Bank reports that while the Soviet job classification system was abandoned in 1991, subsequent decrees to increase wages actually compressed the structure even more. Specifically, the World Bank study stated: "The structure of earnings by sector is poorly related to the structure of education by sector, indicating that financial returns to investment in education are quite low" (World Bank 1992, 70).²

This equation also shows there is an advantage to being male. The coefficient, which has a very significant *t*-statistic, implies that there is a 36 percent increase in Estonian earnings for being male even after controlling for education and other factors. Unfortunately, this is not surprising. On the other hand, it is interesting that, even with the other ethnic differences within Estonian society, being Russian does not seem, in general, to affect wages.

Finally, the branch variables show that there are some branch differentials in earnings. Branch 3 (construction) has an almost 20 percent positive return while branches 9 (education), 10 (public health and social services), and 12 (culture and art) have an average of a 20 percent negative return. Hence, working in construction led to relatively high wage rates, while working in education, public health and social services, and culture and art led to relatively low wage rates. All these results suggest that the wage structure in Estonia in 1991 was very similar to that established by the Soviet authorities.

In wage analysis, economists often discuss individual characteristics that cannot be measured but that are likely to have an effect on wages. These factors are called "unobservables" and are important for the interpretation of the effects on the observable variables in wage regressions. For example, while the coefficient on the higher education variable suggests that the skills and knowledge from education or the holding of a degree directly improve wages, it is possible that there are unobserved characteristics, such as motivation, which both influence the decision to obtain higher education

and influence wages. Higher education and better wages would be correlated but one would not "determine" the other.

Normally, little can be done to separate out these effects. This survey, however, did ask some questions to identify the presence or absence of unobservable characteristics in individuals. The variables used—control, command, and initiative—are explained in Table 1. This table shows that while 60 percent of the respondents felt that what happens to them was their own doing and almost 70 percent said that they took the initiative rather than waiting for others to solve problems, only 35 percent of the respondents felt confident that they could carry out the plans they made.

These qualitative measures are far from perfect for economic analysis, but when included in the regressions they do help to control for some of the unobservable influences on wages. The second column of Table 2 shows the results of the earlier equation with the addition of the three "unobservable" variables. All three of these characteristics do have a positive effect on wages with significant *t*-statistics, but the actual coefficients are not very large. They all have between a 6 and an 8 percent return. Also, the inclusion of these variables does not greatly alter the other coefficients—suggesting that the coefficients do represent direct effects.

Before expanding the analysis, the concept of hedonic wages should be discussed. Extensive work by Clifford Gaddy (1991) demonstrated that in the former Soviet Union, workers in many branches received nonwage, unofficial benefits which, along with paid wages, comprised wage bundles which more accurately reflected incomes. These nonwage benefits were called hedonic wages. Two nonwage benefits were the ability to pilfer goods and the ability to shirk (or steal hours) from the official working day. Gaddy's work suggests that, to the extent that these benefits affect the paid wage, we should control for them in the wage equation. In his empirical work, however, he expressed two proposals. One, pilfering varies by branch and gender, and two, stolen hours do not have a direct effect on official earnings.³ Thus, by controlling for branch and gender in this analysis, these effects are partially controlled for as well.

Sector Differential in Wages

The above two regressions give a general picture of the wage structure in Estonia at the time of the survey. However, the emergence of new economic institutions since the time of perestroika suggests that there is another factor which should be important to the wage structure: jobs outside of the state sector. Economists and other observers expect that productivity in the new and transforming enterprises will be higher. With the elimination of the

Table 2

Multiple Regressions on Log Income for the Full Sample

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant	5.731 (72.664)	5.612 (68.906)	5.910 (425.481)	5.767 (225.098)	5.622 (214.943)	5.637 (70.152)	5.525 (66.769)
Sector			0.294 (7.143)	0.311 (7.873)	0.263 (7.034)	0.207 (5.178)	0.201 (5.034)
Vocational education	-0.029 (0.276)	0.000 (0.002)		-0.065 (0.583)	-0.003 (0.028)	-0.016 (0.156)	0.012 (0.120)
Specialized secondary education	0.044 (1.128)	0.039 (1.089)		-0.046 (1.232)	0.015 (0.425)	0.038 (1.082)	0.034 (0.955)
Higher education	0.300 (10.202)	0.293 (9.725)		0.282 (9.287)	0.265 (9.228)	0.297 (9.986)	0.291 (9.789)
Male	0.360 (13.902)	0.349 (13.515)			0.387 (15.528)	0.349 (13.505)	0.339 (13.152)
Russian	-0.022 (0.771)	-0.025 (0.867)			0.021 (0.801)	-0.010 (0.344)	-0.014 (0.485)
Branch 1	0.023 (0.264)	-0.003 (0.035)				0.065 (0.741)	0.081 (0.930)
Branch 2	0.023 (0.780)	0.042 (0.506)				0.090 (1.087)	0.106 (1.287)
Branch 3	0.190 (2.131)	0.196 (2.211)				0.220 (2.475)	0.226 (2.555)
Branch 4	-0.094 (0.965)	-0.082 (0.853)				-0.013 (0.128)	-0.004 (0.039)
Branch 5	-0.181 (1.500)	-0.156 (1.308)				-0.094 (0.780)	-0.073 (0.611)
Branch 6	-0.101 (1.236)	-0.087 (1.066)				-0.019 (0.231)	-0.007 (0.091)
Branch 7	-0.029 (0.327)	-0.012 (0.138)				-0.017 (0.188)	0.000 (0.006)
Branch 8	-0.072 (0.802)	-0.054 (0.602)				-0.05 (0.060)	0.011 (0.118)
Branch 9	-0.244 (2.988)	-0.234 (2.883)				-0.151 (1.815)	-0.144 (1.744)
Branch 10	-0.208 (2.401)	-0.193 (2.246)				-0.116 (1.322)	-0.105 (1.207)
Branch 11	-0.142 (1.416)	-0.108 (1.082)				-0.045 (0.440)	-0.015 (0.149)
Branch 12	-0.181 (1.940)	-0.156 (1.683)				-0.095 (1.005)	-0.073 (0.782)
Branch 13	-0.097 (1.129)	-0.081 (0.950)				0.001 (0.015)	0.013 (0.149)
Branch 14	-0.024 (0.275)	-0.001 (0.015)				0.042 (0.493)	0.062 (0.727)
Control		0.078 (3.096)					0.080 (3.230)
Command		0.064 (2.471)					0.057 (2.228)
Initiative		0.061 (2.399)					0.057 (2.264)
Adjusted R ²	0.220	0.233	0.281	0.103	0.213	0.232	0.243
Base N	1,735	1,735	1,734	1,734	1,734	1,734	1,734

Note: T-statistics are reported in parentheses underneath the coefficient estimates.

Soviet job classification system, wages should correspond more closely to productivity. Thus, we expect that earnings in nonstate-sector jobs will be higher than those in state-sector jobs.

There are also other reasons to expect that wages in the nonstate sector will be higher. Employment in the nonstate sector is seen as riskier than employment in the state sector; that is, jobs are less secure. Employers in the nonstate sector will have to compensate for this risk with higher wages in order to attract workers (this issue will be discussed further below). Also, state-owned enterprises usually provide benefits to workers in addition to paid wages. These benefits may include access to health and educational facilities run by the firm and other services which are often difficult to obtain outside of the firm. In Estonia over the six years through 1994, mean wages accounting for these subsidies and benefits were 44 percent higher than mean paid wages excluding them (World Bank 1992, 134). New non-state-owned enterprises are less likely to be able to provide these services, thus we would expect that paid wages by these firms will be higher in order to compensate for offering fewer benefits.

This survey of Estonia allowed us to test this claim. In all the Baltic countries, but especially in Estonia, cooperatives were beginning to flourish under the provisions of Gorbachev's perestroika. By 1991 there were other nonstate forms as well: joint stock companies, joint ventures, and a few private enterprises. A little more than 10 percent of the sample consisted of people working full-time in these types of enterprises for their current or most recent job. In this article, these forms are called "private," although they are not all private in the sense of property ownership. Rather they are grouped together to distinguish them from state enterprises because the "private" companies all have decentralized control that allows for flexibility in wage setting.⁴ That is, they have evolved beyond state enterprises in terms of the relevant issue—wages.⁵

Table 2, column 3 presents a simple test of the claim that private sector jobs have a higher return. By regressing log income only on sector, we found that there was indeed a positive and statistically significant return in the private sector—almost 30 percent. The following columns in that table show the change in this effect when we control for the other wage determinants. The results demonstrate that the other factors do indeed explain some of the sector differentials. In addition, the inclusion of the branch effects especially lowers the coefficient on the sector.

However, even in the final column, the coefficient on the sector variable is still 0.2 and is statistically significant. That is, controlling for all the determinants established earlier, there remains a 20 percent return on working in the private sector.

Sector Differences in the Structure of Wages

This analysis merely reveals that wages in the private sector are higher than those in the state sector. Economists expect to see a difference also in the structure of the wages in the two sectors. If private enterprises have truly abandoned the Soviet job classification system, then each individual's earnings should be more reflective of his or her productivity. In addition, an individual's wages should reflect different characteristics (such as education) that relate to his or her productivity, and enterprises should use differentiated wage structures to provide incentives to employees both when hiring and during their employment.

To determine whether the wage structure is different in the private sector, we must use separate wage equations for each sector. Table 3 reports the results of these regressions. Note that to save space, the coefficients for each economic branch will not be listed. However, all of the regression equations were calculated with the dummy variables for the branches, as in Table 2.

The first thing to notice in Table 3 is that while the coefficients on the higher education and gender variables in the state sector are very similar to those for the sample as a whole, the coefficients in the private sector are much larger. Higher education results in a 41 percent increase in wage rates in the private sector compared to a 25 percent increase in the state sector; being male provides a 40 percent increase in the private sector compared with a 33 percent increase in the state sector. Two other coefficients stand out in the private sector equation: completing *tekhnikum* (specialized secondary) education and being Russian. Taking a *tekhnikum* course of education provides an 18.5 percent increase (which is statistically significant), and being Russian seems to provide a 20 percent increase (which is also statistically significant).

The changes in the effects of the education variables are positive from an economic standpoint. They suggest that the private sector does provide a return for a *tekhnikum* degree and the sector also provides a greater return for higher education. This reduces the compression of the wage structure, and thus rewards individuals according to their potential productivity.

The changes in the coefficients for the other variables are a little more troubling. They suggest that gender discrimination increases as one moves away from the Soviet system and that ethnic discrimination might be present in places in which it did not exist before. (These results will be examined more closely somewhat later.)

To understand the differences between the sectors, we should examine what kind of people work in the private sector and in what kinds of enter-

Table 3

Multiple Regressions on Log Income for Separate Sectors

	State	Private	State	Private	Mean	
					State	Private
Constant	5.783	5.971	5.546	5.586	1.000	1.000
Vocational education	-0.040 (0.345)	-0.392 (0.944)	0.031 (0.287)	-0.050 (0.125)	0.014	0.010
Specialized secondary education	-0.062 (1.554)	0.041 (0.352)	0.017 (0.461)	0.185 (1.612)	0.197	0.226
Higher education	0.258 (8.081)	0.465 (4.788)	0.248 (8.974)	0.410 (4.079)	0.543	0.482
Male			0.328 (12.156)	0.402 (4.492)	0.348	0.472
Russian			-0.039 (1.301)	0.198 (1.614)	0.286	0.156
Control			0.073 (2.832)	1.023	0.610	0.588
Command			0.055 (2.041)	0.080 (0.888)	0.340	0.467
Initiative			0.077 (2.909)	-0.100 (1.102)	0.684	0.734
Adjusted R ²	0.071	0.127	0.223	0.245	<i>F</i> test for Private = State	
Base N	1,537	199	1,537	199	<i>F</i> = 2.56	<i>P</i> = 0.0004

Note: T-statistics are reported in parentheses underneath the coefficient estimates. The dummies for branches were included in the equations but are not shown in this table.

prises. The last two columns of Table 3 report the means of the independent variables in the two subsamples. First, there were proportionally more people with tekhnikum degrees in the private sector, but the difference was not substantial. There were also fewer people with higher education in the private sector. Additionally, the biggest differences appeared in the demographic variables. The private sector had a much higher percentage of males and a much lower percentage of Russians.

Finally, the proportion of total jobs broken down by employment in the different economic branches varied greatly across the sectors. Much of the state sector employment included heavy industry, light industry, agriculture and forestry, and education. On the other hand, much of the employment in the private sector in this sample covered construction, trade, and public catering. Thus, during the time of the survey, the private sector looked quite a bit different from the state sector in terms of both demographics and industries.

Selection

The existence of these differences in the kinds of people who worked in the two sectors and the kinds of industries in the two sectors raised the concern that there was an additional "unobservable" factor at work that might be influencing the results of the regressions. People in Estonia and elsewhere were not randomly assigned to work in the state or private sector; rather they selected the sector in which they worked. There may be systematic differences between the people who chose to work in the state sector and those who chose to work in the private sector. The differences in the wages in the two sectors might result from differences between the workers in the two sectors that were not measured by the other variables considered.

This problem is called selection bias. The different compositions of the two sectors in this sample suggest that there are reasons why certain people chose to leave the state sector for a private sector job, and thus suggest that a selection bias might exist in the analysis.

Econometrics provides a technique for reducing some of the possible bias in the coefficient estimates as well as a means to test for the existence of a selection effect. This technique was devised by Lung-Fei Lee (1978) and James J. Heckman (1979); an explanation of it appears in the technical appendix to this article.

The concept of testing for bias and selection effects is based on the following premise. We can speculate about factors which influence the selection decision. Some of them will be the same factors which affect wages, but some of them may be different. For example, if we hypothesize

that education influences the selection decision, it could affect the decision in two ways. First, a person with higher education may expect that his or her wages will be higher in the private sector. If a person believes that the return for higher education is greater in the private sector, this would influence his or her sector selection. However, in addition, it is possible that his or her education led the person to believe that the private sector will be more stable in the long run, or that participation in the private sector is good for the economy. Thus, the person makes his or her decision based on this information. We can think of these as the indirect and direct effects of education on selection.

More important from the econometric standpoint are the factors which influence selection but do not determine wages. These allow us to specify a selection equation which is different from the wage equation. In the transition situation in Estonia one such factor is risk. In any given situation, different people are willing to accept different degrees of risk even with the same payoff. If employment in the private sector is viewed as risky relative to the state sector, then an individual's aversion to taking risks will influence his or her selection decision. Even though, on average, the wages in the private sector might compensate for the increased risk, each individual must be more or less willing to accept the risk/wage trade-off.

There are several reasons why employment in the private sector might be viewed as being riskier. The first is political. The changes in the Soviet republics, specifically the birth of new economic forms, were orchestrated by Gorbachev and his reform government. At the time of the survey, before the coup, there were doubts about Gorbachev's strength and staying power. Even now, with the victory of the reformers in Russia and Estonia's independence, there are still people who fear (or desire) the return of communist governments. A radical change in governments and a return to central planning would lead to the elimination or takeover of the new private enterprises, thus severely affecting individuals employed there.

Another source of risk is derived from the same source as the increased productivity in these enterprises. Because they are not state enterprises, these firms are not supported by state subsidies. This means that a cooperative or other private firm can actually fail, terminating all employment. In another scenario, an enterprise may simply be restricted by budget constraints and decide to decrease the number of workers (that is, it would not be restricted by norms against layoffs). Thus, in the period before mass bankruptcies of state-owned enterprises, employment in private firms was considered to be less secure than employment in state firms.

While risk aversion is difficult to measure, this survey allowed us to test and control for some of its influence. Specifically, the survey asked for a

Table 4

Iterations of the Selection Equation—Probit Regression on Sector

	(1)	(2)	(3)	(4)	(5)	(6)
Constant	-1.417 (19.114)	-1.494 (14.447)	-1.508 (14.134)	-1.552 (12.477)	-1.523 (11.162)	-1.860 (9.420)
Risk	0.294 (3.389)	0.279 (3.188)	0.273 (3.032)	0.263 (2.907)	0.275 (3.019)	0.292 (2.896)
Control		-0.131 (1.581)	-0.094 (1.114)	-0.098 (1.154)	-0.109 (1.270)	-0.091 (0.976)
Command		0.326 (3.927)	0.277 (3.282)	0.276 (3.259)	0.294 (3.430)	0.276 (2.947)
Initiative		0.053 (0.613)	0.060 (0.683)	0.059 (0.675)	0.068 (0.768)	0.083 (0.865)
Male			0.242 (2.994)	0.237 (2.884)	0.261 (3.105)	0.252 (2.658)
Russian			-0.386 (3.857)	-0.399 (3.917)	-0.374 (3.637)	-0.295 (2.561)
Family savings				0.022 (1.460)	0.024 (1.558)	0.037 (2.315)
Dependents				-0.003 (0.078)	0.009 (0.228)	0.034 (0.766)
Vocational education					0.016 (0.049)	-0.215 (0.595)
Specialized secondary education					0.044 (0.375)	0.103 (0.799)
Higher education					-0.174 (1.792)	-0.032 (0.293)

Note: T-statistics are reported in parentheses underneath the coefficient estimates. The dummies for branches were included in the equations but are not shown in this table.

response to the following statement: "I would be willing to work in a private enterprise if it could give me a much higher salary, even if it meant that I would have a greater risk that at some time I could lose my job." The resulting variable is called risk in Table 1. Of the respondents, 67 percent answered this question affirmatively, either agreeing or strongly agreeing. An affirmative response suggests that the individual is less averse to risk. We can then use this variable to help test for determinants of selection.

Two other variables were added as well: family savings and dependents. These variables should influence a person's aversion to risk. That is, if a person belongs to a family with a great deal of savings, he or she might be more willing to take an employment risk. Similarly, if there are many dependents in the household, a person might be less willing to take a risk.

The Heckman-Lee method requires that an estimate be made for the selection equation. That is, an equation is estimated with the above factors as the independent variables, and the sector of employment—private or state—as the dependent variable. This estimation is done using probit regression. Several iterations of this regression are shown in Table 4. The dependent variable is coded one for private and zero for state, so positive coefficients mean that the variable positively influences, or is positively correlated with, the individual's selection of the private sector. In the first column we can see that the willingness to accept risk does indeed have a positive and statistically significant coefficient.

The remaining columns show estimations with increasing numbers of variables. If we want to take all the factors connected with selection decisions into account, we need to include all the variables which we believe influence wages. This is because expected wages in each of the sectors will be part of the information used for selection.

In the final column we see that risk is still important. The variable command is positively correlated with selection, meaning that people who feel that they can make plans at work are more likely to select the private sector. We might suspect that this characteristic affects selection directly rather than only through higher wage expectations. Men are more likely to select the private sector, Russians are less likely, and we can accept that higher education has some impact on the decision. Family savings does have a statistically significant positive correlation, but a small coefficient.

Using the results of each of these regressions, a variable was created to test for selection in the wage equations. This variable is λ (lambda). The inclusion of this variable in the wage regressions should both test for selection effects and reduce the bias. The results of this analysis are presented in Table 5. Each column gives a comparison of state and private wage regressions for a different lambda—a different iteration of the selection equation.

Table 5

Corrected Regressions on Log Income for Various Iterations of the Probit Regressions on Sector

	Probit iteration:		(1)		(2)		(2)		(4)		(4)		(6)		(6)	
	State	Nonstate	State	Nonstate	State	Nonstate	State	Nonstate	State	Nonstate	State	Nonstate	State	Nonstate	State	Nonstate
Constant	5.691 (40.767)	6.538 (9.177)	5.685 (39.787)	6.636 (8.402)	5.594 (49.893)	7.075 (8.816)	5.556 (54.142)	7.058 (10.160)								
Vocational education	0.026 (0.230)	-0.041 (0.109)	0.028 (0.238)	-0.041 (0.109)	0.016 (0.160)	-0.125 (0.336)	0.027 (0.270)	-0.025 (0.059)								
Specialized secondary education	0.015 (0.367)	0.190 (1.727)	0.015 (0.353)	0.190 (1.732)	-0.000 (0.006)	0.182 (1.669)	-0.004 (0.112)	0.124 (0.907)								
Higher education	0.287 (8.532)	0.393 (4.148)	0.287 (8.237)	0.393 (4.155)	0.269 (9.012)	0.399 (4.273)	0.268 (8.912)	0.420 (3.698)								
Male	0.330 (11.258)	0.409 (4.810)	0.331 (10.902)	0.409 (4.801)	0.342 (9.599)	0.237 (1.719)	0.321 (10.463)	0.246 (1.954)								
Russian	-0.029 (0.905)	0.196 (1.681)	-0.029 (0.867)	0.196 (1.675)	-0.057 (1.339)	0.507 (2.697)	-0.036 (1.152)	0.414 (2.730)								
Control	0.079 (2.831)	0.098 (1.160)	0.050 (1.296)	0.161 (1.514)	0.069 (2.638)	0.148 (1.356)	0.075 (2.957)	0.125 (1.216)								
Initiative	0.076 (2.659)	-0.115 (1.340)	0.087 (2.406)	-0.140 (1.428)	0.061 (2.355)	-0.138 (1.296)	0.056 (2.177)	-0.142 (1.364)								
Lambda	0.684 (1.747)	-0.544 (1.348)	0.742 (1.728)	-0.578 (1.338)	0.111 (0.394)	-0.826 (1.891)	-0.133 (0.653)	-0.765 (2.206)								
Adjusted R ²	0.231	0.253	0.231	0.253	0.249	0.272	0.249	0.279								
Base N	1,481	195	1,481	195	1,465	194	1,465	194								

Note: T-statistics are reported in parentheses underneath the coefficient estimates. The dummies for branches were included in the equations but are not shown in this table.

The final columns of Table 5 then present the estimates which should have the least bias. Looking at these columns labeled "(6)," we can determine that a larger return exists for higher education in the private sector.

The difference between the returns in the two sectors actually increased by controlling for selection. Although the return for being male was lower in the private sector, this was mildly reassuring. Men in the private sector could expect a 25-percent return from discrimination at the time of the survey compared with a 32-percent return in the state sector. It is striking that the private sector showed a large return for being Russian. As a matter of fact, the return for this characteristic, 41 percent, was the largest of the estimated coefficients in this equation. There is no return at all for this characteristic in the state sector. The interpretation of this result will need further analysis, but it suggests that another kind of discrimination could exist in the new enterprises.

In the last row of the estimates, the selection variable, lambda, has a negative, large, and statistically significant coefficient in the private sector. The sign of the coefficient together with the sign of the lambdas in this sector (positive) indicates that there is negative selection of the private sector. In other words, the predicted wage in the private sector, which is conditional on selection of that sector, is less than the predicted wage given a random sorting.

That means that the people working in the private sector are not the people who could potentially earn the highest wages in this sector. These individuals might do better in the private sector than they would in the state sector, but they are less-than-average workers in both sectors. This is an interesting result. It suggests that as the transition progresses and more people move from state to private enterprises, productivity and wages will increase. However, productivity will only increase to the extent that the higher wages do not represent discrimination.

Finally, we can use a method developed by Blinder (1973) and Oaxaca (1973) to study the overall differential and/or the differential between the average wages in the private and state sectors. This method is described in the technical appendix, but the results are shown in the bottom right-hand corner of Table 6.

The total for column E of Table 6 represents the difference in wages explained by the differences in the characteristics, or endowments, of the employees. The total for the column marked C represents the difference in wages explained by the differences in the returns of the characteristics—that is, the differences in the coefficients in the wage equation. The negative E suggests that, according to endowments, individuals in the private sector should, on average, earn less. In turn, the positive C suggests that according

Table 6

Decomposition of the Differentials from the Selection-Corrected Equations

Variable	(1) State coefficient	(2) Private coefficient	(3) State mean of X	(4) Private mean of X	(5) E	(6) C	S
Constant	5.556	7.058	1.000	1.000	0.000	1.502	
Vocational education	0.027	-0.025	0.014	0.010	0.000	-0.001	
Specialized secondary education	-0.004	0.124	0.197	0.216	0.001	0.027	
Higher education	0.268	0.420	0.546	0.485	-0.021	0.078	
Male	0.321	0.246	0.354	0.479	0.036	-0.031	
Russian	-0.036	0.414	0.282	0.155	-0.024	0.098	
Control	0.075	0.125	0.609	0.598	-0.001	0.030	
Command	0.048	-0.120	0.343	0.469	-0.005	-0.068	
Initiative	0.056	-0.142	0.686	0.732	-0.002	-0.140	
Lambda	-0.133	-0.765	-0.184	-1.393			-1.090
Total					-0.197	1.571	
					R =	0.284	
					RC =	1.374	

to the returns of the endowments, individuals in the private sector should, on average, earn more. The calculation of S , then, is the difference in wages explained by selection. That is, given the selection process, individuals in the private sector should, on average, earn less than those in the state sector.

R in lower right-hand corner of Table 6 is the final differential. Even with the negative E and the negative S , it is still positive and indicates that there was a 28-percent return for working in the private sector at the time of the survey. This estimation is actually larger than the 20-percent return found in the noncorrected regression. RC is the net differential of the selectivity effect. It supports the above conclusion that the wage differential between the sectors would have been much higher with random sorting.

Conclusions

This article examined Estonian wages and its wage structure in several different ways. While one should not believe that the number estimates provide exact reflections of reality, there were a few points which the analysis makes clear. First, we found evidence of wage discrimination against women. This evidence supports the findings of other researchers concerning the former Soviet Union, but the differential in this analysis appears in the whole sample and in both the state and the private sectors. This indicates that discrimination continues to persist in the new enterprise forms.

In both the uncorrected and corrected estimated wage equations, evidence is found for a private-sector wage differential. There are good reasons to hypothesize that a differential exists in addition to the higher productivity of private sector firms. The differential could be compensating for both increased risk and reduced benefits outside of the state sector. In addition, evidence from both the uncorrected and corrected regressions indicates that the wage structure in the private sector did indeed expand. A greater return exists for higher education, and a return appears for both a *tekhnikum* degree and for being Russian. The increased returns for education are what economists hope to see during and after the transition.

Technical Appendix

The Heckman-Lee method involves estimating a selection equation which, in this case, is a probit model on the binary variable of sector participation. Using these coefficient estimates, one calculates the Inverse Mill's Ratio, or λ , for each observation. One then uses this variable to control for selection in the wage regressions. Observations about the private ($SECTOR = 1$) and state ($SECTOR = 0$) sectors calculate λ as follows:

$$\lambda_1 = \frac{\Phi(\beta'x_i)}{\Phi(\beta'x_i)}$$

$$\lambda_0 = \frac{-\Phi(\beta'x_i)}{1 - \Phi(\beta'x_i)}$$

Estimation of a selectivity variable assumes that there are determinants that influence selection which do not directly affect wages and are therefore not accounted for in the wage equations. In this analysis these variables are risk, family savings, and dependents.

The Blinder/Oaxaca method of separating out the three components of a differential is explained by Idson and Feaster (1990). This method attempts to separate out the three components of the differential which are (i) differences in the characteristics of the employees, (ii) differences in the returns for these characteristics in the two sectors, and (iii) selection bias. As explained by Idson and Feaster (1990, 112), conditional on being employed in the private sector, the wage equation for the i th individual may be written as follows:

$$\ln W_{ip} = \beta_{ip}x_{ip} + \psi_{ip}\lambda_{ip} + v_{ip}$$

where x_{ip} is the vector of regressors for the i th person in the private sector, β is the associated coefficient vector, λ is the selection criterion, and ψ is the covariance between the two errors. One can decompose the differential as:

$$\ln \bar{W}_{ip} - \ln \bar{W}_{is} =$$

$$0.5(\beta_p + \beta_s)'(\bar{x}_p - \bar{x}_s) + 0.5(\beta_p - \beta_s)'(\bar{x}_p - \bar{x}_s) + (\psi_p\bar{\lambda}_p - \psi_s\bar{\lambda}_s)$$

where subscripts p and s denote the private and state sectors, and $\bar{x}$ and $\bar{\lambda}$ denote the mean values over individuals within each sector.

In Table 6 then, the column marked E is the calculation of the first term of the three terms on the right-hand side. This is the first component of the differential as listed above. The column marked C is the second term or the second component, and the column marked S is the selection component. Thus, $R = E + C + S$ and $RC = R - S$.

Notes

1. The actual interpretation of the coefficients in the equations which have logged dependent variables is that a coefficient β indicates that the independent variable has a

100($e^{\beta}-1$) percent effect on the dependent variable. When β is close to zero, however, reading the coefficient itself as the percentage is a close approximation. This convention is used here.

2. In this quote, "sector" means branch of the economy and not state or nonstate sector.

3. While stolen hours do comprise an important part of the wage bundle, Gaddy found that they do not compensate for low official pay and they are uncorrelated with pilferage. Thus, they do not have a direct effect on official earnings.

4. In this case, "state" means jobs in state-owned enterprises which include—but are not exclusive to—jobs which fall within the state budget itself.

5. For an extensive discussion of the categorization of enterprise forms, see Brown's earlier work, "Private Sector Wage Differentials in Estonia," September 1992, University of Michigan, Department of Economics (mimeo).

Bibliography

- Abowd, John M., and Orley Ashenfelter. 1981. "Anticipated Unemployment, Temporary Layoffs, and Compensating Wage Differentials." In *Studies in Labor Markets*, edited by Sherwin Rosen. Chicago: University of Chicago Press.
- Anderson, Barbara A., and Rein Vöörmann. 1990. "The Early Life Course in the Soviet Union and the United States." Population Studies Center, University of Michigan. Manuscript.
- Blinder, Alan S. 1973. "Wage Discrimination: Reduced Form and Structural Estimates." *Journal of Human Resources* 8:436–55.
- Brown, Annette N. 1992. "Determinants of Attitudes Toward Economic Reform: Evidence from Estonia." Center for Russian and East European Studies, University of Michigan. Manuscript.
- Commander, Simon, and Fabrizio Coricelli. 1992. "The Labour Market in Transitional Socialist Economies: A Summary of the Workshop at Dobris." World Bank Research Project, World Bank (July). Mimeo.
- Gaddy, Clifford G. 1991. "The Labor Market and the Second Economy in the Soviet Union." *Berkeley-Duke Occasional Papers on the Second Economy in the USSR*, no. 24 (January). Working paper.
- Gaston, Noel. 1991. "Employment Uncertainty as a Job Characteristic." *Research in Labor Economics* 12:85–116.
- Greene, William H. 1991. *Limdep Version 6.0: User's Manual and Reference Guide*. Bellport, NY: Econometric Software, Inc.
- Heckman, James J. 1974. "Shadow Prices, Market Wages, and Labor Supply." *Econometrica* 42 (July): 679–94.
- . 1979. "Sample Selection Bias as a Specification Error." *Econometrica* 47 (January): 153–62.
- Idson, Todd L., and Daniel J. Feaster. 1990. "A Selectivity Model of Employer-Size Wage Differentials." *Journal of Labor Economics* 8 (January): 99–122.
- Lee, Lung-Fei. 1978. "Unionism and Wage Rates: A Simultaneous Equations Model with Qualitative and Limited Dependent Variables." *International Economic Review* 19 (June): 415–34.
- Maddala, G. S. 1983. *Limited-Dependent and Qualitative Variables in Econometrics*. Cambridge: Cambridge University Press.
- Oaxaca, Ronald. 1973. "Male-Female Wage Differentials in Urban Labor Markets." *International Economic Review* 9:693–709.

Ofer, Gur, and Aaron Vinokur. 1983. "The Labor-Force Participation of Married Women in the Soviet Union: A Household Cross-Section Analysis." *Journal of Comparative Economics* 7 (June): 158–76.

Slider, Darrell. 1991. "Embattled Entrepreneurs: Soviet Cooperatives in an Unreformed Economy." *Soviet Studies* (November): 797–821.

Topel, Robert H. 1984. "Equilibrium Earnings, Turnover, and Unemployment: New Evidence." *Journal of Labor Economics* 2 (October): 500–522.

Willis, Robert J. 1986. "Wage Determinants: A Survey and Reinterpretation of Human Capital Earnings Functions." In Volume 1 of *Handbook of Labor Economics*, edited by O. Ashenfelter and R. Layard. New York: Elsevier Science Publishers.

World Bank. 1992. "Estonia: The Transition to a Market Economy." *Country Economic Report*, vol. 1. Washington, DC: World Bank.