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THE LABOR MARKET AND THE SECOND ECONOMY IN THE SOVIET UNION

Clifford G. Gaddy

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WHO WORKS "ON THE LEFT"? THE DETERMINANTS OF SOVIET CITIZENS' SUPPLY OF LABOR TO THE SECOND ECONOMY*

CLIFFORD GADDY, *Duke University*

SUMMARY

What determines the propensity of Soviet citizens to work in the informal private sector of their economy? This paper examines the interaction between the formal and informal parts of the labor market in the USSR in the late 1970s based on data from the Berkeley–Duke survey of Soviet emigrants to the United States. Three main findings are reported:

(1) Soviet workers adjust their official incomes and working hours by various informal mechanisms, including stealing time, pilfering goods and materials from the workplace, and moonlighting in the second economy. Results of this analysis suggest that Soviet workers perceive the formal and informal components of their compensation in the first economy as equivalent.

(2) For both men and women, the labor supply curve in the second economy is forward–bending. As hourly earnings in second economy activity go up, both men and women supply more hours to the second economy.

(3) There is a clear asymmetry in household decision–making. When making his decision on participation in the second economy, the typical Soviet husband regards his wife's income as indistinguishable from his own (and the more she earns, the less likely he is to take a second economy job); yet his decision takes no account of her hours of work. For the wife, the situation is reversed: she must take into account her husband's work burden when making her decision to moonlight in the second economy (being less likely to moonlight as he works more hours on his primary job), while his income has no impact on her decision at all.

* A shorter version of this paper was published [in Russian] in *Ekonomika i matematicheskiye metody [Economics and mathematical methods]*, 25:3 (May–June 1990), pp. 398–411. Earlier versions were presented at the Duke University Labor Economics Workshop in February 1989 and the Social Science Research Council's Fifth Summer Workshop in Soviet and East European Economics, held at the University of California, Berkeley, in July 1989. Numerous participants at the Duke and Berkeley workshops offered valuable comments. Vladimir Treml and Gregory Grossman have provided constant advice and support in the context of the Berkeley–Duke Project on the Second Economy in the USSR. Special thanks to Marjorie McElroy for encouraging my efforts to adapt the theory and techniques of Western labor economics to the case of the Soviet Union. All responsibility for errors and omissions in this work is my own.

I. INTRODUCTION

Although a great deal has been written on the question of labor force participation and labor supply in the Soviet Union, very little includes any empirical testing of hypotheses. The main reason for this is data limitations. Despite *glasnost'*, the official Soviet data on the labor market remain extremely crude. As yet, there are no officially compiled micro data sets available to Western researchers (and indeed they may not be available to Soviet economists either.)

As a result, economists wishing to analyze Soviet labor market behavior have had to be content with highly aggregated data at best. Among the rare exceptions is the work of OFER and VINOKUR [1983, 1985], who used cross–sectional data from a survey of recent Soviet emigres to Israel to estimate female labor supply in the USSR. The present study is in part an attempt to supplement their efforts with estimation from another source of micro data on labor supply in the Soviet Union, the Berkeley–Duke Emigrant Survey (this survey is described in Section VI below). In addition, however, this paper extends previous investigations of Soviet labor supply by taking in account the substantial private economic activity of Soviet citizens, the phenomenon popularly known as working "on the left" [*nalevo*].

The paper outlines a model of labor supply and labor market participation in a setting of parallel official (state–sector) and unofficial (private–sector) labor markets. The model assumes that the individual is constrained to supply some minimum number of hours to the official labor market, but may in addition have the opportunity to supply hours to a separate unofficial market, where the wage may be higher than the wage in the official market.

The outline of the rest of this paper is as follows: Section II briefly indicates the importance of the unofficial, or "second," economy in the Soviet Union and in particular, for labor supply. Section III, concentrating on questions of measurement, contrasts the reality of the Soviet labor market to some common misperceptions about it. Section IV begins the preliminary development of a model through a simple graphical exposition of the individual's budget set in a second economy setting. Section V presents an empirical specification based on the model. Section VI introduces the data set and definitions of the variables used. Section VII contains the results of estimation. Section VIII summarizes the main conclusions.

II. THE SIZE OF THE SECOND ECONOMY

Over the past ten years, there has been significant research in the West on the phenomenon of the second economy in the Soviet Union.[1] It is only with the advent of *glasnost'* that Soviet researchers have been able to contribute openly to this discussion. Since about 1987, numerous quantitative estimates of the size of the "shadow" economy have appeared in Soviet journals. To this date, however, there are still no authoritative Soviet estimates of how large this sector of the economy is. Figures range from under 100 billion rubles a year to as high as 300–350 billion rubles a year [GOLOVNIN and SHOKHIN 1990].

The one area in which the Soviet estimates have tended to be fairly consistent is that of services. In quasi–official statements on the shadow economy in services, Soviet economists have since 1988 cited a figure of 14–16 billion rubles paid for services provided in the second economy in the mid–1980s, although even here it is stated that the true figure may be as high as 22–24 billion rubles a year [KORYAGINA 1989]. The upper limit of 24 billion rubles, which corresponds to estimates based on the Berkeley–Duke survey [NEUHAUSER and GADDY 1989], would imply that, measured in rubles spent, the private service economy is 50% as large as the official service sector, which totals around 50 billion rubles.

Exactly how such global estimates of the size of the second economy translate into labor supply is still an open question. In a recent article, economist Tat'yana KORYAGINA [1990] stated that some 30 million individuals, or 20% of the total Soviet work force, engage to some extent in illegal second economy activities. As of the beginning of 1990, there were nearly 5 million individuals officially recorded as part–time or full–time workers in the new (legal) private cooperatives, and approximately a million persons listed as private entrepreneurs under the new Law on Individual labor Activity. Based on Berkeley–Duke survey data, TREML [1990] estimates that around 11.5% of work hours of adult citizens in the urban USSR were being supplied to the second economy in the late 1970s.[2] The present paper does not directly attempt to reexamine these issues of aggregate labor supply to the second economy, but focuses instead on the determinants of second economy labor supply on the micro–level. That is, it will seek to explain who works in the second economy and how many hours they supply.

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[1] The now–standard definition of the Soviet second economy was established by Gregory GROSSMAN [1977, p. 25] as all production and exchange that is either (a) carried out directly for private gain or (b) knowingly illegal, or both. GROSSMAN [1990] lists over 300 Western–language publications on the topic of the Soviet second economy. Grossman's 1977 paper remains the best brief introduction to the phenomenon itself.

[2] Treml's estimate covers only what can be described as "productive labor." That is, it ignores the labor inputs associated with capital income (rental of housing space and sales of capital-type goods such as cars, houses, or apartments) and the labor time spent in such criminal activities as prostitution, gambling, or smuggling. We adhere to this same notion of second economy labor supply in the remainder of this paper.

Before beginning to develop a model to explain the individual's labor supply choices between the first and second economies, however, some preliminary issues of measurement need to be clarified.

III. MYTHS AND REALITIES OF THE SOVIET LABOR MARKET

Conventional descriptions of the conditions facing Soviet workers and employees are often contradictory. On the one hand, most Western economists acknowledge that (even prior to the current reform efforts) market–type forces have played an important role in the allocation of labor in the Soviet economy [GREGORY and STUART 1986]. On the other hand, it is a common perception that labor supply in the Soviet Union is rigid or even rationed. As part of a highly centralized command economy, it is certainly not unreasonable to expect that the system of labor allocation in the Soviet Union would fail to meet the conditions characterizing a free market. The notion of the rigidity of Soviet labor supply has to some extent been a corollary of official Soviet doctrine with respect to work itself. The author of a popular Soviet textbook of political economy, NIKITIN [1983], summed up the official position as of the mid–1980s: "While guaranteeing everyone the right to work, socialism also makes labor obligatory for all, makes it compulsory for everyone to participate in socialist production, this being the sacred duty of all members of socialist society, irrespective of their origins, sex, nationality, etc."

Such an ideological attitude is clearly not conducive to the concept of free choice in a market, and not surprisingly, formal Soviet law has hitherto followed in the same vein. Not only must everyone work, according to official doctrine—they must also work essentially the same amount. The length of the work week in the Soviet Union is regulated by law. On average it is 40.6 hours for industrial workers and 39.7 for white collar workers. Overtime is allowed, but it too is strictly regulated: the law sets a ceiling on overtime at 120 hours a year, or 2.5 hours a week on average. Similar legal restrictions make parttime work virtually impossible, at least on paper.

Surprisingly many Western scholars have accepted a substantial part of this picture of the rigid labor market. Their assessments of the possibility of working less than the standard work week are a good example. OFER and VINOKUR [1983], e.g., assert flatly that "parttime work does not exist in the USSR." MOSKOFF [1984, p. 27] states that "the proportion of all workers doing parttime work in the Soviet Union was miniscule: 0.32 per cent in 1974, 0.41 per cent in 1976, and 0.32 per cent in 1979."

If in fact such statements by both Western observers and official Soviet sources were true, it would be correct to characterize the Soviet labor market as a classic quantity–rationed regime [cf. KILLINGSWORTH 1983, pp. 48–66]. It would be, in this view, a "take–it–or–leave–it" regime (or perhaps better, a "take–it–or–else" regime). We shall see below, however, that this is not the case at all.

Just as in the West, where rigidity may be the case for an individual in the short term and with respect to a particular employer, there are also numerous devices available to make labor supply more flexible: choice of occupation, choice of firm, absenteeism, vacations, overtime, moonlighting, and more. It turns out that all of these devices have been employed in the Soviet Union, and often to a greater extent than in the West.

Perhaps the most widespread method employed by Soviet workers to create more flexible labor supply schedules has been the phenomenon of "stealing time." More than just "goldbricking" or loafing on the job (although that is rampant, too), "stealing time" includes the practice of using official job time for productive purposes.[3] That is, a worker either leaves the job altogether for part of the day (for shopping, or rather, for waiting in lines to shop, during lunch breaks, etc.), or he or she devotes time on the job to activities other than the official work, including engaging in surreptitious production of goods or services for the black market.

Most important of all, this practice of stealing time—as well as various other flexibility–creating mechanisms employed by Soviet workers—has been condoned by the regime. It is one component of what has been described as a "social contract" between the regime and the working class.[4]

In short, what this system of stolen time does is remove the official rationing system of hours, and permit greater flexibility in labor supply. Just how far this flexibility of hours extends may be surprising. Figs. 1–3 illustrate the importance of accurately measuring the effects of unreported hours of work and leisure in making judgements about labor supply in the Soviet Union. The charts show the relative frequencies of work weeks for Soviet married men of working age (N=782) from the Berkeley–Duke survey sample.

Fig. 1 presents hours of work per week on the respondent's state–sector (first economy) job as formally reported. This does indeed resemble the picture of a rationed market. Persons working fewer than 40 hours a week are quite rare, and there are not many who work more than that, either.

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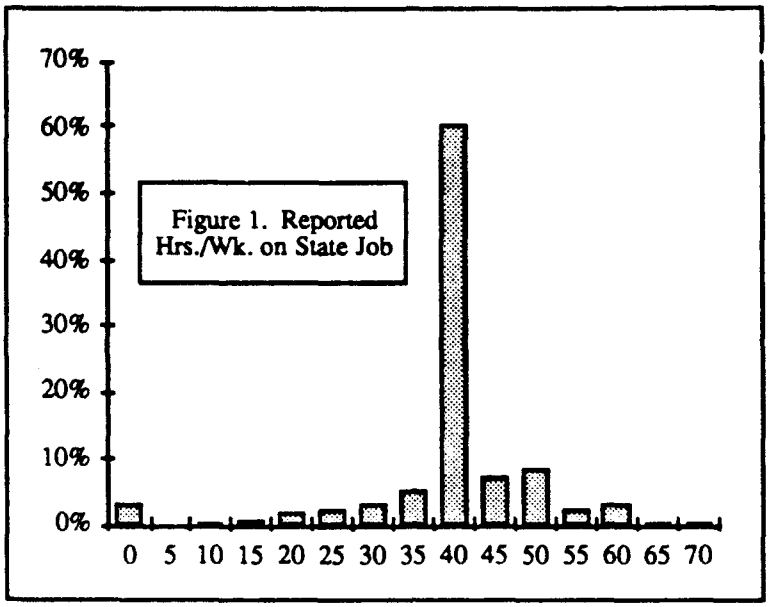
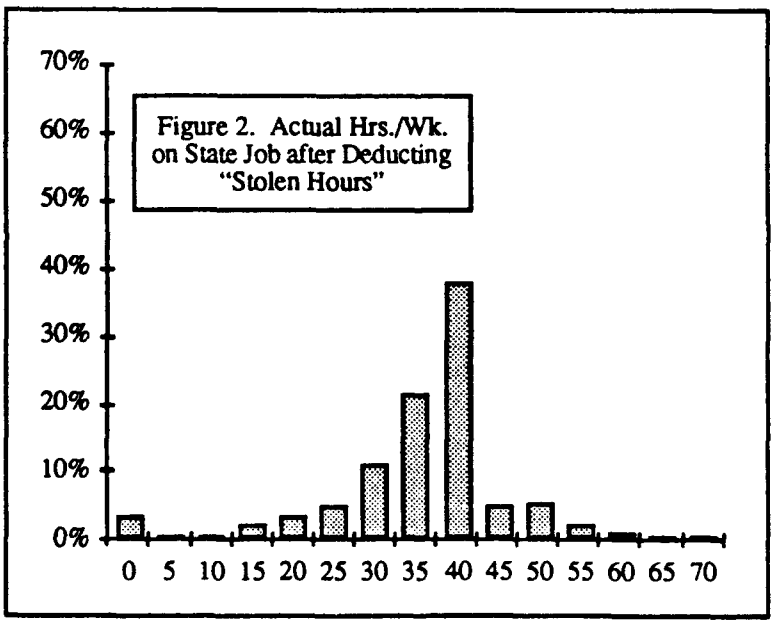
[3] The term "productive" refers here to either market or nonmarket (household) production. Time spent shopping or standing in line at stores would be classified as household production time.

[4] This same idea was expressed with considerably greater cynicism in the popular saying of Soviet workers in the Brezhnev era: "We pretend to work and they pretend to pay us." One of the best descriptions of this aspect of the workers' situation in the USSR is in Hedrick SMITH's *The Russians* [1976]: "The propaganda vision of shockworkers tirelessly building socialism was quickly dispelled for me by the undisguised goldbricking of waitresses, repairmen or builders. 'This is the workers' paradise—the greatest place in the world for workers to goof off,' a young Russian linguist chirped to me. 'They can't fire us.'"



From Fig. 1 alone, we cannot, of course, conclude that this huge spike at 40 hours is necessarily the result of rationing. In principle, it might be possible that Soviet citizens simply do not want to work less or more than 40 hours. However, further facts from the survey sample suggest a more plausible idea of true preferences. In particular, Fig. 2 shows the result when we take stolen time into account; that is, the figure now records the **actual** hours worked per week on the state job. The sharp spike at 40 hours in Fig. 1 has been lowered considerably and the lower tail of the distribution fattens, as as the sample displays a distribution of actual hours worked (that is, after deducting stolen time) which is concentrated to the range of 30 hours to 40 hours, still with relatively few observations at higher levels.



The difference between Figs. 1 and 2 suggests that what actually may be happening on the Soviet labor market is that individuals choose jobs with knowledge not only of the official wage rate and length of work week on that job, but also of what the "stolen hours rate" is.

But even this picture is not the full story. Fig. 3 shows what happens when we consider the possibility of work in the second economy in addition to the state job. The peak at 40 hours is further reduced slightly. But even more noteworthy is the filling in of the upper tail of the distribution of hours, as individuals devote some of their reported "leisure" (whether original or stolen) to gainful economy activity in the second economy. The difference between Figs. 1 and 3 is striking: clearly, Fig. 3 is **not** the picture of a rigid, quantity–rationed labor market. It suggests that Soviet workers and employees are indeed fairly free to choose the number of hours they wish to work—perhaps as free as what one would expect in a Western market economy.

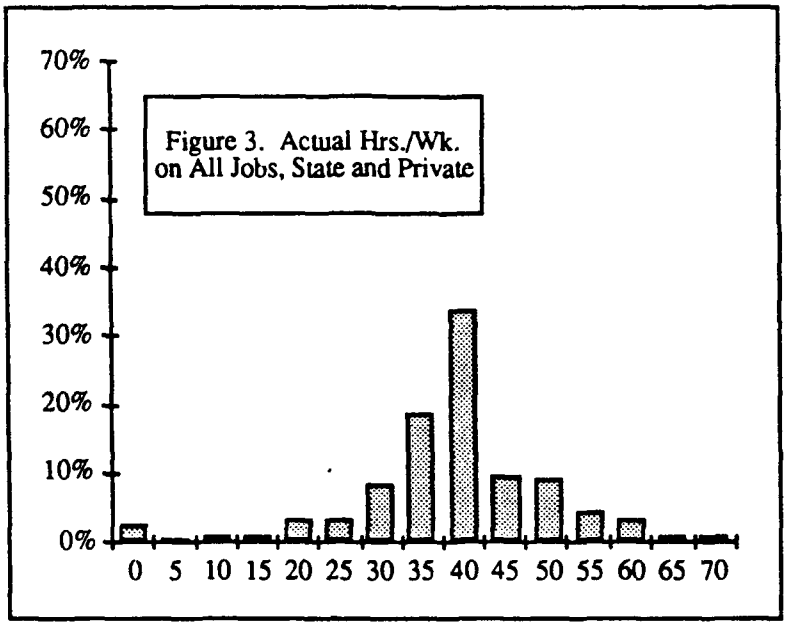


Figure 3. Actual Hrs./Wk. on All Jobs, State and Private

IV. SIMPLE GRAPHICAL EXPOSITION

We can now use the preceding discussion on the reality of the Soviet labor market to construct the budget set—that is, the range of opportunities for consumption of goods and leisure—of the typical Soviet worker or employee. We will use the familiar "leisure—all other goods" diagram, with consumption of leisure, L, measured along the horizontal axis and consumption of all other goods, C, along the vertical axis.

Consider the situation if a Soviet citizen actually did face a quantity–rationed regime. That is, let us assume the following: everyone must work, and he or she

must work full time. Assume also that full time work is prescribed by law to be 40 hours a week. Work in excess of that minimum is limited by an official ceiling on overtime of 120 hours per year, or 2.5 hours a week. The official wage rate (which we will call W_0) is centrally regulated and is constant over hours. Taxes are low and can be ignored. There is some nonwage income, V, but it is a low figure, since opportunities for income from assets, etc. are minimal.

The opportunities available to this individual—his budget set—would then be represented by the short segment labeled A on the line with slope W_0 in Fig. 4.[5]

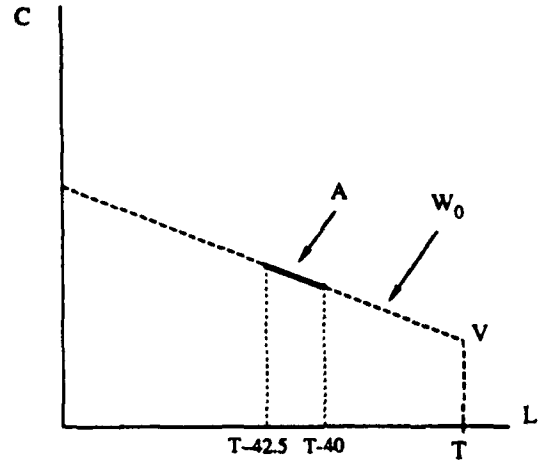


FIG. 4. THE BUDGET SET IN A QUANTITY-RATIONED REGIME

However, as we saw in the preceding section, Fig. 4 and the assumptions on which it is based do not fit reality. To begin with, this short segment of the budget line can be extended quite legally by various means. An individual can choose an occupation, e.g., teacher, with fewer than 40 official hours of work per week. Overtime is also not as constrained as it would appear on paper. Furthermore, moonlighting in a second official job may be possible. In short, the opportunity set can be extended in both directions fairly far beyond the 40—42.5 range, to something like 30—60 hours. Such a budget set would appear as in Fig. 5.

[5] In Fig. 4 and following, we label the total number of hours available to the individual as T (= 168 hours/week). Maximum consumption of C would thus be 168 times the hourly wage rate plus any "nonlabor" income available to the individual.

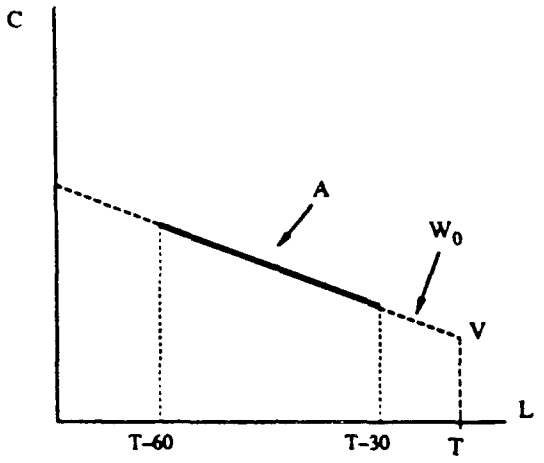


FIG. 5. THE BUDGET SET WHEN THE OFFICIAL WORK WEEK CAN VARY BETWEEN 30 AND 60 HOURS.

But more changes have to be made in the budget set than this. In particular, we must allow for our previous conclusions regarding "stolen time." Fig. 6 indicates what happens when "stolen time" is taken into account. If a certain proportion, θ, of hours officially worked are actually used for the individual's private ends, then what in effect happens is that he receives a higher wage than reported: that is, he is now being paid a wage which we can call $W_1 = W_0/(1 - \theta)$. Fig. 6 introduces the new budget line determined by this "actual" hourly income W_1.[6]

[6] Arguments similar to the one we make regarding adjustment of working hours by the informal mechanism of stealing time could also be made with respect to informal means of adjusting official income. For instance, the phenomenon of pilferage from the workplace as such an informal adjustment mechanism has been investigated by TREML [1990]. Pilferage from the workplace could be incorporated into the budget set as follows. If the individual receives pilfered goods valued at an amount S in addition to his official money wage, then the implied total income from the job is actually $(H_0W_0 + S)$, where H_0 is the number of hours per week officially worked. In sum, then, he both works fewer hours than officially reported (because he steals some) and receives more "wage income" than officially reported (because we are including the value of pilfered goods as part of his income from the job). His actual hourly earnings would then be $(H_0W_0 + S)/(H_0[1 - \theta])$. In terms of the graph (Fig. 6) this would make W_1 even steeper. Other informal material benefits from the job (bribes, etc.) could be dealt with analogously.

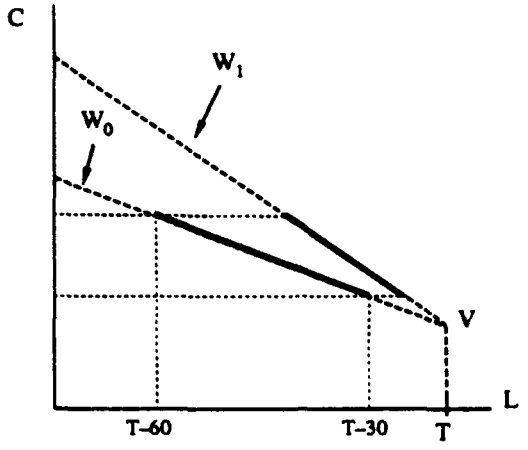


FIG. 6. THE BUDGET SET WHEN STOLEN HOURS ARE TAKEN INTO ACCOUNT.

Finally, yet another dramatic change occurs when we take the second economy into account. The individual may find it possible to participate in unofficial (private) economic activity in addition to his official job. As shown in Fig. 7, the budget set will then be extended by a segment with slope W_2, which represents these opportunities.[7]

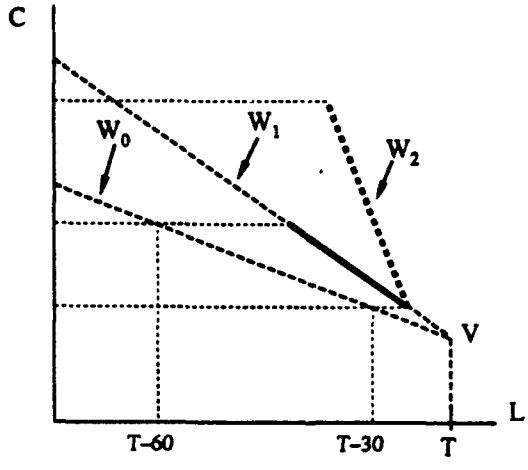


FIG. 7. THE BUDGET SET WHEN SECOND ECONOMY OPPORTUNITIES ARE TAKEN INTO ACCOUNT.

[7] Fig. 7 assumes an upper bound on second economy opportunities. Perhaps the best way to think of this upper bound is to consider it to be either the result of societal norms (unwillingness of Soviet citizens to see their neighbors enrich themselves beyond some socially acceptable limits) or the result of the social contract itself. In either case, the excessive risk involved in obtaining second economy income beyond some limit would in practice set the upper bound.

So far, we have constructed the individual's budget set; that is, we have defined the range of opportunities available to him for trade-offs between consuming goods and consuming leisure. To understand how an individual will behave in an actual situation we must also take into consideration his own preferences between leisure and consumption. In graphical terms, we must include his indifference (or utility) curves in the diagram.

To see how the budget set constructed above might interact with indifference curves, let us look at the case of two individuals, A and B, with the same budget set—that is, the same wage in the first economy, W_0, the same mandatory work week (say 40 hours), and the same opportunity to steal time, but with differing preferences.[8] We shall now examine how these two individuals react to identical opportunities for work in the second economy.

In the case illustrated in Fig. 8, both individuals are "overemployed" at 40 hours. That is, at wage rate W_0 they would prefer to work fewer than 40 hours. (In graphical terms, they could clearly reach higher indifference curves by moving further to the right on the budget set). They therefore both chose a job where management condones their "stealing" a proportion of those 40 hours. Let us assume that they each find a job allowing the same ratio of stolen hours, θ. They each now work only $(1 - \theta)$ 40 hours. Call this number of hours H^*.

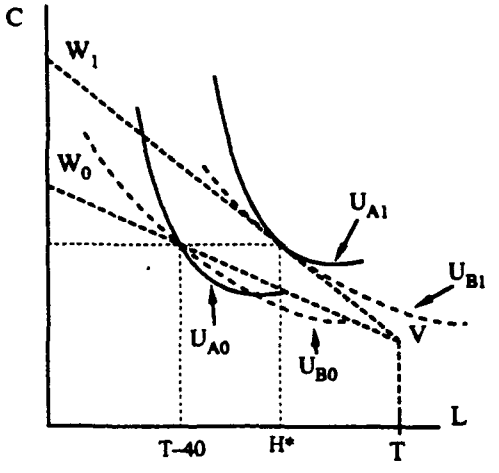


FIG. 8. COMPARISON OF THE BUDGET SET AND INDIFFERENCE CURVES WITHOUT STOLEN HOURS (W_0) AND WITH STOLEN HOURS (W_1).

To simplify the diagram, assume now that both A and B are fortunate enough that working exactly H^* hours happens to put them both at an equilibrium. In other words, at H^* hours their indifference curves are tangent to the budget line, and hence the utility they would gain (lose) from spending one more (less) ruble on C and one less (more) ruble on L would be exactly offset by the utility that would be

[8] For simplification, we ignore here the possibility of pilferage, since it does not change the substance of the argument.

lost (gained) by the reduction (increase) in L. There would therefore be no reason to reallocate time from leisure to work or vice–versa. Expressed in the terminology of neoclassical economics, at H^* hours of work their marginal rates of substitution between leisure and consumption are equal to the actual wage rate, W_1.

Let us now suppose that for both A and B, second economy opportunities appear, offering a higher wage, W_2, than the actual first economy wage, W_1. These second economy opportunities are represented in Fig. 9 by the wage line, W_2, which is steeper than the W_1 line.

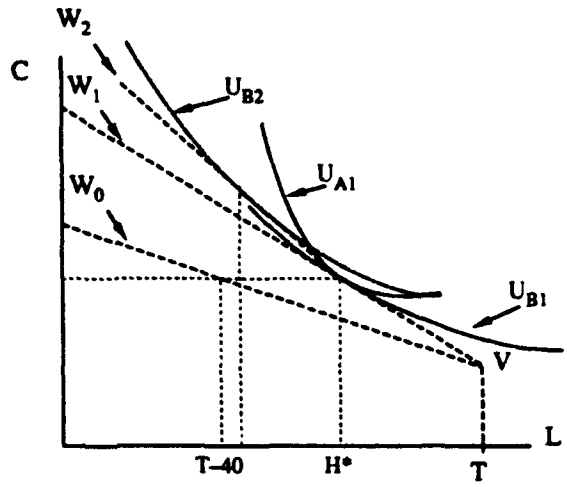


FIG. 9. BUDGET SET AND INDIFFERENCE SET COMPARISON INCLUDING SECOND ECONOMY OPPORTUNITIES.

The choices A and B now have are whether or not to moonlight in the second economy and if so, how many hours of labor to supply to the second economy?

Their indifference curves—i.e., their subjective preferences between consumption and leisure—provide the answer for their choices. We have already assumed that both A and B are at an equilibrium when they work H^* hours in the first economy. Hence, $W_1 = MRS^*$, where MRS^* is the marginal rate of substitution between consumption and leisure at H^* hours of work. Since $W_2 > W_1$ for both individuals, we can be sure that both A and B will be able to reach higher indifference curves on the W_2 line, and thus they will both work some positive number of hours at the second economy job. However, because they exhibit different shapes of their indifference curves, they will differ in the **number** of hours they supply to the second economy.

A's marginal rate of substitution between consumption and leisure (the slope of his indifference curve) increases sharply to the left of H^*. Therefore, after only a very small amount of time in excess of H^*, A's marginal rate of substitution will be greater than W_2 and he will stop working. The total number of hours supplied by A to the second economy will be small (too small, in fact, to appear on the diagram). For B, on the other hand, W_2 remains considerably higher than the slope of his

indifference curve to the left of H^*. Hence B will work more hours than A in the second economy, moving from indifference level U_{B1} to U_{B2}.

Thus how A and B behave in respect to identical second economy opportunities depends on the relationship between their marginal rate of substitution (the shape of their indifference curves) and the second economy wage, W_2. In the graphical example above, the particular shape of the indifference curves we chose guaranteed that the individuals responded positively to a higher second economy wage. That is, the higher the wage, the more labor would be supplied. Theoretically, this does not have to be the case, as is well known. The income effect may well dominate the substitution effect. Only empirical analysis can determine the outcome for each concrete case. We address the problem of the proper empirical specification of a model in the next section.

V. EMPIRICAL SPECIFICATION OF THE MODEL

Before we proceed to the elaboration of an estimable model for the problem of second economy labor supply, we need to make explicit one of the important assumptions we have been making so far. The graphical example presented in the previous section implicitly assumed that individuals make first and second economy labor supply decisions sequentially rather than simultaneously. That is, we assumed that the individuals choose a first economy job which offers a certain wage and length of work week (including stolen hours) and then consider the moonlighting choice—the second economy job. However, it is reasonable to assume that people make the choices simultaneously. For instance, a person might choose one job where the number of stolen hours is less than another if the former job offered other benefits in the form of pilferage of desirable goods from the workplace or if it provided exceptionally good opportunities that might translate into a higher second economy wage, a higher W_2. If this were the case, then the actual choice made by an individual would be a simultaneous decision with respect to a package of benefits offered by an enterprise. Formulating this using some of our terminology, we would have a package consisting of:

(1) an official wage offer (W_0)
(2) an official work week (H_0)
(3) the opportunity to steal time
(4) the opportunity to pilfer goods or receive other informal material benefits
(5) an opportunity for second economy income (hours H_2 at wage W_2), which may have as a prerequisite working in the firm (i.e., an implicit or explicit assurance that "you can use our machines and our materials for your private job" and even an offer of benefits such as a sales network, protection, etc.).

Estimation of labor supply under such conditions would require solving a set of simultaneous equations embodying the relationships among all the components of the package. This is in fact an approach being pursued in another part of this

project.[9] In the sections that follow we will, however, follow a simpler path of assuming sequential and independent first and second economy labor supply decisions. In effect, what we do is to treat first economy income, including the value of goods pilfered from the workplace, as exogenous "nonlabor income" with respect to the second economy labor supply decision. Similarly, the hours on the first economy job (and the stolen hours) are assumed to be predetermined before the second economy decision is made. Analysis thus reduces to the conventional estimation of labor force participation with structural equations which stipulate that an individual will work if and only if his or her marginal rate of substitution between consumption and leisure at zero hours of work is less than the offered wage rate. In our case, this formally reduces to:[10]

$$H_{2i} > 0 \text{ iff } W_{2i} > MRS_i^* \qquad [1]$$
$$H_{2i} = 0 \text{ iff } W_{2i} \leq MRS_i^*,$$

where H_{2i} is hours/week of second economy work for individual i, W_{2i} is the second economy wage rate, and MRS_i^* is the marginal rate of substitution between consumption and leisure at $H_{2i} = 0$ (or, in other words, MRS_i^* is the "second economy reservation wage").

As is also commonly done in labor supply estimation, we adopt HECKMAN's [1974] "proportionality" hypothesis. That is, we assume that the number of hours of labor supplied is proportional to the gap between market wages (W_2) and reservation wages (MRS^*). To be able to estimate this econometrically, we must specify a form for the W_2 and MRS^* functions. We will make the function for W_2 a semi–logarithmic function of a vector X of observed variables such as age, education, etc. (dictated by the economic model of wage determination advanced by MINCER [1974]) and a mean–zero random error term ε_{W2}, representing unobserved factors such as "motivation" or "innate ability."

$$\log W_{2i} = \varphi' X_i + \varepsilon_{W2i}. \qquad [2]$$

Next, the individual's marginal rate of substitution (M) between consumption and leisure will be assumed to be a linear function of the second economy wage (W_2), hours of work in the second economy (H_2), a vector of non–second economy income sources (V), a vector of other observed characteristics or "taste–shifters" (Z), and unobservables (ε_M).

$$M_i = a_M + b_{1M} W_{2i} + b_{2M} H_{2i} + c_M' V_i + d_M' Z_i + \varepsilon_{Mi}. \qquad [3]$$

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[9] See my paper "Pretending to Work and Pretending to Pay: A Hedonic Wage Approach to the Behavior of Soviet Workers and Managers."

[10] In the following we have adapted the notation and exposition used in KILLINGSWORTH [1983, Chapter 4] for the standard labor supply model.

(The non–second economy income (V) is in turn composed of official first economy income, pilferage from the first economy job, and the spouse's income, while Z also includes official first economy hours (H_0) and stolen hours from the first economy job.)

The second economy reservation wage MRS^* (i.e., equation [3] evaluated at $H_2 = 0$ and $W_2 = 0$) is then

$$MRS_i^* = a_M + c_M'V_i + d_M'Z_i + \varepsilon_{Mi}. \qquad [4]$$

With W_2 and MRS^* thus specified, Heckman's proportionality hypothesis for hours supplied to the second economy (H_2) becomes

$$\begin{aligned} H_{2i} &= b(W_{2i} - MRS_i^*) \qquad [5] \\ &= a + bW_{2i} + c'V_i + d'Z_i + \varepsilon_{Mi} \\ &\qquad \text{if and only if } W_{2i} > MRS_i^*, \text{ and} \\ H_{2i} &= 0 \qquad \text{if and only if } W_{2i} \le MRS_i^* \end{aligned}$$

where $a = -ba_M$, $c = -bc_M$, $d = -bd_M$.

Equation [5], then, is a labor supply equation which has hours of second economy labor supply (H_2) as the dependent variable, and the second economy wage (W_2) and MRS^*–related variables (e.g., variables describing income, hours of work on the state job, and family circumstances) as the independent variables.

The following section presents the data set used for analysis and the definitions of the variables.

VI. Data Set and Variable Definitions

A. Berkeley–Duke Survey

The data used in this analysis come from the Berkeley–Duke Emigrant Survey of families who emigrated from the USSR to the United States in the late 1970s and early 1980s. On average, their "last normal year" (in the economic sense) before emigration was 1977. The full sample consisted of 1,061 households containing 3,023 individuals (2,299 over the age of 16). Sample members answered over 600 questions on household budget–related topics. Focusing broadly on issues of the second economy, the survey questionnaire elicited information in three main areas: (1) family and individual incomes, (2) family expenditures, and (3) respondents' perceptions of second economy incomes of various occupational groups in Soviet society.

One of the most valuable features of the Berkeley–Duke survey sample is the extensive information it contains on all family members. In particular, the survey provides as much data on the spouse's economic behavior (including second economy activity) as it does for the head of household. This offers the opportunity of estimating our model on both men and women separately. Thus, for the specific purposes of this study, two (overlapping) subsamples of the Berkeley–Duke data set were chosen, one consisting of 742 households comprised of married couples with working–age (16–59 years) husbands, and the other of 591 married couples with working–age (16–54 years) wives. For both subsamples, each principal respondent (the husbands in the first case and the wives in the second) holds an official state job.

A couple of points are to be noted as regards the representiveness of the survey sample. First of all, the Berkeley–Duke sample is composed nearly exclusively of former urban residents. Given the significant differences between the urban and rural employment patterns in the USSR, it is to be expected that the survey results can be used to form valid estimates for the urban population only.

In addition to the urban bias, the Berkeley–Duke sample is unrepresentative of the parent population in numerous other ways. It has, for instance, a greater share of white collar workers and a higher level of educational achievement than is found in the parent population. In addition, because of Soviet emigration policy, it has a much greater proportion of persons of Jewish and Armenian nationality than the USSR as a whole. The adults in the sample are 52.8% Jewish, 22.0% Armenian, and 18.1% Slavic (Russian, Ukrainian or Belorussian), while the percentages for these groups in the parent population are 0.7%, 1.6%, and 73.3%, respectively.[11]

Despite all the problems of apparent bias, previous work with the sample has indicated that in terms of economic behavior, the sample—given proper controls for region and ethnic groups—fairly reflects the parent population.[12]

B. DEFINITIONS OF VARIABLES

The dependent variable for the main equation of interest—hours of labor supplied to the second economy—was computed as the sum of responses to three questions: (i) "How many hours each week did you work privately for state enterprises or institutions?" (ii) "How many hours each week did you work privately for cooperatives and public organizations?" (iii) "How many hours did you work each week for private parties (including work on order, for hire, for sale, for exchange, etc.?)" Respondents were specifically asked not to include overtime work at their normal job nor officially sanctioned moonlighting [*sovmestitel'stvo*] as second economy work.

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[11] The nationality of persons in the sample was reported according to the way they were listed in their Soviet passports. Since individuals wishing to emigrate may have wanted to list themselves as ethnic Armenians or Jews to enhance their chances for leaving the USSR, the percentage of actual Jewish and Armenian respondents may be overstated.

[12] GROSSMAN [1987] has a more detailed description of the Berkeley–Duke sample. ALEXEEV [1988] discusses the issue of possible biases in the sample.

Second economy earnings were computed as total earnings from these jobs, less any money paid for kickbacks or bribes connected with obtaining or keeping the jobs and any expenses incurred for materials, transport, or hire of labor. (The kickbacks and expenses were reported separately by the respondents.) The second economy hourly "wage" was then computed by dividing net weekly earnings by weekly hours.

First economy official earnings and hours were reported as income earned and time worked either at (i) the individual's primary state–sector job or (ii) work at another state or cooperative enterprise or institution [*sovmestitel'stvo*]. Again, the "wage" was computed by dividing earnings by hours.

Time stolen from the first economy job was the sum of hours of official job time devoted to second economy activity and hours of job time devoted to non–remuneratory uses (leisure).

Pilferage from the first economy job was not reported directly by survey respondents. The figure used here is a proxy, and is the amount reported by respondents as all income not explicitly derived from the official or private work elsewhere recorded in the questionnaire or from government transfers.[13]

The X vector of personal characteristics determining the second economy wage included age and education, with quadratic terms in order to capture possible nonlinear effects (i.e., increasing or decreasing marginal returns to age and education). Educational attainment in the Berkeley–Duke survey was specified as one of the following six levels, which were then converted to number of years as shown in parentheses: (i) primary education (3.0 years); (ii) incomplete secondary education (8.0 years); (iii) completed secondary education (10.0 years); (iv) specialized secondary education (10.1 years); (v) incomplete higher education (12.5 years); and (vi) completed higher education (15.0 years).[14]

The Z vector of variables assumed to influence the individual's marginal rate of substitution between consumption and leisure included both age and education and their squares, as above, as well as a number of household variables. The number of children under the age of 4 and the number of children between the ages of 4 and 15 were included to capture the value of household time. The spouse's income from his or her first economy job, including pilferage, represents a household income effect. The spouse's hours spent on the first economy job, net of stolen hours, was

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[13] This figure is admittedly problematic. In one sense, it unquestionably overstates the value of pilferage *per se*. It would, at a minimum, include other informal material benefits from the first economy job such as bribes and under–the–table payments (e.g., for retail workers). On the other hand, even if we assume that the figure does represent only pilfered goods, we have to leave open the question of how respondents determined the value of such goods. Were they valued at official state prices, at black market prices, or at some individually determined, subjective prices?

[14] The number of years represented by each level of education is taken from TREML [1986, p. 2.3]. GREGORY and KOHLHASE [1988] argue that because of the prevalence of vocational and continuing education in the Soviet Union, a continuous variable for educational attainment is misleading, and they use dummy variables for the separate levels. Alternative specifications using dummies for the education levels as originally stated in the survey questionnaire seemed to provide virtually the same information as the continuous variables and quadratic terms. Only specifications with the continuous variables are reported here, since they are easier to interpret.

included in order to test household decision–making effects (about which more below).

The respondents' geographical area was presumed to be an important determinant of both labor market conditions (thus influencing the second economy wage) and the utility function (for instance, to the extent that location reflects national or regional cultural differences relating to household production functions and/or tastes for leisure). Preliminary testing of various regional breakdowns of the samples showed that in only one case did inclusion of a regional dummy variable seemed warranted: this was the case of ethnic Armenians residing in Armenia. Finally, other dummy variables were included to reflect the respondent's occupation and branch of the economy for the first economy job.

The means and standard deviations of all these variables for men and women who did and did not moonlight in the second economy are presented in Tables 1A and 1B, respectively. As the tables show, it is hard to detect substantial differences in the human capital variables (age and education) between the two groups, either for men or for women. Age seems to be about the same for second economy participants and nonparticipants for both sexes, while there is a slightly lower level of educational achievement for men who work in the second economy.

The most marked differences between the two groups appear in the variables relating to the first economy job. For both sexes, second economy participants show a distinct pattern of (i) earning less official first economy income; (ii) pilfering less from the first economy workplace; (iii) holding first economy jobs with fewer official hours; and (iv) stealing more time from their first economy jobs. The net result of that pattern is that the actual hourly earnings on the first economy job appear to be fairly close for participants and nonparticipants (for men, in fact, the hourly figures are identical).

The family data variables show that participating and nonparticipating males display no substantial differences as regards the number of children in the family, while the female second economy participants have more children in both the younger and older age groups than their nonparticipating counterparts. Finally, it is interesting to note the difference in behavior of Armenians of the two sexes: for men, the proportion of Armenians is higher among participants than nonparticipants, while for women the opposite is true.

TABLE 1A. MEANS OF VARIABLES FOR MEN.
742 husbands of working age (16–59 years) with primary jobs in the state sector

	Moonlighted in the second economy? YES (N = 264) Mean	(Std)	NO (N = 478) Mean	(Std)
PERSONAL CHARACTERISTICS				
1. Husband's age in years	38.9	(8.7)	38.5	(8.7)
2. Husband's education in years	11.3	(2.9)	12.1	(2.8)
SECOND ECONOMY EARNINGS AND HOURS				
3. Second economy hrs./wk.	12.1	(10.1)	—	—
4. Second economy hourly earnings (R/hr.)	4.27	(3.45)	—	—
5. Monthly earnings on second economy job (R/mo.)	206	(277)	—	—
FIRST ECONOMY EARNINGS AND HOURS				
6. Official monthly earnings on first economy job (R/mo.)	164	(78)	185	(86)
7. Pilferage from first economy job (R/mo.)	32	(101)	61	(133)
8. Total first economy monthly earnings, incl. pilferage (R/mo.)	196	(128)	246	(142)
9. Official first economy hrs./wk.	39.7	(8.3)	42.0	(7.3)
10. Hrs./wk. stolen from first economy job	6.1	(7.3)	3.7	(7.6)
11. Hrs./wk. on first economy job (net of stolen hrs.)	33.7	(10.2)	38.5	(8.7)
12. Official hourly earnings on first economy job (R/hr.)	1.00	(0.47)	1.03	(0.45)
13. Actual hourly earnings on first economy job, incl. pilferage and stolen hrs. (R/hr.)	1.60	(1.61)	1.60	(1.30)
SPOUSE'S FIRST ECONOMY EARNINGS AND HOURS				
14. Wife's first economy earnings, incl. pilferage (R/mo.)	97	(70)	112	(90)
15. Wife's first economy hrs./wk., net of stolen hrs.	26.0	(16)	27.2	(16.4)
FAMILY DATA				
16. Number of children age 0–3 years	0.16	(0.39)	0.18	(0.43)
17. Number of children age 4–15 years	0.67	(0.80)	0.67	(0.78)
REGIONAL CONDITIONS*				
18. Armenia	25%		16%	
OCCUPATION*				
19. Clerical	3%		5%	
20. Operative	58%		37%	
21. Professional	36%		45%	
22. Managerial	3%		13%	
BRANCH OF ECONOMY FOR FIRST ECONOMY JOB*				
23. Materials processing	4%		8%	
24. Machine industry	6%		10%	
25. Craft industry	17%		8%	
26. Light industry	3%		11%	
27. Transport	8%		6%	
28. Construction	11%		10%	
29. Retail trade	2%		8%	
30. Services	22%		10%	
31. Health	8%		5%	
32. Education	10%		6%	
33. Culture and arts	3%		5%	
34. Science	3%		8%	
35. Government administration	3%		5%	

* Relative frequencies of the categories listed for moonlighters or non-moonlighters.

TABLE 1B. MEANS OF VARIABLES FOR WOMEN
591 wives of working age (16–54 years) with primary jobs in the state sector

	Moonlighted in the second economy? YES (N = 126) Mean	(Std)	NO (N = 465) Mean	(Std)
PERSONAL CHARACTERISTICS				
1. Wife's age in years	35.4	(7.9)	35.4	(8.2)
2. Wife's education in years	11.5	(2.5)	11.8	(2.7)
SECOND ECONOMY EARNINGS AND HOURS				
3. Second economy hrs./wk.	8.9	(6.7)	—	—
4. Second economy hourly earnings (R/hr.)	3.56	(2.58)	—	—
5. Monthly earnings on second economy job (R/mo.)	113	(104)	—	—
FIRST ECONOMY EARNINGS AND HOURS				
6. Official monthly earnings on first economy job (R/mo.)	106	(33)	117	(46)
7. Pilferage from first economy job (R/mo.)	8	(26)	23	(64)
8. Total first economy monthly earnings, incl. pilferage (R/mo.)	113	(104)	140	(77)
9. Official first economy hrs./wk.	34.6	(10.1)	38.0	(8.1)
10. Hrs./wk. stolen from first economy job	4.1	(6.2)	3.0	(6.1)
11. Hrs./wk. on first economy job (net of stolen hrs.)	30.7	(10.4)	35.1	(8.9)
12. Official hourly earnings on first economy job (R/hr.)	0.79	(0.39)	0.76	(0.37)
13. Actual hourly earnings on first economy job, incl. pilferage and stolen hrs. (R/hr.)	1.17	(1.59)	1.04	(1.02)
SPOUSE'S FIRST ECONOMY EARNINGS AND HOURS				
14. Husband's first economy earnings, incl. pilferage (R/mo.)	197	(118)	204	(115)
15. Husband's first economy hrs./wk., net of stolen hrs.	34.3	(13)	36.5	(10.8)
FAMILY DATA				
16. Number of children age 0–3 years	0.19	(0.43)	0.13	(0.43)
17. Number of children age 4–15 years	0.79	(0.84)	0.71	(0.78)
REGIONAL CONDITIONS*				
18. Armenia	10%		14%	
OCCUPATION*				
19. Clerical	12%		18%	
20. Operative	31%		24%	
21. Professional	56%		55%	
22. Managerial	1%		2%	
BRANCH OF ECONOMY FOR FIRST ECONOMY JOB*				
23. Materials processing	2%		4%	
24. Machine industry	0%		3%	
25. Craft industry	7%		7%	
26. Light industry	3%		7%	
27. Transport	0%		2%	
28. Construction	2%		4%	
29. Retail trade	0%		10%	
30. Services	21%		9%	
31. Health	20%		14%	
32. Education	30%		21%	
33. Culture and arts	10%		9%	
34. Science	0%		4%	
35. Government administration	5%		5%	

* Relative frequencies of the categories listed for moonlighters or non-moonlighters.

VII. RESULTS OF ESTIMATION

As described in the preceding section, our analysis of Soviet labor market behavior requires estimation of an equation that has hours of second economy labor supply (H_2) as the dependent variable, with the second economy wage (W_2) and a set of utility–related variables as the independent variables. However, since some 64% of the men in the sample and around 79% of the women do not participate at all in the second economy and thus have zero hours of second economy labor supply, tobit estimation techniques are preferred to simple ordinary least squares (OLS).[15] Before proceeding to the tobit estimation, a series of preliminary steps are required. One of the key explanatory variables for second economy labor supply—the offered wage in the second economy market (W_2)—is available only for those who actually did work in the second economy. (Those who did not participate in the second economy, of course, cannot report any such wage.) To solve this problem we predict a second economy wage for the entire sample (even for those who did not actually have such a wage) by using an OLS wage regression on the subsample which did participate in the second economy. Since such a regression is subject to sample selectivity bias, we must correct for the bias using the well–known procedure developed by HECKMAN [1979]. This involves estimating (by probit analysis) a reduced–form participation equation to obtain a measure of the selectivity bias for each individual, labelled λ_i. This λ is then used as a regressor in the second economy wage equation.

To sum up, then, there are four stages to the estimation:

(i) A **reduced–form participation equation** (i.e., an equation which does not explicitly contain W_2, but rather only the variables which can be thought to determine W_2), estimated on all members of the sample by probit analysis. This reduced–form equation will be used to obtain the selectivity bias measure, λ, as well as for conducting hypothesis tests and making preliminary observations about the determinants of participation in the second economy.

(ii) The **second economy wage equation**, estimated by OLS only on members of the sample who did participate in the second economy. The selectivity bias variable, λ, will be included as one of the regressors. The estimated coefficients from this regression will be used to predict a second economy wage for all members of the sample.

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[15] The tobit regression model [see TOBIN 1958] uses the properties of the truncated normal distribution to estimate so–called censored data. In such a censored regression model we typically have data on the explanatory variables (the right–hand side) variables for all observations. For the dependent variable (the left–hand side), however, we have the actual data for some observations but for others we know only that they fall below a certain threshold. (In the case here, for instance, we know a person's desired second economy hours, H_2, only if $H_2 > 0$.)

(iii) **Prediction of a second economy wage** for all members of the sample, using the estimated coefficients from stage (ii).

(iv) The **labor supply equation**, estimated by tobit analysis on the entire sample and including the predicted second economy wage obtained from stage (iii) as one of the regressors. The coefficient estimates from this regression give us the information we are seeking on the determinants of hours of labor supplied to the second economy.

We examine the results of each of these stages in turn.

(i) REDUCED-FORM PARTICIPATION EQUATION (STAGE 1 PROBIT)

Table 2 shows the results of the initial reduced-form probit equation for men and women.

TABLE 2. REDUCED-FORM PROBIT ESTIMATES FOR MEN'S AND WOMEN'S PARTICIPATION IN THE SECOND ECONOMY

(742 husbands of working age, 16–59 years; 591 wives of working age, 16–54 years)

	MEN		WOMEN	
	Estimate	(t-statistic)	Estimate	(t-statistic)
PERSONAL CHARACTERISTICS				
1. Age in years	0.0741	(1.28)	0.0713	(0.93)
2. Age in years squared	–0.0010	(1.37)	–0.0007	(0.72)
3. Education in years	0.0810	(0.54)	0.3937	(1.43)
4. Education in years squared	–0.0048	(0.74)	–0.0170	(1.51)
FIRST ECONOMY EARNINGS AND HOURS				
5. Official monthly earnings on first economy job (R/mo.)	–0.0014	(1.86)	–0.0027	(1.33)
6. Pilferage from first economy job (R/mo.)	–0.0022	(3.78)	–0.0053	(2.49)
7. Official first economy hrs./wk.	–0.0190	(2.44)	–0.0215	(2.55)
8. Hrs./wk. stolen from first economy job	0.0271	(4.21)	0.0155	(1.75)
SPOUSE'S FIRST ECONOMY EARNINGS AND HOURS				
9. Spouse's first economy earnings, incl. pilferage (R/mo.)	–0.0017	(1.81)	0.0007	(1.06)
10. Spouse's first economy hrs./wk., net of stolen hrs.	0.0044	(0.98)	–0.0136	(2.26)
FAMILY DATA				
11. Number of children age 0–3 years	–0.0014	(0.01)	0.3848	(2.23)
12. Number of children age 4–15 years	–0.0407	(0.54)	0.1004	(1.12)
REGIONAL CONDITIONS				
13. Armenia	0.4095	(2.67)	–0.2779	(1.28)
Constant	–0.4387	(0.31)	0.2435	(0.18)
Log likelihood value	–398.48		–437.69	

Note.—T-statistics are absolute values. Other independent variables included in the regressions but not reported here were dummies for first economy occupation and branch of the economy.

Since this first reduced–form probit includes all relevant variables, the coefficient estimates reported in Table 2 do show us the determinants of second economy participation. However, we have to remember that the influence of some of the factors listed as independent variables are acting in dual fashion: both directly and through their effect on the second economy wage. The purpose of continuing with the remaining steps of estimation outlined above is precisely to be able to separate the wage effect from other effects. For that reason, we will reserve comment on most variables until step (iv). What we will do at this point, however, is use the reduced–form probit for testing some behavioral hypotheses related to labor force participation. The two sets of issues we want to test are: (a) the relationship between the informal and the formal components of wages and earnings on the first economy job, and (b) the nature of household decision–making.

(a) FORMAL VS. INFORMAL CHARACTERISTICS OF THE FIRST ECONOMY JOB

Our graphical model in Section IV assumed that one hour stolen from a first economy job was equal to a one–hour reduction of the official work week. Similarly, we asserted that the value of pilfered goods could simply be added, ruble for ruble, to official earnings to obtain gross first economy income. Both of these are strong assumptions and should be tested on the data. Since we have entered the formal and informal variables separately in our empirical specification, we can perform such a test.

If we compare the coefficient estimates of the relevant hours variables in Table 2—"Official first economy hrs./wk." (variable 7) and "Hrs./wk. stolen from first economy job" (variable 8)—we see that that the estimates are fairly close for both men and women. Formal tests of the equality of the coefficient estimates are reported in Tables A1 and A2 in the Appendix. They show that we cannot reject the hypothesis that the estimates are identical, i.e., that the stolen hour is the same as the one–hour official reduction. The results for official first economy earnings and pilferage are similar. Hence, for both men and women, the conclusion is that a worker is indeed indifferent between pilfering goods worth, say, 20 rubles a month from the workplace and receiving an official pay raise of 20 rubles/month, and that he or she is indifferent between being allowed to steal 5 hours a week from the job, for instance, and simply having the official work week reduced by 5 hours.

(b) VARIABLES RELATED TO HOUSEHOLD DECISION–MAKING

In the last few years, important work has been done to extend analyses of family labor supply to more complicated forms of household decision–making than the family utility, or common preferences, model dictated by the standard neoclassical model (see HORNEY and MCELROY [1986], SCHULTZ [1990], and MCELROY [1990]). Although rigorous testing of either the common preferences or alternative models is beyond the scope of the present paper, some suggestive results regarding decision–making processes in Soviet households do emerge from the present study.

In the neoclassical ("common preferences") model of family demand behavior, the unearned income of the husband and wife is constrained to have the identical effect on family labor supply and commodity demands. In other words, the model assumes that the family "pools" all unearned income regardless of source. This is one of the few testable assumptions of the neoclassical model.[16] In the labor supply model in this paper, we have assumed that all first economy income, for both husband and wife, is predetermined with respect to the second economy participation decision. As pointed out earlier, this is the same as classifying first economy income as unearned income with respect to the second economy decision. Hence, conditional on this assumption of exogeneity of the first economy choice, the pooled income assumption is testable in our case as well.

Once again, consider the coefficient estimates in Table 2. For men, the estimates for variable 5 ("Official monthly earnings on first economy job") and variable 9 ("Spouse's first economy earnings") are extremely close in value and are at least moderately significant. As predicted by theory, both reflect a pure income effect and thus have a negative impact on the participation decision. For wives, on the other hand, neither of the estimates for these two variables is significant, and they are not close in value. In particular, the coefficient on the husband's first economy earnings is practically zero—i.e., it has no effect on her decision.

These results suggest that the common preferences model may not valid for Soviet households. Husbands and wives do not have the same preferences. Husbands can regard their wives' first economy earnings are equivalent to their own, but wives apparently cannot act on that assumption.

A similar analysis can be made regarding the two spouses' allocation of labor to the first economy. In this case, however, the testing is more complicated. Family utility theory does not assert that the family members "pool hours" in the same way they purportedly pool income. Family members have differing qualities of labor; so any comparison of the impact of hours worked would have to be adjusted for productivity. However, it is interesting merely to observe the differences between the men and women in our sample in this regard. For men, the wife's hours have no significant impact at all. For women, in contrast, the husband's hours on the first economy job significantly reduce her probability of participation in a second economy job.

The overall pattern that emerges can be seen from the fact that out of six household income and hours variables (variables 5–10 in Table 2), the **least** important for the husband is the **wife's hours**, and the **least** important for the wife is the **husband's earnings**.

In general, then, there is a clear asymmetry which works to the wife's disadvantage. To sum it up bluntly, while the husband counts his wife's earnings as his own, he doesn't let her double burden of work in the market and work at home affect his moonlighting decision. Meanwhile, although the wife cannot count

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[16] But, as pointed out by SCHULTZ [1990], to test this assumption, the unearned income in question must (a) be indistinguishable in terms of what it can purchase in the market and produce in the household, and (b) be exogenous.

on sharing equally her husband's earnings, she must take into account his extra hours on his primary job (and they clearly reduce her probability of working in the second economy).

(ii) SECOND ECONOMY WAGE EQUATION

After this digression for hypothesis testing on the reduced–form probit model, we can now return to the steps aimed at estimation of hours of labor supply. Step (ii) is a straightforward Mincer–type regression on second economy participants to determine the factors influencing the second economy wage. The regressors represent three categories of variables: (1) individual productivity–related characteristics; (2) demand conditions in the region, occupation, and branch of the economy; and (3) the selectivity bias variable, λ, which we obtained in step (i). The variables employed and the results of the estimation are presented in Table 3.

As Table 3 shows, none of the productivity–related personal characteristics appear to be particularly significant in determining the second economy wage for either sex, although they are especially poor for women. The Armenia dummy is very large for both men and women: Armenians residing in Armenia can expect on average to earn 50–60% more in the second economy than other Soviets. Perhaps the most important conclusion from Table 3 relates to the selectivity bias variable.

TABLE 3. OLS ESTIMATES FOR SECOND ECONOMY WAGE EQUATION FOR MEN AND WOMEN

Dependent variable: Logarithm of rubles/hour on second economy job. Estimated only on sample members who participated in the second economy.

	MEN (N=264)		WOMEN (N=126)	
	Estimate	t–statistic	Estimate	t–statistic
PERSONAL CHARACTERISTICS				
1. Age in years	0.103	(1.72)	–0.069	(0.85)
2. Age in years squared	–0.001	(1.65)	0.001	(0.90)
3. Education in years	0.138	(1.00)	–0.247	(0.79)
4. Education in years squared	–0.009	(1.43)	0.011	(0.83)
REGIONAL CONDITIONS				
5. Armenia	0.506	(3.39)	0.576	(2.16)
SELECTIVITY BIAS VARIABLE				
6. λ	0.919	(3.37)	0.147	(0.53)
7. Constant	–2.119	(1.52)	3.100	(1.30)
R^2	0.185		0.187	
R^2 adjusted	0.111		0.055	

Note.—T–statistics are absolute values. Other independent variables included in the regressions but not reported here were dummies for first economy occupation and branch of the economy. The F–value for the entire set of coefficients for the men's estimation was 2.508 (Prob > F = 0.0005). For the women's equation, the F–value was 1.411 (Prob > F = 0.1460).

We see that the variable is positive and statistically significant for men. The significance of the coefficient suggests that if we had failed to include the correction variable, we would have predicted a different wage in the second economy for males. For women, on the other hand, λ is not significant. In other words, we would not systematically have mismeasured the expected second economy wage for women by omitting λ from the wage regression.[17]

(iii) PREDICTED SECOND ECONOMY WAGE

The coefficient estimates from the step (ii) regression—estimated only on those individuals who participated in the second economy—were then used to predict a second economy wage for the entire sample. That is, each individual's characteristics such as age and education (X_i), the demand conditions in the individual's region, occupation, and industry (D_i), and the value of the selectivity bias variable (λ_i) were substituted into the following equation:

$$W_{2i} = a_0 + a_1'X_i + a_2'D_i + a_3\lambda_i,$$

where W_{2i} is the predicted second economy wage for the i–th individual and the a_j's are the coefficient estimates in Table 3. The average predicted second economy wage for participants and nonparticipants may be seen in Table 4 below.

TABLE 4. FIRST AND SECOND ECONOMY WAGES FOR MEN AND WOMEN

	Participated in second economy?							
	YES				NO			
	W_0	W_1	Pred. W_2	Act. W_2	W_0	W_1	Pred. W_2	Act. W_2
Men	1.00	1.60	3.43	4.27	1.03	1.60	0.78	–
Women	0.79	1.17	2.88	3.56	0.76	1.04	2.41	–

W_0: Official hourly earnings on first economy job.
W_1: Hourly earnings on first economy job after taking into account theft of time and pilferage.
Pred. W_2: Predicted second economy hourly earnings, estimated by OLS wage regression with correction for selectivity bias (see Table 3).
Act. W_2: Actual second economy hourly earnings for those who participated in second economy.

Two interesting patterns may be deduced from Table 4. First of all, although the differential between men's and women's average wages observed in the first economy persists in the second economy, it is much milder. For this particular

[17] That is, we would not have systematically mismeasured the expected wage relative to what we actually did. Note, however, that what we did was not very good, as the low F–statistic for the regression shows.

sample (which of course is not a random sample), the men on average earn about 38% more per hour in the first economy (when we include pilferage), but only 20% more in the second economy, both for predicted and actual second economy wages.

Secondly, Table 4 shows the remarkable difference between men and women in the way the expected wage segments the sample into second economy participants and nonparticipants. For men, those who do moonlight in the second economy face a predicted W_2 of 3.43 rubles/hour, while those who do not can expect to make only 0.78 rubles/hour! This already suggests that W_2 will be a powerful factor in men's participation decisions. Meanwhile, for women, the situation is much less clear. On average, those who work in the second economy have a higher expected W_2, but not by much.

(iv) LABOR SUPPLY EQUATION

Now that we have obtained a predicted second economy wage for the entire sample, we can finally proceed to the study of the determinants of labor supply. Table 5 presents the results from tobit estimation of the second economy labor supply function.

First, consider the result for the second economy wage.The extremely large and significant coefficient estimate implies that labor supply in the second economy is highly elastic and is forward–bending for both sexes. This result agrees well with studies of moonlighting in a Western market economy. SHISHKO and ROSTKER [1976], e.g., found that the higher the expected wage on the secondary job, the more hours American males worked on that job.

Secondly, we can note that first economy earnings and hours show up here with generally the same impact as we predicted from simple inspection of the means of these variables for the participating and nonparticipating subsamples. Both first economy earnings and pilferage have negative effects (and as in the case of the initial reduced–form probit, they are of roughly the same magnitude; in the case of women, they are identical). Official hours also have a negative effect on second economy participation: the more hours worked on the primary job, the fewer hours worked on the second economy job. The effects of the spouse's income and hours are also the same as in the reduced form: for the husband, his wife's earnings are indistinguishable from his own, while her hours are insignificant. For the wife, the husband's earnings are insignificant, while his first economy hours have the same qualitative effect as her own.

Age and education have clearly important effects on labor supply for both sexes, with nonlinearities in all cases. Concretely, among men, moonlighting rates are highest for younger men. They then decline until about age 40, where they remain relatively stable until age 60. For women, the peak age of second economy labor supply is around 37 years. The youngest and oldest women supply considerably fewer hours. The effect of education also differs between the sexes. After the mid–secondary level (7 or 8 years of education), the more education a man has, the more hours he tends to supply to the second economy. The positive effect of education for women, on the other hand, peaks at around 12 years. Women with

more than 12 years of education start to moonlight less, although their moonlighting rates are still much higher than those of women with very low education.

TABLE 5. TOBIT ESTIMATES FOR SECOND ECONOMY LABOR SUPPLY FOR MARRIED MEN AND WOMEN

Dependent variable: Weekly hours in second economy activity. Estimated on all men and women in the sample.

	MEN (N=742)		WOMEN (N=591)	
	Estimate	t–statistic	Estimate	t–statistic
SECOND ECONOMY WAGE				
1. Predicted second economy wage (R/hr.)	12.928	(14.99)	27.568	(11.41)
FIRST ECONOMY EARNINGS AND HOURS				
2. Official first economy earnings (R/mo.)	–0.040	(4.32)	–0.062	(2.46)
3. Pilferage from first economy job (R/mo.)	–0.081	(9.36)	–0.062	(2.57)
4. Official first economy hrs./wk.	–0.667	(7.42)	–0.255	(2.86)
5. Hrs./wk. stolen from first economy job	0.512	(7.27)	0.327	(3.81)
SPOUSE'S FIRST ECONOMY EARNINGS AND HOURS				
6. Spouse's first economy earnings (R./mo.)	–0.041	(3.33)	0.010	(1.44)
7. Spouse's first economy hours/week	0.040	(0.76)	–0.109	(1.73)
PERSONAL CHARACTERISTICS				
8. Age in years	–2.092	(3.20)	5.884	(6.17)
9. Age in years squared	0.021	(2.61)	–0.079	(6.16)
10. Education in years	–3.281	(2.06)	48.890	(9.83)
11. Education in years squared	0.221	(3.12)	–2.020	(9.82)
FAMILY DATA				
12. Number of children age 0–3	–0.582	(0.36)	5.946	(3.41)
13. Number of children age 4–15	–0.435	(0.53)	1.840	(1.98)
REGIONAL CONDITIONS				
14. Armenia	–7.900	(4.02)	–59.426	(9.69)
15. Constant	69.470		–427.459	
Log likelihood value	–1021.290		–528.726	

Note.—The figures listed as t–statistics are actually the absolute values of the asymptotically normal z–statistics, which are computed from the coefficients and their standard errors just as t–statistics are. In large samples, z–statistics are identical to t–statistics. Other independent variables included in the regressions but not reported here were dummies for first economy occupation and branch of the economy.

Finally, the family data variables show clearly that the number of children in the family has an influence on women only. The presence of children under the age of four years is a particularly strong motivating factor for second economy activity for women. Based on the model we have followed here, this is a somewhat peculiar finding. While it is true that studies from other countries generally confirm that women with small children tend to work in the informal sector for the flexibility of hours it offers (see TIEFENTHALER [1990] and other works cited in her paper), the women in our sample all hold full–time primary jobs in the state sector (formal sector). Consequently, moonlighting in the second economy means working extra

hours in addition to what we have assumed to be a predetermined number of first economy hours—hardly a move towards flexibility. There are two possible explanations for our finding. The first is that for some reason Soviet women with small children place a higher value than do other women on moonlighting income relative to the increased nonmarket time they would have if they did not moonlight. The other explanation is that our basic assumption of an exogenous first economy choice is simply not true. In other words, Soviet women may indeed be adjusting their first economy jobs to allow for fewer hours there, and replacing those hours with hours in the second economy. Thus, while their total hours might remain the same, the result would be increased flexibility. To the extent one rejects the plausibility of the first of these explanations, there is reason to reconsider the assumption that the first and second economy labor supply choices are independent.

SEPARATE PARTICIPATION AND HOURS DECISIONS

One final issue to be discussed before concluding our analysis is that of whether or not the decision to participate in the second economy and the decision of how many hours to supply, once a person has decided to participate, are truly the same decision. The tobit model we have used is based on the assumption that these two decisions are generated from a single truncated process. As pointed out by various authors (e.g., HECKMAN [1980] and SCHULTZ [1990]), such an approach may suppress distinctive features of the actual decision-making process. As Schultz notes, "[t]here are good reasons ... to analyze separately the decision to enter the market labor force and the choice of how many hours to work when participating." One way to separate the two decisions is to look only at those individuals who actually chose to moonlight in the second economy and examine the determinants of their labor supply. To do this, we performed a simple OLS regression of second economy hours on the same variables as used in the previous tobit analysis, adding only the selectivity bias variable. The results are shown in Table 6.

Perhaps the most noticeable difference between Tables 5 and 6 is the reduction in the size of the impact of the predicted second economy wage. From this we conclude that the main effect of a change in the predicted second economy wage is to affect participation, and not hours of labor supplied, given that an individual has already decided to participate. We can also see that personal characteristics (age and education) seem to have little effect on labor supply once the participation decision has been made. Interestingly, the effects of variables associated with the first economy job are very little changed by making labor supply conditional on second economy participation (at least not for men): the OLS estimates are close to the tobit estimates.[18]

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[18] One other interesting comparison that can be made is one between our results and those in SHISHKO and ROSTKER's [1976] study of moonlighting by American males (male heads of households with full-time primary jobs) in 1969. Although our Soviet males moonlighted at a much higher rate than the American males (36% as compared to 15%), the Soviet females in our sample were more nearly comparable: their rate of moonlighting was 21%. The mean number of hours supplied by moonlighters and their wages were also very close: the American men worked 8.1 hours/week on the second job, while the Soviet women worked 8.9 hours/week. The average

TABLE 6. OLS ESTIMATES FOR SECOND ECONOMY LABOR SUPPLY FOR MARRIED MEN AND WOMEN

Dependent variable: Weekly hours in second economy activity. Estimated only on men and women who participated in second economy.

	MEN (N=264)		WOMEN (N=126)	
	Estimate	t-statistic	Estimate	t-statistic
SECOND ECONOMY WAGE				
1. Predicted second economy wage (R/hr.)	2.189	(1.40)	3.978	(1.39)
FIRST ECONOMY EARNINGS AND HOURS				
2. Official first economy earnings (R/mo.)	–0.037	(2.17)	–0.036	(0.61)
3. Pilferage from first economy job (R/mo.)	–0.077	(3.31)	–0.122	(0.99)
4. Official first economy hrs./wk.	–0.706	(3.35)	–0.359	(0.78)
5. Hrs./wk. stolen from first economy job	0.800	(2.95)	0.423	(1.25)
SPOUSE'S FIRST ECONOMY EARNINGS AND HOURS				
6. Spouse's first economy earnings (R./mo.)	–0.054	(2.66)	0.009	(0.57)
7. Spouse's first economy hours/week	0.110	(1.55)	–0.159	(0.56)
PERSONAL CHARACTERISTICS				
8. Age in years	0.576	(0.51)	2.214	(1.17)
9. Age in years squared	–0.010	(0.67)	–0.028	(1.31)
10. Education in years	0.193	(0.10)	9.520	(0.92)
11. Education in years squared	0.011	(0.11)	–0.411	(0.93)
FAMILY DATA				
12. Number of children age 0–3	0.495	(0.28)	5.531	(0.68)
13. Number of children age 4–15	–0.951	(1.03)	1.468	(0.63)
REGIONAL CONDITIONS				
14. Armenia	9.934	(1.81)	–8.254	(0.84)
SELECTIVITY BIAS VARIABLE				
15. λ	32.542	(1.87)	16.623	(0.58)
16. Constant	8.951	(0.33)	–92.388	(0.90)
R^2	0.284		0.318	
R^2 adjusted	0.191		0.131	

Note.—T-statistics are absolute values. Other independent variables included in the regressions but not reported were dummies for first economy occupation and branch of the economy.

moonlighting wage in the U.S. sample in 1969 was $3.42; our women earned 3.56 rubles per hour. The coefficient estimates from our OLS labor supply regression (reported in Table 6) and the comparable estimates in Shishko and Rostker's study not only have the same sign throughout, but are remarkably close in value. The effect of the moonlighting wage on second job hours ($\partial H_2/\partial W_2$) for Soviet women was 3.978; for American men it was 3.153. The effect on nonlabor income ($\partial H_2/\partial V$) was –.036 for Soviet women, and –.034 for American men. The effect of primary job hours on moonlighting hours ($\partial H_2/\partial H_1$) was –.359 for Soviet women and –.275 for American men.

VIII. CONCLUSIONS

The findings of this study can be summarized in three main points.

(1) Contrary to some common assumptions about the Soviet labor market, there is a genuine flexibility of hours overall for Soviet workers. Much of this flexibility is due to purely informal elements in the Soviet labor market—the ability of workers to steal time from their primary job and to work extra hours in the second economy. Flexibility also appears to exist in wage–setting, in the sense that some workers can steal enough materials from their jobs to substantially raise the level of average hourly earnings on the first economy job, not to mention what they can earn in the second economy. Our analysis showed that the impact of these formal and informal elements on workers' moonlighting decisions is equivalent.

(2) Soviet men and Soviet women both exhibit a forward–bending labor supply curve for the second economy. As the second economy wage rises, workers supply more hours. In this respect, Soviets behave the same as workers in the United States have been shown to do with respect to moonlighting.

(3) There is a clear asymmetry in household decision–making. In making their second economy participation decision, Soviet men regard their wives' primary job income as equivalent to their own, but they do not let their wives' hours of work affect their decision. Women, on the other hand, must take their husband's working hours into account, but are not influenced by their husbands' income.

All of these conclusions are conditional upon one fundamental assumption made in this paper: that first economy hours and earnings are exogenous to the second economy labor supply decision. That is, we assumed that an individual first makes his or her choice of a first economy job with all its attributes, and only then decides on whether or not, and how much, to moonlight in the second economy. The robustness of the conclusions stated above to changes in this assumption remain to be studied.

APPENDIX

TABLE A1. TESTING FOR THE EQUALITY OF FORMAL VS INFORMAL VARIABLES AND HOUSEHOLD DECISION–MAKING VARIABLES FROM THE HUSBAND'S STANDPOINT

Likelihood ratio tests based on the stage 1 reduced–form probit for men's participation

Model	Null hypothesis ((hypothesis to test)	Log likelihood value	LRT	χ^2	Decision
(1)	Basic model	–398.48			
(2)	Husband's official earnings = husband's pilferage	–398.85	0.74	5.02	Accept
(3)	Husband's official hours = – husband's stolen hours	–398.81	0.65	5.02	Accept
(4)	Husband's official earnings = husband's pilferage AND husband's official hours = – husband's stolen hours	–399.36	1.76	7.38	Accept
(5)	Husband official earnings = wife's official earnings	–398.50	0.04	5.02	Accept
(6)	Husband's official hours = – wife's official hours	–399.90	2.85	5.02	Accept
(7)	Husband's stolen hours = wife's official hours	–402.83	8.69	5.02	**Reject**
(8)	Husband's pilferage = wife's official earnings	–398.60	0.24	5.02	Accept
(9)	Husband's official hours = – husband's stolen hours = wife's official hours	–403.36	9.75	7.38	**Reject**
(10)	Husband's official earnings = husband's pilferage = wife's official earnings	–398.90	0.85	7.38	Accept

Note.—The hypothesis tests reported in the table consisted of testing each of the models (2)–(10) against the basic unconstained model (1). Model (1) included all variables entered separately. LRT, or the likelihood ratio test statistic, is defined as $2[\log L(\Omega) - \log L(\omega)]$, where $L(\Omega)$ is the likelihood value of the unconstrained model (model 1) and $L(\omega)$ is the likelihood value of the constrained model (models (2)–(10), each with a different null hypothesis imposed). LRT can be shown to have the limit distribution χ^2 (q), where q is the number of constraints imposed [AMEMIYA 1985, pp. 141–146]. The χ^2 value listed is the 5 percent significance limit for the number of degrees of freedom for the test in question. $\chi^2(1) = 5.02$; $\chi^2(2) = 7.38$. If LRT > χ^2 (q), the null hypothesis must be rejected.

TABLE A2. TESTING FOR THE EQUALITY OF FORMAL VS INFORMAL VARIABLES AND HOUSEHOLD DECISION–MAKING VARIABLES FROM THE WIFE'S STANDPOINT

Likelihood ratio tests based on the stage 1 reduced–form probit for women's participation

Model	Null hypothesis (hypothesis to test)	Log likelihood value	LRT	χ^2	Decision
(1)	Basic model	–264.80			
(2)	Wife's official earnings = wife's pilferage	–265.22	0.84	5.02	Accept
(3)	Wife's official hours = – wife's stolen hours	–264.93	0.26	5.02	Accept
(4)	Wife's official earnings = wife's pilferage AND wife's official hours = – wife's stolen hours	–265.31	1.03	7.38	Accept
(5)	Wife official earnings = – husband's official earnings	–265.35	1.09	5.02	Accept
(6)	Wife's official hours = husband's official hours	–265.09	0.57	5.02	Accept
(7)	Wife's stolen hours = – husband's official hours	–264.82	0.03	5.02	Accept
(8)	Wife's pilferage = – husband's official earnings	–267.58	5.55	5.02	**Reject**
(9)	Wife's official hours = – wife's stolen hours = husband's official hours	–265.10	0.60	7.38	Accept
(10)	Wife's official earnings = wife's pilferage = – husband's official earnings	–268.00	6.39	7.38	Accept

Note.—The hypothesis tests reported in the table consisted of testing each of the models (2)–(10) against the basic unconstained model (1). Model (1) included all variables entered separately. LRT, or the likelihood ratio test statistic, is defined as $2[\log L(\Omega) - \log L(\omega)]$, where $L(\Omega)$ is the likelihood value of the unconstrained model (model 1) and $L(\omega)$ is the likelihood value of the constrained model (models (2)–(10), each with a different null hypothesis imposed). LRT can be shown to have the limit distribution χ^2 (q), where q is the number of constraints imposed [AMEMIYA 1985, pp. 141–146]. The χ^2 value listed is the 5 percent significance limit for the number of degrees of freedom for the test in question. $\chi^2(1) = 5.02$; $\chi^2(2) = 7.38$. If LRT > χ^2 (q), the null hypothesis must be rejected.

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PRETENDING TO WORK AND PRETENDING TO PAY: A HEDONIC WAGE APPROACH TO THE BEHAVIOR OF SOVIET WORKERS AND MANAGERS*

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SUMMARY

The widespread shirking and pilfering on the part of Soviet workers has long been a favorite subject of observers of the contemporary Soviet Union. It is more difficult to find a sensible explanation of the causes of this behavior.

This paper argues that, rather than being an expression of some cultural flaw of the Soviet worker, this apparent slothfulness and thievery are a rational response to the hitherto prevailing organization of the Soviet labor market. By stealing time and goods, workers are introducing flexibility into an otherwise rigid administered system of pay and hours. Moreover, since such flexibility is in the interest of both workers *and* managers, the informal compensatory activities of Soviet workers have become an institutionalized feature of the Soviet economy.

In short, by an unwritten agreement between the immediate parties on the Soviet labor market, the "real" wage paid and received for a job in the Soviet Union is not a simple sum of rubles each month, but rather a bundle of components, some legal and some technically quite illegal.

Using an implicit market, or hedonic wage, approach, the paper examines what the "wage bundles" in the Soviet Union are like, how they differ both across the sectors of the economy and across individuals, and why.

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I. INTRODUCTION

In their recent book, *The Turning Point: Revitalizing the Soviet Economy,* Nikolai SHMELEV and Vladimir POPOV [1989] describe a major contradiction between theory and practice in the current system of pay and labor incentives in the Soviet Union. In *theory,* the central state labor organization, Goskomtrud, sets wages to provide fair compensation to each worker on the basis of "the quality and quantity of labor expended, the difficulty, intensity, or harmfulness of the work, the natural and climatic living conditions, and a number of other factors" [p. 184]. In *practice,* what happens in wage-setting is quite different. Shmelev and Popov give an example of the real situation:

> [W]hy are wages in trade, light industry, the food industry, and the administrative bureaucracy noticeably lower than in machine building? Is it possible that the qualifications of the workers are lower, or is the labor less intensive? In individual cases, one of these may be the reason, but that is not the whole story.... The real reason is that there are no opportunities in heavy industry to supplement one's income or, more simply, you can't take much out of the factory that can be used in a home business or that can be sold on the black market. In trade, light industry, and the food industry, which deal with consumer goods, there are many more such opportunities. The administrative bureaucracy has additional benefits, such as ease of obtaining housing, travel to recreational facilities, and so on....
>
> Here are the stubborn facts. Workers engaged in trade and commerce spend 60 percent more than their official incomes [*Ogonyok*, No. 36, 1987, p. 7]. If we multiply the average wage of workers in trade by the coefficient characterizing the amount by which their spending exceeds their income (1.6), we get the average wage for a construction worker (245 rubles). It goes without saying that, in construction, the qualifications are higher and the labor is more difficult (although how is one to judge?), but we must also make a correction for the risks that accompany obtaining "unofficial" income [pp. 185–186].

In the opinion of Shmelev and Popov, whatever the country's official wage rate system may have been when it was originally designed, it has by now become "an artificial construction, alienated from real economic life, a kind of decorative addition to the actual mechanism of payment of labor" [p. 184].

The present paper is about this "actual mechanism of payment of labor." In all the branches of the Soviet economy, not only are workers paid an official, legal wage, but they additionally compensate themselves by stealing goods and materials, by "stealing time," and by taking advantage of opportunities to engage in underground private economic activity. Moreover, and perhaps more important, they do not engage in these unofficial compensatory activities randomly and in

conflict with their superiors. Rather, they do so systematically and with the approval, even the encouragement, of their bosses. In short, by an unwritten agreement between the immediate parties on the Soviet labor market, the real "wage" paid and received for a job in the Soviet Union is not a simple sum of money each month, but rather a bundle of components, some legal and some technically quite illegal.[1]

This paper will begin to examine what the wage bundles in the Soviet Union are like, how they differ across branches, and why. The rest of the paper is structured as follows. Section II discusses the picture of branches as presented in official Soviet statistics. Section III gives some examples of the anecdotal evidence of unofficial components of the wages received by Soviet workers. Section IV presents a model of labor market behavior of both workers and enterprises to explain the existence of such bundles. Section V introduces a unique set of data, the Berkeley–Duke Emigre Survey, that can permit an investigation of these bundles empirically. Section VI presents some results obtained from estimation using the data set.

II. OFFICIAL DATA ON DIFFERENCES AMONG THE BRANCHES OF THE SOVIET ECONOMY

Before we examine the "actual mechanism" of Soviet wage–setting, it may be helpful to look at the official picture. Table 1 summarizes the wage differences across some of the main branches of the Soviet economy.[2]

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[1] Although I have chosen to cite the work of Shmelev and Popov to introduce the theme of this paper, it should be noted that discussion of the concept of an informal wage mechanism in the Soviet economy is much older. Over ten years ago, Gregory GROSSMAN [1979, p. 854] described the inverse relationship that exists between illegal side earnings in a Soviet job and the official pay. In work begun in 1987–88, TREML [1990] has followed an innovative approach in estimating the value of one of the informal wage components, namely theft of materials.

[2] The figures in Table 1 are for 1977. That year was chosen in order to facilitate comparisons later in the paper with data from the Berkeley–Duke Emigre Survey, which relates to conditions in the late 1970s. Still, very little has changed even today regarding the pattern of relative wages across industries and the number of hours worked per week.

The figure listed in Table 1 as "Average Pay (R/mo.)" is what is referred to in Soviet statistical handbooks as the "average monthly monetary wage [*srednemesyachnaya denezhnaya zarabotnaya plata*]" for all wage earners and salaried employees. This is computed by dividing the wage fund by the average number of employees in a branch or the entire economy. The wage fund includes all regular wages (including piecework earnings and overtime), regular bonuses, vacation pay, and the value (at state prices) of free housing, free municipal services, and similar in–kind payments prescribed by law. The wage fund does not include one–time bonues or such social welfare transfers as sick pay or maternity pay.

TABLE 1. AVERAGE MONTHLY AND HOURLY EARNINGS IN VARIOUS BRANCHES OF THE SOVIET ECONOMY IN 1977

Sector	Average pay (R/mo.)	Average hrs./wk.	Hourly earnings (R/hr.)
All Sectors	155.2	40.1	0.90
Industry	172.9	40.7	0.99
Coal Mining	281.7	35.6	1.84
Machine-Building and Metalworking	174.5	40.9	0.99
Chemical and Petrochemical	174.5	39.9	1.02
Light	136.5	40.9	0.78
Food	158.8	41.0	0.90
Transportation	186.2	41.0	1.06
Communications	136.4	40.6	0.78
Construction	185.4	40.9	1.05
Retail Trade and Public Dining	117.1	40.9	0.67
Housing, Municipal and Consumer Services	117.3	41.0	0.67
Health	108.7	38.6	0.65
Education	129.7	32.6	0.93
Culture	97.7	38.8	0.59
Arts	109.8		
Science	164.6	40.6	0.94
Credit and State Insurance	140.5	41.0	0.80
Government Administration	135.9	41.0	0.77

NOTE.—Monthly wages for the five industrial sectors are from *Vestnik statistiki*, No. 8, 1980, p. 78. All others from *Narkhoz 1977*, pp. 385–386. Weekly hours are from *Narkhoz 1977*, pp. 388–389. Hourly earnings = average monthly wage ÷ (average weekly hours x 4.3).

Whether we calculate wages as earnings per month (as all Soviet statistics do) or as hourly earnings, Table 1 shows that there are significant differences across the branches. Even if we exclude a case such as coal mining, the average worker in the highest paid branch commands around 80% higher pay than the worker in the lowest paid branch. In itself, of course, such a difference does not necessarily contradict the officially stated principles of wage-setting. It may be that the differences in pay are easily explainable by precisely those differences in worker characteristics, job conditions, or geographical location which are explicitly provided for in official policy. If, for instance, workers in one branch are more highly skilled or are exposed to more difficult or dangerous working conditions, it is only natural that they be paid more. But to determine whether or not this is the case, we would need to look at data on such inter-industry differences with respect to the labor force and to the jobs performed. Unfortunately, this is easier said than done. Despite a flow of new statistical materials from the Soviet Union in the past couple of years, we still lack some very elementary information on the Soviet work force in general and across industries or sectors of the economy in particular. There are, for instance, no detailed figures on educational and skill levels by industry and

no breakdowns of specific male–female wage differences. It is only possible in some cases to provide rough estimates of relevant labor force characteristics. Table 2 presents some of what we do know.

TABLE 2. CHARACTERISTICS OF THE SOVIET WORK FORCE IN VARIOUS BRANCHES

Sector	% Urban	Average Age	Average Years of Education	% Female
All Sectors	.79		9.0	.51
Industry	.92	37.6	9.0	.48
Coal Mining				
Machine–Building and Metalworking				.43
Light				.78
Food				.57
Transportation	.92	37.7	8.7	.24
Communications	.84		9.1	
Construction	.83	37.1	9.1	.28
Retail Trade and Dining	.84	37.4	8.9	.76
Services	.92	40.0	8.4	
Health	.81	38.7	10.1	.82
Education	.65	38.0	11.3	.74
Culture		38.0	10.2	.67
Arts	.69			
Science	.93		11.5	.51
Information Processing	.96			
Credit and State Insurance	.90		10.2	.84
Government Administration	.83	38.3	11.1	.66

NOTE.—The data in Table 2 relate to various years, depending on availability of statistics. Percentages of employees in urban areas are for 1975 given in *Trud v SSSR* [1988, pp. 37–38]. Average ages are for 1987 given in *Trud v SSSR* [1988, p. 109]. Years of education are estimated on the basis of the distribution of employees in sectors by educational level in 1979 presented in *Chislennost' i sostav naseleniya 1979 goda* [1984, p. 173]. The estimated number of years of education for each educational level is from TREML [1987, p. 2.3]. Percentages of female employees in industrial branches (for 1978) are from *Narkhoz 1988* [p. 40]; for other branches (for 1980) from *Trud v SSSR* [1988, p. 105].

Table 2 allows us to informally test some possible explanations for wage differences. For instance, we can begin with the first column, the percentage of urban employees in each branch. The least urbanized branches (Arts and Culture, and Health) have the lowest wages, while two of the most urban branches, Science and Transportation, are highly paid—facts which suggest a positive correlation between wage levels and percentage of workers in urban areas. But what then do we say about Education, a relatively rural branch which receives above–average pay (measured as an hourly wage)? Or Services, which is an extremely urbanized sector and yet very poorly paid?

Age, though it varies less across branches, shows the same ambiguity. Years of education, too, are contradictory. On the one hand, workers in Government and Health have above–average educational levels, but below–average wages. Workers in Retail Trade have average educational levels but very low pay. Transportation

workers are somewhat more poorly educated than average but still earn substantially higher wages. And so on. We thus search in vain for an adequate single explanatory factor. (Indeed, embarrassingly enough for the theory of Soviet wage–setting, the only explanatory factor listed in this Table that does seem to be valid across the board is one that suggests outright gender discrimination: female–dominated branches earn less.)

All the above observations, of course, do not invalidate the official explanations of wage differences. While it may be true that none of the characteristics listed above, taken separately, accounts for wage differences across branches, perhaps some combination of them would. But official statistics are simply too sparse to allow such an analysis. Most important, the official statistics do not even hint at the possibility of other, illegal, components in a remuneration package to workers. For this, we have to turn to other sources. One such source is the vast evidence of a more informal nature in the Soviet literature. If reports in both the popular and scholarly press are to be believed, there is indeed, as Shmelev and Popov contend, something else going on beneath the surface. These unofficial elements of the Soviet pay structure are what we consider in the next section.

III. THE UNOFFICIAL COMPONENTS OF WAGE BUNDLES[3]

As any observer of the contemporary Soviet Union knows, there is no lack of anecdotal evidence of the stealing and shirking of Soviet workers. It is more difficult to find attempts to sort out the causes of this behavior. In the most recent period, it has become the custom among certain circles to attribute stealing from the workplace to pervasive moral flaws in the national character. Typical of this sort of indiscriminate self–flagellation is an article by Stanislav Govorukhin in *Sovetskaya kul'tura* [July 29, 1989, p. 6]:

> ... [W]e have turned into a nation of thieves of epidemic proportions. There is scarcely a single one of us who doesn't steal something. We steal from our plants and factories: sugar, coffee, tea, candy, screws, boards, transistors, paper. And from the enterprises where we work, we steal time—we arrive at work late, we leave early, and in the middle of the working day we take time off to run our own personal errands.

[3] The present section is only a very brief review of some published accounts of the informal aspects of the Soviet labor market and is intended merely to highlight the stylized facts. I am preparing a much more thorough compilation of the evidence, with special focus on documenting managerial complicity in arranging and protecting workers' rights to the components of the wage bundle. One particularly good secondary source for this subject (from which several of the Soviet–literature references in this section come) is ARNOT [1988], particularly his chapter 4, "Labour Discipline and Labour Shortage."

But while references such as this, and there are many, identify the universality of the phenomena we are studying in this paper, they miss the vital point that when workers steal—goods or time—they are often doing so with the complicity of their bosses. In this sense, some of the best sources on what goes on in the Soviet labor market have been not the outraged critics of general moral decline, but the specific official Party and government campaigns directed at the workplace. Two such campaigns can serve to illustrate the point. The first was Yuri Andropov's "campaign for workplace discipline" of late 1982 and early 1983. The second was the 1986 "campaign against unearned income."

Andropov launched his anti–shirking campaign only ten days after being elected Communist Party General Secretary in November 1982. His identification of the problem of what we have been referring to as "stealing time" led to immediate and extensive press coverage of cases of abuse. Not only did the articles attempt to provide some figures to quantify the problem[4], but they also described how managers themselves condoned or even organized the time theft. In fact, in one sense it was the managers, not the workers, who were the target of the campaign.[5] The campaign against "unearned income" was launched by a May 1986 Communist Party Central Committee resolution.[6] Although the concept of unearned income in Soviet usage refers to nearly all economic crime, there was in this campaign a particular focus on labor market behavior. As the economist V.M. RUTGAYZER [1989, p. 159] stated: "There is no doubt that the largest source of unearned income arose in the area of payment of labor and that it is associated with serious shortcomings in the planning and organization of the wage system." Rutgayzer describes how managers bend and break every conceivable rule to increase workers' pay (so as to recruit more workers and thereby increase the enterprise bonus fund). One example he cites is the common practice of padding of work orders. In transportation and construction, he writes, this practice has meant an average 15–20% increase in monetary payments to workers. Such reports, as well as the more familiar ones of theft of goods from the workplace, have been common in the four years since the campaign against unearned income was launched.[7]

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[4] For instance, *Trud* of December 29, 1982, reported that the average number of hours stolen by a worker is 2.4 hours a week; *Pravda* of December 28, 1982, claimed that a survey of 245 Moscow enterprises had shown that some firms had only 10% of their work force at work for the last hour of the working day.

[5] The climate towards managers in early 1983 was clearly different than in the more laid–back Brezhnev period when, for instance, *Pravda* [April 21, 1982, p. 3] could write, with a certain measure of sympathy, that the most important thing for a manager is to keep the workers happy: it's better to have a worker who turns up late, takes excessive breaks during his shift, and leaves early, than no worker at all.

[6] See BELKINDAS [1989] for a chronology of important press sources on the campaign and its results.

[7] Increasing the monetary wages of workers, through falsification of work orders, manipulation of pay norms, etc., is of course an old practice on the part of Soviet managers. BERLINER [1957] describes how intense competition for labor in the 1930s and 1940s led to the use of such methods as part of the "labor pirating" among firms. Sources cited by BARBER [1986]

IV. TRADE-OFFS BETWEEN LEGAL AND ILLEGAL COMPONENTS OF THE WAGE BUNDLE

The preceding section gave a hint of the ample evidence in the Soviet literature of the existence of illegal components of wage bundles, as well as of the fact that workers and managers have a joint interest in this system. In the present section, we offer an explanation for why this system has arisen and how it operates to produce an equilibrium of sorts in the labor market. To do so, we look at both the worker and the enterprise.

A. THE WORKER'S TRADE-OFFS

It is not hard to understand the worker's interest in a system of informal compensation for low legal pay. Faced with the choice between working a 40-hour week for a low legal wage and being able to supplement the wage by stolen goods or to reduce the work week by stealing hours, most workers would be tempted to take the extra compensation, provided the risk is not too high. But if there were a choice between two jobs, one offering high pay and low theft opportunities and another with low pay and ample theft opportunities, how does he decide between them? Clearly, workers will differ in their choices.

Take theft of materials. There are reasons why this might be both better or worse than rubles in one's pay envelope. If the goods in question are desirable to the employee and are scarce, the stolen goods might be better than cash (for instance, if some sort of queue-rationing mechanism required a time expenditure as well as money to purchase goods in state stores). In a shortage economy, the value of cash itself may not be very certain, in terms of goods commanded in the market. On the other hand, there is *some* risk involved in stealing, and hence the subjective trade-off between cash and stolen goods will depend on the worker's attitudes towards the risk of detection and the possible penalty for pilferage.[8] Apart from the legal issue—the risk of penalties—theft of materials from the workplace will generally also be associated with uncertainty of supply. The month-to-month variation in opportunities to pilfer goods (or variation in the types, amounts, and qualitity of goods to steal) would imply that the utility value of stolen materials is less to a risk-averse individual than the cash equivalent of their mean value.

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document that during the Stalinist era managers continued such practices even in the face of direct threats of imprisonment or execution.

[8] I would argue that in general, the risk of incurring penalties for engaging in pilferage from the workplace has been very small. As described in the previous section, there was a crackdown during the Andropov period, and even during the Brezhnev era there were, of course, some arrests for theft from the workplace. However, in view of the rampant nature of the pilferage phenomenon, what seems remarkable is that there were so few documented cases of arrest and prosecution.

Similarly, we can expect workers to have different preferences for stolen hours. Here, too, both risk of penalty and uncertainty of availability would be considerations. But we may also find that different workers may be very eager to steal hours for quite different reasons. One may simply want more leisure, another may need the time for household production (e.g., standing in queues), while a third may be eager to have more time for second economy activity. Consequently, the biggest "leisure–lovers" and the biggest "workaholics" may be among those who are most willing to make a job choice which entails sacrificing a high legal wage in order to steal more hours.

In short, heterogeneity of workers' preferences and constraints will yield differences in the demand for various bundles.

B. THE ENTERPRISE MANAGER'S TRADE–OFFS

To determine the supply of wage bundles, we must look at the problem from the standpoint of the Soviet enterprise, or rather, the enterprise manager. Just as the worker is interested in supplementing his legal wage by unofficial elements, so too the manager is interested in finding means of informal compensation to workers. The manager's success and well–being in his position depends very directly on the number of workers he has. Not only is there a immediate connection between his own bonuses and the size of his work force, but his ability to meet virtually every success indicator will increase, the more workers he has. ARNOT [1988] sums up the manager's position in this respect:

> As Berliner pointed out in the late fifties, labour will be hoarded to meet unexpected contingencies. This situation has not changed and the continual changes in plan targets, changes in priorities, breakdowns due to poor quality machine tools coupled with inadequate maintenance and repair, staff being withdrawn for agricultural work at harvest time, late supply of essential inputs, all lead to arhythmic work patterns and confirm the rationality of labor hoarding for enterprise management seeking to fulfil plan targets [p. 41].

Thus the manager wants to attract labor, and yet he is constrained by the fact that the central authorities prevent him from offering a high enough wage. So he has to offer something more: he must illegally manipulate pay scales, allow workers to steal goods, permit them to openly shirk or be absent, or grant them some other privileges not provided for officially. The problem for the manager is that all of these informal compensation mechanisms carry a cost. Hence he must balance the benefit of having more workers against the cost of the means to attract and keep them.

It is here that variation among branches enters into the picture. At some enterprises or institutions, a manager may find that letting workers shirk or even be absent from the plant—permitting them to steal time—is relatively costless (that is,

measuring cost in terms of the impact on output or other performance indicators). At other plants, condoning theft of desirable goods may be an easier (cheaper) way of attracting workers. And still others may happen to offer ideal opportunities for use of tools and other facilities by their workers to produce goods for the second economy.

The pattern of behavior of workers and managers described above fits into a formal model of labor markets known as the implicit market model, or the hedonic wage model. (The model is presented in more detail in Appendix A to this paper.) Following standard results from the hedonic wage model, the amounts of the various wage components supplied (and the number of workers demanded) by the manager can be derived from the representative manager's utility function (or equivalently for this purpose, his bonus function). Utility maximization implies that the manager will offer more pilferage, more stolen time, and more of the other informal compensation mechanisms as these become easier for him to supply. For instance, the relaxation of an Andropov–style labor discipline campaign will make it easier to supply stolen time.

One of the most important implications of the hedonic wage model, however, is that workers and enterprises will in equilibrium be matched with one another depending on workers' preferences and enterprises' abilities to provide different components. Because of this equilibrium matching and sorting, the effects of a change in one component in the wage bundle on all the others is uncertain. It depends on compensating trade–offs among the components on the part of both workers and managers (and hence ultimately on the distribution of tastes and technologies across workers and firms). If there were no such compensating trade–offs, then as the wage rises, theft and stolen hours would decline. However, when the compensating differences are taken into account, the wage increase causes an uncertain response (at least, one which is unpredictable by theory) in terms of theft and stolen time. The final result becomes an empirical question. This leads to the issue of actual data on the full wage bundles, the topic of the next section.

V. DATA FOR EMPIRICAL INVESTIGATION

As we have seen, official Soviet statistics to date do not give us a clear picture even of what is happening with respect to the official components of the wage bundles, much less information about the nature of the informal/unofficial components and their determinants. The best we have from Soviet sources are the types of references mentioned in Section III. To take one of the more precise examples (which is still very crude in terms of what would be needed), recall that the *Ogonyek* article cited by Shmelev and Popov states that the unofficial incomes of retail trade workers exceed their official incomes by 60%. Even if we assume that this extra 60% consists exclusively of pilferage and/or bribes from the retail job, the data are inadequate. Ideally, what we would need are such figures for each branch of Soviet industry. Then we would want the data on the number of stolen

hours, plus something to indicate the availability of second economy opportunities in each branch. Finally, we would need to know how these components all fit together into specific packages, how they mutually determine one another, and to what extent they are related to the observable characteristics of the workers in that branch. Only with such a picture could we begin to think about predicting why different individuals choose to work in different branches, and so on.

The one source that does offer a possibility of examining important elements of the unofficial wage structure is the data set from the Berkeley–Duke Emigre Survey. The Berkeley–Duke survey was compiled in the early 1980s by Professors Gregory Grossman, Vladimir Treml, and Michael Alexeev for the specific purpose of studying the second economy in the Soviet Union. The survey is based on extensive interviews with members of over 1000 Soviet households who had recently emigrated to the United States.[9] One of the areas covered rather thoroughly by the survey is labor supply and allocation of time.

The subsample of the Berkeley–Duke data set used for investigation here consists only of married couples with both spouses working—1388 individuals. Table 3 presents the sample means of these wage bundle variables by branch of the economy. Table 4 shows some of the demographic characteristics of workers in the branches.

Note first that the official monthly wage of sample participants in each branch is generally not far from that reported in official statistics (listed in Table 1). The notable exceptions are Health, Culture, and Science, where the sample means are substantially higher than the parent population means. There are several possible explanations. The Berkeley–Duke sample is exclusively urban, while the means in Table 1 are means for the entire urban *and* rural working population of the USSR.[10] A comparison of Table 4 and Table 2 also shows that the Berkeley–Duke sample is more highly educated than the labor force at large. Perhaps most notable are the regional and ethnic differences between the sample and the parent population. As the last four columns of Table 4 show, the Berkeley–Duke sample includes heavy representation by residents of Moscow and Leningrad and by ethnic Armenians, groups which account for a much smaller proportion of the overall Soviet work force.[11]

In general, it is clear that in order to make inferences about the actual labor force in the USSR and the wage bundles workers receive, we will have to control for the nonrandom nature of the Berkeley–Duke survey. The next section reports the results of two approaches to do this.

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[9] For a more detailed description of the Berkeley–Duke survey, see GROSSMAN [1987].

[10] The means in Table 1 do not include collective farm workers, nor do they include supervisory personnel.

[11] An estimate of the regional/ethnic breakdown of the labor force by branch was not available for this report. However, it can be noted for reference that Moscow and Leningrad together account for 7.3% and Armenia for 1.2% of the total population of the Soviet Union.

TABLE 3. SAMPLE MEANS OF HEDONIC WAGE COMPONENTS, BY BRANCH

Sector	N	Official Earnings (R./mo.)	Official Hours (Hrs./wk.)	Pilferage (R./mo.)	Stolen Hours (Hrs./wk.)	Second Economy Participation Rate (%)
Entire Sample	1388	149	39.3	37.21	3.95	.29
1. Machine	82	188	41.4	10.86	2.52	.21
2. Materials	75	166	40.0	21.20	3.84	.17
3. Craft	128	154	41.0	13.34	4.26	.41
4. Light	100	142	41.1	52.45	3.90	.13
5. Transportation	64	172	43.8	79.39	4.70	.34
6. Construction	97	189	42.1	39.85	5.39	.33
7. Retail Trade	94	113	42.1	130.14	4.28	.06
8. Services	192	125	41.2	49.99	5.13	.47
9. Health	144	144	39.4	32.35	2.80	.33
10. Education	195	140	30.0	19.26	2.16	.33
11. Culture	87	132	36.5	8.54	4.32	.23
12. Science	66	191	41.0	4.53	4.33	.12
13. Government	64	148	41.5	31.32	5.62	.22

TABLE 4. SAMPLE MEANS OF DEMOGRAPHIC VARIABLES, BY BRANCH

Sector	N	% Female	Average Age	Years of Education	% ML	% North	% South	% Armenia
Entire Sample	1388	.44	38.4	11.7	.18	.48	.17	.17
1. Machine-Building	82	.20	38.1	11.9	.20	.50	.11	.20
2. Materials	75	.31	39.2	12.5	.21	.47	.16	.16
3. Craft	128	.35	37.3	10.5	.15	.52	.10	.23
4. Light	100	.38	37.5	10.9	.08	.48	.24	.20
5. Transportation	64	.14	41.0	10.5	.20	.47	.08	.25
6. Construction	97	.20	39.1	11.9	.13	.57	.11	.19
7. Retail Trade	94	.53	39.5	10.4	.09	.56	.19	.16
8. Services	192	.39	40.2	10.1	.09	.57	.22	.12
9. Health	144	.67	40.4	12.3	.16	.49	.24	.12
10. Education	195	.71	36.6	13.3	.15	.41	.23	.21
11. Culture	87	.66	34.5	12.4	.46	.34	.11	.08
12. Science	66	.29	38.4	14.6	.48	.26	.17	.09
13. Government	64	.45	37.6	12.2	.31	.52	.03	.14

Notes to Tables 3 and 4.—"Materials" is a composite of extractive, fuel, petrochemical, paper and pulp, and metals industries. "Craft" is a composite including mainly electronics, instruments, furniture, apparel, and footwear industries. "Light" consists of light (other than those in "Craft") and food industries. "Culture" includes arts as well as culture. "Government" includes the sectors of communications, information processing, and credit and insurance as well as government administration.

In Table 3, "Pilferage" is a proxy and may include other informal income, including bribes, etc. It was valued by the respondents themselves.

In Table 4, "ML" stands for residents of Moscow and Leningrad; "North" for residents of the RSFSR (except for Moscow and Leningrad), Belorussia, the Ukraine, the Baltic republics, and Moldavia; "South" for residents of the Transcaucasian and Central Asian republics except for ethnic Armenians living in Armenia; and "Armenia" stands for ethnic Armenians residing in Armenia. Virtually all of the individuals classified as "South" in the Berkeley–Duke sample were ethnic "Northerners" (Russians, Jews) living in the South.

VI. ESTIMATION AND RESULTS

Our goal in this section will be to use the data from the Berkeley–Duke survey to do two things: (1) to establish that the wage bundles received by workers in the Soviet Union reflect clearly defined trade–offs among the various components; and (2) to determine the role of branch choice as the instrument for realizing these trade–offs.

Table 3 in the previous section (the sample means for the wage bundle components across branches) certainly suggests that distinct bundles exist in different branches. However, even this table does not allow us to answer the question of the nature of the trade–offs. For instance, is it true that a lower legal wage is associated with more theft of materials? Is more theft associated with more or fewer stolen hours? And so on. To investigate this, we will have to go beyond the mean values for each branch and look at individuals. We do, after all, have 1388 concrete wage bundles in the sample. How do the components relate to one another across the sample?

One relatively simple way to tackle this problem is to look at the pairwise correlations between bundle components. The problem here, however, is that if we do detect a correlation between two components, we will not know to what extent this is a result of the direct relationship between them and to what extent it is caused by the fact that both are related to a third set of factors, namely the worker's characteristics (e.g., age, education, region). The solution to this dilemma is to examine *partial correlation coefficients* rather than direct correlations. Partial correlation coefficients "purge" the correlations between two variables of their common explanatory factors.[12]

The correlations between the following six wage components were estimated in this way:

1. legal monthly earnings
2. the value (per month) of materials pilfered from the workplace
3. official hours per week
4. stolen hours per week
5. monthly earnings from a second economy job
6. weekly hours supplied to the second economy job.

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[12] Formally, partial correlation coefficients between two variables are obtained by linearly regressing each of the variables on the same group of control variables and then measuring the direct correlation between the two sets of residuals. That is, in our case, given a set of regression equations $W_{ij} = \beta' X_i + \varepsilon_{ij}$, where W_{ij} is the j–th wage component for the i–th worker (e.g., official earnings, official hours, stolen hours, pilferage) and X_i is a vector of personal characteristics (age, education), we run an ordinary least squares (OLS) regression for each component, save the residuals, and then measure the pairwise correlations between the residuals. The partial correlation coefficients are the correlation coefficients between those residuals.

The common control variables included a dummy for males, age in years, years of education, education squared, dummies for residence in Moscow–Leningrad, in the southern USSR outside Armenia, and in Armenia—the omitted regional dummy was residence in the northern USSR outside Moscow or Leningrad—and dummies for clerical occupations, professionals, and supervisory positions. The omitted occupation dummy was blue–collar occupations. Finally, there were four interaction terms to capture the specific effect of education in Armenia, and gender in Armenia, Moscow–Leningrad, and the southern USSR.

Table 5 shows the results of this exercise.

TABLE 5. PARTIAL CORRELATION COEFFICIENTS AMONG LEGAL AND ILLEGAL WAGE COMPONENTS

	Official Earnings	Pilferage	Official Hours	Stolen Hours	Sec. Econ. Earnings	Sec. Econ. Hours
Official Earnings	1.0000 (.0000)					
Pilferage	−.1134 (.0001)	1.0000 (.0000)				
Official Hours	.2802 (.0001)	.0970 (.0003)	1.0000 (.0000)			
Stolen Hours	.0086 (.7523)	.0419 (.1225)	.0596 (.0280)	1.0000 (.0000)		
Sec. Econ. Earnings	.0003 (.9898)	−.1005 (.0002)	−.1092 (.0001)	.1698 (.0001)	1.0000 (.0000)	
Sec. Econ. Hours	−.0712 (.0085)	−.1292 (.0001)	−.1293 (.0001)	.1698 (.0001)	.6638 (.0001)	1.0000 (.0000)

NOTE.—The top figure in each cell is the partial correlation coefficient between the row and column variables. The bottom figure in parentheses in each cell is the probability of the null hypothesis that there is a zero correlation.
For definitions of variables, see text.

Since it is mainly the sign and strength of the partial correlation coefficients that are of interest (rather than the numbers as such), Table 6 restates the information in Table 5 in a form which (hopefully) is easier to interpret. To repeat, what both Table 5 and Table 6 show are the pair–wise linear associations between components of our hypothesized wage bundles *after* we have adjusted for the personal characteristics of individual workers.

TABLE 6. SIGNS AND SIGNIFICANCE LEVELS OF PARTIAL CORRELATION COEFFICIENTS BETWEN HEDONIC WAGE COMPONENTS

	Official Earnings	Pilferage	Official Hours	Stolen Hours	Sec. Econ. Earnings	Sec. Econ. Hours
Official Earnings						
Pilferage	– – –					
Official Hours	+ + +	+ +				
Stolen Hours	0	0	+			
Sec. Econ. Earnings	0	– –	– – –	+ + +		
Sec. Econ. Hours	–	– – –	– – –	+ + +	+ + +	

NOTE.— A + or – indicates sign of partial correlation coefficient between pairs of variables. The number of +'s or –'s indicates the strength of the association from Table 5.

As a glance at all the '+'s and '–'s in Table 6 shows, there are numerous clear and strong associations. A couple of them are fairly trivial: OFFICIAL EARNINGS and OFFICIAL HOURS on the job show a strong positive correlation, as do SECOND ECONOMY EARNINGS and SECOND ECONOMY HOURS. This simply says that the more you work, in the first or the second economy, the more money you make—not a particularly surprising result. More interesting is to examine how the other components relate with one another.

We can examine the correlations in two groups. We will look first at how the informal components (PILFERAGE, STOLEN HOURS, and SECOND ECONOMY EARNINGS/HOURS) relate to the formal components (OFFICIAL EARNINGS and OFFICIAL HOURS) and then look at the relationships between the informal components themselves.

A. FORMAL VS. INFORMAL COMPONENTS

(i) The very strong negative correlation between PILFERAGE and OFFICIAL EARNINGS corroborate the Grossman–Treml (and later, Shmelev–Popov)

thesis: people who earn less legally tend to work in places that allow more theft of goods from the job. The strong positive correlation between PILFERAGE and OFFICIAL HOURS suggests that for some people, pilfering is a compensation for longer official hours as well.

(ii) STOLEN HOURS are positively correlated (albeit somewhat weakly) with OFFICIAL HOURS, suggesting that workers steal hours as a way of compensating for long legal hours. They do not, however, appear to compensate for low official pay by stealing hours (zero correlation between STOLEN HOURS and OFFICIAL EARNINGS).

(iii) SECOND ECONOMY EARNINGS/SECOND ECONOMY HOURS play a different role than the previous two unofficial components in the overall wage package. Whereas PILFERAGE and STOLEN HOURS are compensatory elements for low legal pay and/or long legal hours, the second economy components appear to be unrelated to official earnings and are negatively related to the length of the official work week. But this makes sense. After all, people who work in the second economy don't do it to compensate for long hours in the first economy. On the contrary, they can be expected to choose jobs in the first economy with *shorter* hours so that they will have more time to devote to their private economic activities.

Now let us look at the interplay among the informal components.

B. INFORMAL VS. INFORMAL COMPONENTS

(i) PILFERAGE vs. STOLEN HOURS shows no correlation. This means that workers whose compensation packages include large amounts of stolen goods show no consistent pattern of stealing more or less hours.

(ii) PILFERAGE vs. SECOND ECONOMY EARNINGS/SECOND ECONOMY HOURS. The correlation here is strongly negative, which suggests a rather interesting trade-off. Apparently, the same individual tends not to engage both in theft of materials from the first economy job and in second economy activity. Or to put it another way, a person who takes a job for its good second economy opportunities will be prepared to sacrifice theft opportunities. (Again, this highlights the relative importance for the second economy worker of *free time* in which to pursue his private activity.)

(iii) STOLEN HOURS vs. SECOND ECONOMY HOURS. The more hours you steal from your official job, the more hours you tend to devote to second economy activity. The relationship is very strong and could mean that most people who steal hours do so for purposes of using that time for second economy work rather than leisure.

This, then, is the pattern of trade–offs between components of the wage bundles *across the entire sample*. What remains to be considered is the role played by the worker's choice of branch. Is it the case that branch choice is a (or perhaps, *the*) mechanism by which these apparently well–defined bundles are realized? That is, is there a clear difference among bundles across branches? From Table 3, we know that there are differences in the sample means of the bundle components. However, those means were not corrected for productivity and other personal characteristics. One way of stating the problem we are interested in is to say that we do not want to know the value of the bundle facing the *average person* in a branch, since the average person might be quite different from one branch to another. Rather, we want to know what the bundles would look like, across branches, *for the same person*.

The following exercise was aimed at achieving that goal. Specifically, we tried to determine the expected value of the wage bundles in each of the 13 sectors for the same representative individual. In fact, the procedure was repeated for *two* individuals: first for a 37–year old male with 11 years of education from the northern USSR (but not Moscow or Leningrad), and then for a female with the same characteristics. (We also estimated the bundles for the average individual actually observed, at least according to official data, to be working in the branches. The latter estimates can be compared to our original Table 1 or even be used to roughly calculate total values of stolen time or stolen materials for the entire Soviet economy.)

Our method of estimation was as follows. We treated the equations for the wage bundle components as a system of simultaneous equations. That is, we assumed each wage component was determined by the other components as well as by a set of demographic variables. To avoid simultaneous equations bias, however, we regressed each component separately against the instruments in a reduced form equation. (See the Appendix for a discussion of the problem of simultaneous equations bias, as well as two other problems of estimation bias.) The regressions were run separately by branch, using only the observations within each individual branch. Four of the bundle components (official earnings, official hours, pilferage, and stolen hours) were estimated by OLS. A dummy variable for second economy participation was estimated by a probit regression. The same set of instrumental variables was used for all OLS and probit regressions, and included sex, age, education, and regional dummies (for Moscow–Leningrad, the South, and Armenia). Finally, using the coefficient estimates from the regressions, the regression equations for each branch were evaluated at the specific values of the independent variables assumed for the representative male and female mentioned above, and for the assumed population mean values for each branch. The results are in Tables 7–9.

TABLE 7. EXPECTED VALUES OF HEDONIC WAGE PACKAGE, BY BRANCH, FOR REPRESENTATIVE MALE (37–year old male with 11 years of education, from Northern USSR—not Moscow or Leningrad)

Sector	Official Earnings (R/mo.)	Official Hours (Hrs./wk.)	Pilferage (R/mo.)	Stolen Hours (Hrs./wk.)	Second Econ. Partic. Rate (%)
1. Machine–Building	194	43.2	15.67	2.34	.19
2. Materials	183	42.2	12.94	2.43	.16
3. Craft	162	42.2	18.95	3.34	.51
4. Light	163	41.1	22.17	3.36	.17
5. Transportation	199	45.1	46.85	4.34	.25
6. Construction	207	42.6	22.15	3.36	.38
7. Retail Trade	134	43.8	128.21	5.27	.21
8. Services	145	43.1	40.22	6.62	.56
9. Health	161	41.0	36.00	1.79	.42
10. Education	161	33.6	25.35	3.19	.50
11. Culture	173	41.1	14.49	5.50	.36
12. Science	157	40.6	–4.13	2.80	.55
13. Government	147	39.9	16.83	10.03	.24

TABLE 8. EXPECTED VALUES OF HEDONIC WAGE PACKAGE, BY BRANCH, FOR REPRESENTATIVE FEMALE (37–year old female with 11 years of education, from Northern USSR—not Moscow or Leningrad)

Sector	Official Earnings (R/mo.)	Official Hours (Hrs./wk.)	Pilferage (R/mo.)	Stolen Hours (Hrs./wk.)	Second Econ. Partic. Rate (%)
1. Machine–Building	124	41.9	15.25	2.03	.00
2. Materials	134	41.9	19.71	3.64	.03
3. Craft	117	40.8	11.47	2.09	.15
4. Light	131	40.1	–13.10	2.39	.07
5. Transportation	142	43.4	31.90	4.05	.00
6. Construction	134	41.0	–5.63	2.46	.10
7. Retail Trade	114	41.7	41.65	2.93	.00
8. Services	104	42.0	23.19	3.18	.41
9. Health	104	37.8	0.02	2.54	.24
10. Education	102	30.7	4.57	2.81	.30
11. Culture	96	36.0	0.75	6.33	.28
12. Science	96	39.3	–7.10	0.91	.00
13. Government	133	40.3	–13.09	4.92	.23

Notes to Tables 7–8.—See notes following Table 9.

TABLE 9. ESTIMATES OF HEDONIC WAGE PACKAGE, BY BRANCH, EVALUATED AT POPULATION MEANS OF DEMOGRAPHIC VARIABLES

Sector	Official Earnings (R/mo.)	Official Hours (Hrs./wk.)	Pilferage (R/mo.)	Stolen Hours (Hrs./wk.)	Second Econ. Partic. Rate (%)
1. Machine-Building	178	42.0	6.65	1.14	.20
2. Materials	155	41.8	16.37	4.09	.34
3. Craft	135	41.0	13.47	2.82	.41
4. Light	135	40.4	16.24	2.98	.10
5. Transportation	144	44.0	46.82	3.93	.19
6. Construction	180	41.7	9.24	2.42	.28
7. Retail Trade	103	40.8	72.76	3.12	.01
8. Services	113	40.7	31.62	5.32	.55
9. Health	107	37.7	11.68	2.37	.29
10. Education	123	31.4	12.18	2.87	.33
11. Culture	106	36.8	5.93	5.02	.26
12. Science	132	39.8	-4.32	2.14	.02
13. Government	140	40.6	1.45	5.92	.26

Notes to Tables 7–9.—The tables list the predicted values for individuals with the characteristics stated (i.e., age, education, sex, region). The method of prediction is explained in the text. For comment on the negative values for "Pilferage" in some branches, see Note 3 of Appendix B.

Tables 7 and 8 contain some provocative results, to which we shall return shortly, but let us look first at Table 9. What we now have in Table 9 is our best attempt at adjusting the sample data to reflect the actual structure of the parent population in the various branches. If this has been done correctly (and if we can trust the official Soviet data), the first two columns of Table 9 should correspond to the first two columns of Table 1 (official monthly earnings and official weekly hours of work).

Although for most branches the monthly wage figures are quite close, there are fairly wide discrepancies in two cases: Transportation and Science. The estimated values are much lower than those reported by the official statistics. In the case of Transportation, it is very likely that much of the discrepancy is due to an aggregation problem. The Soviet transportation sector includes some relatively highly paid occupations in merchant shipping, etc., which were not represented at all in the sample. It is not as clear why the sample estimate for Science should be as low as it is. With respect to official working hours, there is a certain discrepancy across the board, but again the sector that stands out most is Transportation.

Of course, the most interesting part of Table 9 is the last three columns, the estimates of the informal components of the wage bundles. One general observation that can be made is that the adjustment for demographic factors yields a "less extreme" picture than the unadjusted sample means (Table 3). This can be seen immediately by comparing the pilferage rates in Tables 3 and 9: the rates in Table 9 are much lower. Still, some of the adjusted values are quite remarkable. According

to the new estimates, workers in Retail Trade are on average stealing goods worth 70% of their official wages (a figure which incidentally is not too far from Shmelev and Popov's cited 60%). With respect to stolen hours, there are several cases where the branch average rate is between 10% and 15% of official working time.[13]

Now for Tables 7 and 8. If we look at Table 7 (the 37–year old male with 11 years of education) there is no question that on the surface the bundles differ radically across branches. But how do they rank in his preferences? If we knew this, we could predict which branch of the economy he would choose to work in. So far we have made no assumptions about preferences. But for the sake of illustration, let us now make a few assumptions about the worker's rate of trade–off between certain wage components. First of all, assume he is not at all interested in second economy work, so column 5 is irrelevant. Second, assume all he cares about is how much money he makes and how many hours he works (the nature of the job otherwise is unimportant). Finally, suppose that he is completely indifferent between legal and illegal income and between legal and illegal hours. This means we can add "Official Earnings" to "Pilferage" to obtain total monthly earnings, and subtract "Stolen Hours" from "Official Hours" to get net hours worked per week. What then are some of his choices? He could work in Machine–Building for a net 40.9 hours a week (43.2 – 2.34) and earn a total of 210 rubles a month (194 + 16). But in that case, he would definitely prefer to work in Construction. Why? Because there he makes a total of 229 rubles a month for only 39.2 hours of effective work a week. But by the same reasoning, Retail Trade is even more attractive: he can make 262 rubles for only 38.5 hours.

Consequently, given these (admittedly very strong) assumptions about preferences, we can deduce some unambiguous choices on the part of the individual. In other cases, however, we still can draw no conclusion. Take, for instance, a job in Education. He can expect to make 186 rubles total for 30.4 hours of work. Is that better or worse than 262 for 38.5 hours in Retail Trade? It depends on his preferences for leisure versus consumption.

Finally, let us look briefly at Table 8, the representative female case. The only difference between the workers we considered in Tables 7 and 8 is gender. Yet the differences in expected values of the wage bundles are startling. In most branches of the economy, the female can expect to earn a legal wage which is only around 70% that of her male counterpart.[14] While it is true that in general she can expect a slightly shorter official work week, it is difficult to imagine that the shorter hours come close to compensating for the much lower pay. But even more interesting is the fact that when we take the illegal portions of the wage package into account, the

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[13] This can be compared to a figure cited by VOLGIN and SIDYAKIN [1985], who claim that the loss of working time may total as much as 15–20% of the working day (although they also may be including machine stoppages and more technical causes of lost time). In general, it can be noted that the figure of 2.4 stolen hours per week quoted by one source in Section III above seems quite consistent with the estimates in Table 9.

[14] The figure of 70% for the female–male ratio of official earnings is roughly the same as previously estimated by both Soviet [see references in MCAULEY 1981, p. 21] and Western scholars [OFER and VINOKUR 1981].

woman typically ends up in an unambiguously worse situation relative to the male. Not only does she receive substantially less in stolen goods, but in only 3 of the 13 branches is she able to steal more hours. She is similarly disadvantaged when it comes to second economy participation. In short, results of the present analysis suggest that the gender gap that researchers have long suspected in the official wage system of the Soviet Union is not merely upheld, but apparently even exacerbated, by the "actual wage mechanism."

APPENDIX A

MOTIVATING THE SUPPLY AND DEMAND FOR NUMBER OF EMPLOYEES AND WAGE BUNDLES BY AN IMPLICIT MARKET MODEL

The model of labor market behavior that best explains the patterns of labor market behavior described in this paper is the implicit market or hedonic wage model. Pioneered by Gregg LEWIS [1969] and Sherwin ROSEN [1974], it has been used as an alternative to the traditional labor supply model in the West to study the trade-offs between a pecuniary wage and various implicit wage components such as unpleasant working conditions, working hours, mandatory overtime, etc. A rigorous restatement of the model, which shows that the conventional model is a special case of the hedonic model, was given by KINOSHITA [1987]. The following is an simple intuitive presentation, which modifies the exposition in HAMERMESH and REES [1984] for the Soviet situation as we have described it in the text. For simplicity, we consider a wage bundle in which the only variable components are official earnings and stolen hours.

Consider the situation of an arbitrary worker, whom we will label Worker 1, in a Soviet enterprise or institution. Curve U_1 in Figure 1 shows the combinations of official monthly pay, Y, and stolen hours, t, which leave this worker indifferent. Indifference curve U_1 has a negative slope since the worker requires more stolen hours (higher t) to compensate for lower legal pay (lower Y). In fact, the curve is convex to the origin since more and more stolen hours would be required to offset lower and lower pay. U_1' is another indifference curve for the same worker. The worker clearly prefers U_1' to U_1, since at every level of legal pay, he is allowed to steal more hours along U_1'.

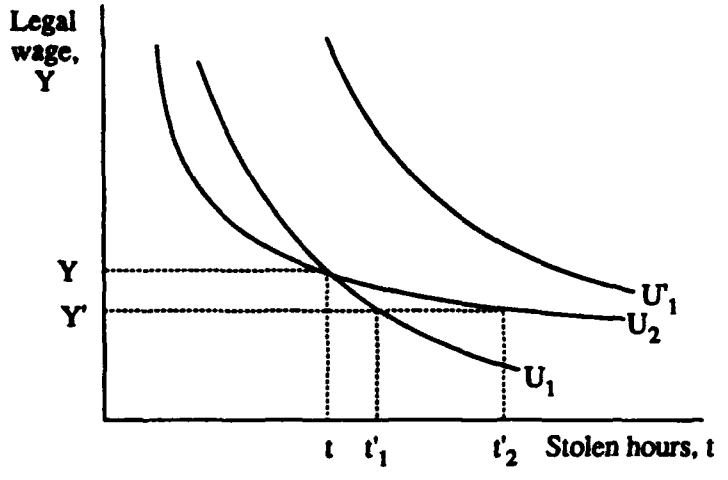

FIG. 1. THE WORKERS' TRADE-OFFS BETWEEN LEGAL PAY AND STOLEN HOURS

Now consider a second worker, Worker 2, in this same branch, but with different tastes for legal pay and stolen hours. Label his indifference curves U_2, U'_2, etc. Assume that in this branch, the prevailing legal wage is Y and the rate of stolen hours is t. At this point, Worker 1 can be said to be less concerned about the legal wage than Worker 2. That is, at Y, Worker 1 would require fewer extra stolen hours to compensate for having a small legal wage cut, say from Y to Y', than Worker 2 (Worker 2's indifference curve is flatter at Y).

Now, in the same way that workers have different preferences for legal pay versus stolen hours and hence different degrees of willingness to trade off one for the other, different branches will have different abilities to offer combinations of legal pay and stolen hours. The way this works is as follows. Assume that the Soviet manager is rewarded according to a bonus scheme that depends essentially on two things: (1) the number of workers he has, and (2) meeting his output target.

If the only thing he had to consider for recruiting workers were legal pay and if the supply of workers were unlimited, the Soviet manager would hire new workers without restraint. As far as the manager of an enterprise is concerned, the legal pay he can offer costs him nothing. That is, as soon as he can sign up a worker for his enterprise, he can apply for an increase in his wages fund and it will generally be approved—the "soft budget constraint." The problem is that because the supply of workers is limited, he will be very unlikely to find a worker willing to work for legal pay only. He has to offer something else—stolen hours, theft of goods, or second economy opportunities, or some combination of them.

Let us again consider only the case of a trade-off between legal pay and stolen hours. Whereas legal pay costs the manager nothing, offering stolen hours does represent a cost to him. If he permits an increased rate of stolen hours in order to recruit a marginal worker, he will have to allow the same rate for his entire work force. No matter how lax the discipline in Soviet enterprises, there is some limit to how much time-theft a manager can tolerate. (I am excluding here the case of "dead souls"—workers who, for a fee, allow their names to be listed on the firm payroll when in fact they do no work at all—although they might formally be considered "workers" who are allowed to steal 100% of their legal work week.) Beyond a certain point, stolen time will adversely affect the output of the enterprise and other measures of managerial performance, and consequently affect the manager's own pay.

There will therefore be some relationship between the number of workers the manager will be willing to hire (N) and the amount of stolen hours (t) which he will permit, a relationship mediated through the bonus function. Just as the worker has indifference curves showing the various combinations of legal pay and stolen hours that give him the same utility, so the manager has "isobonus" curves that denote the combinations of legal pay and stolen hours that afford him the same level of bonus pay (since those combinations of legal pay and stolen hours also determine a certain number of employees). Thus, in Figure 2, the bonuses of Manager 1 are all the same at points along B_1. The curve has a negative slope since as legal pay, Y, is reduced, he has to offer more stolen hours to keep his labor force and maintain his bonus level.

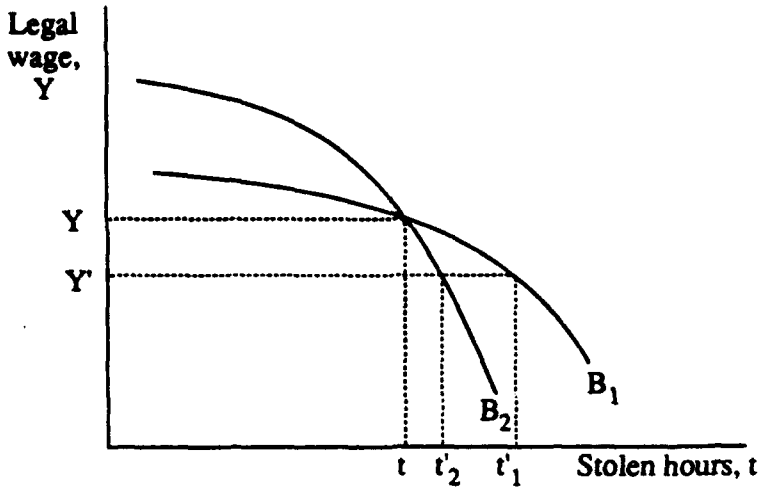

FIG. 2. THE MANAGER'S TRADE-OFFS BETWEEN LEGAL PAY AND STOLEN HOURS

Now, just as workers differ in their preferences for legal pay and stolen hours, managers differ in their ability to trade stolen hours for legal pay because the technology of their enterprises (or institutions) will make it harder or easier to permit stolen hours. For one manager, stolen hours may be a cheap commodity: for him, it may make very little difference whether or not workers take a few hours off each day or simply don't show up (a department of the government bureaucracy, for instance). For such a manager, a drop in legal pay can relatively easily be compensated by an increase in stolen hours and his bonus level will stay the same (i.e., it costs him little, in terms of the negative effect on his bonus of allowing more stolen hours, to offset the negative effect of lower legal pay on the size of his labor force). Another manager might not be so easily able to afford increased stolen hours. In Figure 2, B_2 is the isobonus curve of a manager who will have to offer fewer extra stolen hours than Manager 1 when the legal wage is reduced slightly, say from Y to Y', to remain on the same isobonus curve.

What does equilibrium look like in this model? A worker like Worker 1 will be ready to take a job with low pay and a high rate of stolen hours. He will work for a manager like Manager 1, who does not have high legal wages but can offer stolen hours. Worker 2 will want to find a job with a high legal wage even if it means he has to work nearly the full legal work week. Hence he'll work for Manager 2, who pays relatively well and does not permit much shirking. Workers with the least dislike for working long legal hours will be matched by the market with firms that pay the highest legal wages and allow fewest stolen hours. (Remember that this simple version of the model looks only at a two-component wage; things would become much more complex with more components ... .) Hence, assuming a large number of workers and firms, the market in full equilibrium will be characterized by a series of tangencies between workers' indifference curves and managers' isobonus curves, with the result being the envelope of both sets of curves at the

tangency points. This envelope is what ROSEN [1974] termed the "hedonic wage locus."

In Figure 3, the hedonic wage locus—the market trade–off between legal pay and stolen hours—is shown by the heavy line *WW*. Along that locus, all workers are as well off as they can be, given that managers must compete with one another for a limited supply of labor. Each manager is receiving the highest bonus he can, given the need to offer stolen hours in order to attract workers to jobs in which legal pay alone does not suffice to recruit them.

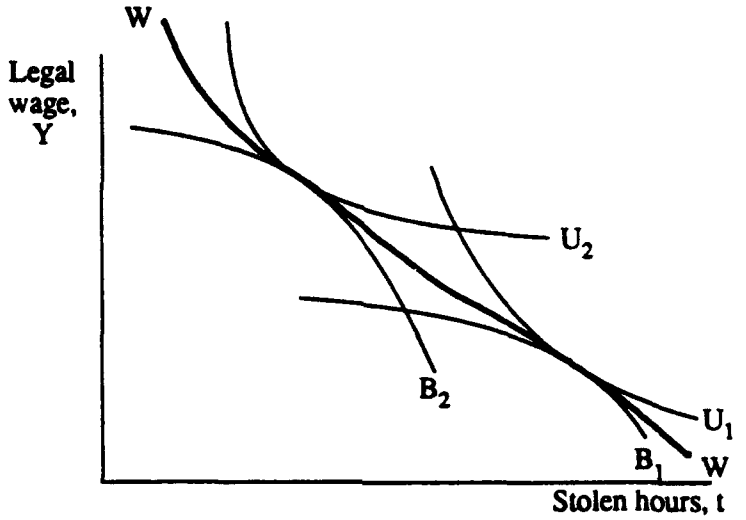

FIG. 3. THE MARKET EQUILIBRIUM

But note what this model implies for observable behavior. What we observe is a distribution of workers across branches. In the different branches we observe differing bundles of various legal and illegal wage components. Taken together, the different observed combinations give us the hedonic wage locus. But since, as we have now seen, this locus (the heavy *WW* line in Figure 3) is actually determined **both** by workers' preferences for different wage bundles **and** by managers' abilities to offer those different wage bundles, we will not normally be able to sort out what is due to what. In particular, we cannot infer workers' preferences (their rates of trade–off between bundle components) from what we observe. We can merely describe what has evolved as an equilibrium in the market.

APPENDIX B

ESTIMATION BIAS ISSUES: SAMPLE SELECTIVITY, SIMULTANEOUS EQUATIONS, AND LIMITED DEPENDENT VARIABLES

1. SAMPLE SELECTIVITY

The issue of sample selection bias in labor supply decisions was originally investigated in depth and methods proposed for its correction by HECKMAN [1979] and LEE [1978]. An application of their ideas to an empirical problem similar to that in this paper is presented in IDSON and FEASTER [1990]. The following exposition is based closely on theirs.

Let V_{ij} be the maximum utility that worker i can achieve if he works in branch j. V_{ij} is a function of all the legal and illegal components of the wage bundle, leisure, and a vector of exogenous variables. Assume (following TROST and LEE [1984]) that V_{ij} can be decomposed into a nonstochastic part, $\delta_{ij}'X_i$, and a stochastic part, ε_{ij}. That is,

$$V_{ij} = \delta_{ij}'X_i + \varepsilon_{ij}, \qquad [1]$$

where X_i is a vector of observable individual characteristics and exogenous variables, δ_{ij} is a parameter vector for individual i working in branch j, and ε_{ij} is a function of unobservables.

Suppose a person is choosing between two branches, k and l. Assuming he chooses the branch which offers him the greatest utility, the probability that he will choose k is

$$\Pr_{ik} = \Pr\,(V_{ik} > V_{il}). \qquad [2]$$

Or, if we substitute from [1],

$$\Pr_{ik} = \Pr\,(\delta_{ik}'X_i + \varepsilon_{ik} > \delta_{il}'X_i + \varepsilon_{il}). \qquad [3]$$

Hence, both observable (X_i) and unobservable (ε_{ij}) characteristics determine the worker's choice of branch. But if there are factors in ε_{ij} that also determine the components of the wage bundle, a problem arises. If we try to estimate the size of the components on a group of individuals who work in a particular branch—even if we control for observable characteristics—we would obtain biased estimates, since there is a nonzero correlation between the error terms (the unobservable characteristics) and the decision to work in that branch. To put it another way, the sample with which we dealing is truncated (and nonrandom); yet we would be

taking the mean of the truncated sample and interpreting it as the mean of an untruncated sample.

The Heckman and Lee approach to correcting for the bias that results from sample truncation boils down to incorporating the branch choice process (equations [1] and [3]) into the estimation of the wage bundle components.

The procedure involves using a probit model to predict the branch that an individual chooses. Define a latent variable for each individual, S_i, as

$$S_i = \beta Y_i + u_i, \qquad [4]$$

where Y_i is a vector of the individual's characteristics thought to influence branch choice, β is a vector of parameters to be estimated, and u_i is a normally distributed error term. The actual value of S_i is not observed. We observe only which branch the person has actually chosen. But because the scale of S_i is arbitrary, we can scale u_i to a $N(0, 1)$ random variable. If we again consider a two–branch choice, we will then observe

$$\begin{array}{ll} Z_{ik} = 1 & \text{if } S_i > \alpha \\ Z_{ik} = 0 \text{ (and hence } Z_{il} = 1) & \text{otherwise,} \end{array}$$

where α is some cutoff value to be determined.

α and β can be estimated by a probit regression, and those estimates used to predict a $N(0, 1)$ variate S_i. This predicted value can then be used to construct truncated means to correct the wage equations (estimated separately for each branch) for the selection bias that would necessarily result from a specification that implicitly assumed individuals were randomly sorted into branches. In summary, the Heckman two–step procedure to produce an unbiased estimate of the coefficients of the wage equations is (i) estimate a probit to obtain β and compute the truncated mean for each individual, and then (ii) run separate ordinary least squares (OLS) wage equations on individuals who work in different branches, including, as a regressor, the individual–predicted truncated means.

This deals with the problem of the endogeneity of branch selection. However, *within* each branch, a similar problem arises for estimating the first and second economy components. As long as we suspect that individuals within a branch are not randomly sorted into those who do and those who do not participate in the second economy, and if we moreover believe that even the legal (first economy) components of the wage bundle depend on whether or not the individual participates in the second economy, we must correct for selection bias here as well. If we for a second ignore the branch selection process, the formal set–up for dealing with this selectivity bias is the same as above. That is, (i) run a probit on individuals in the branch for second economy participation; (ii) obtain the truncated means by individual; (iii) run the wage regressions with the new selection variable included as a regressor.

However, since the two selectivity problems occur simultaneously (there is "selectivity within selectivity"), the problem is much more difficult (and beyond the scope of this paper). The course chosen here has been to ignore the selectivity bias in estimation. The estimates in Tables 7–9 are *conditional* estimates—conditional upon branch choice—and are therefore biased.

2. SIMULTANEOUS EQUATIONS BIAS

The components of the wage bundle are not independent of one another (that, of course, is the thesis of this paper), and as such they are properly estimated as a system of simultaneous equations. As is well known, applying ordinary least squares (OLS) to a simultaneous equations model produces estimates of structural equations that are biased, not only in small samples: they are also inconsistent and asymptotically biased. However, OLS on the reduced form equations—i.e., the equations containing only the instrumental variables on the right–hand side—will be unbiased and consistent. Although this approach is less efficient than, for instance, two–stage least squares estimation of the structural equations since it sacrifices some information, at the present stage of this study it was decided to follow the conservative approach of using OLS estimates of the reduced form parameters.

3. LIMITED DEPENDENT VARIABLES

It will be noticed in Tables 7–9 that there are negative estimates for "Pilferage" in several branches. It might be argued that, strictly speaking, both "Pilferage" and "Stolen Hours" are limited dependent variables—that is, they cannot assume negative values—and hence should be estimated by the appropriate technique (e.g., tobit).

However, there is a good reason why not to treat "Pilferage" as a limited variable (and hence to estimate it by OLS as has been done here). In his study of theft of materials from Soviet firms, TREML [1990] offers the following sensible explanation of a negative value for pilferage: "It simply means that wages in the given branch are higher than the market clearing wage and that the employees are willing to bribe enterprise management to be hired (and continue to pay a certain sum to retain their jobs)."

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