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**TITLE: INCOME DISTRIBUTION IN  
THE USSR IN THE 1980S**

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## ABSTRACT

In 1989 Soviet authorities released unprecedented new data on the size distribution of income in the USSR in the 1980s, including the distributions by republics. With the goal of providing a benchmark for evaluating the effect of current and future economic reforms on income distribution in the former Soviet Union, this paper estimates inequality measures for the new data. The estimation uses a simple nonparametric technique based on the Kolmogorov–Smirnov test to fit the Soviet data to a lognormal distribution. The results suggest that, for income from official sources, (1) inequality in the Soviet Union as a whole declined throughout the 1980s — both before and after Gorbachev's accession in 1985, and (2) income inequality was greater in the poorer, Southern republics of the USSR than in the North.



## 1. INTRODUCTION

In the spring of 1989, when the Congress of People's Deputies — the first real Soviet parliament since 1918 — convened in Moscow, one topic which quickly attracted strong attention was the complex of issues relating to welfare, poverty, and economic equity. For virtually the entire previous history of the USSR, public discussion of the major discrepancies in welfare levels in the country had been taboo. Even the publication of statistical data on income distribution had been suppressed. But the interest in the subject shown by the deputies in the new parliament soon led the government statistics agency, Goskomstat, to release several new statistical series on the personal money income of Soviet citizens, including the distributions by republics. Data published in the summer of 1989 showed the size distribution of income for the entire USSR for 1980, 1985, and 1988, along with the size distributions by republic for 1988. Two years later, similar sets of figures were released for 1990. Not only were the newly published data on incomes the first such data published since the 1920s, but even today they remain the best available data we have on Soviet income distribution. As the basis for a picture of the final years of the old regime, these data not only shed light on the situation in the USSR before its collapse, but they also provide a baseline for evaluating future trends in the post-Soviet societies in the midst of rapid social and economic change.

The primary purpose of this paper is to use the new Soviet data — which are reproduced for reference in Tables 1 and 2 on the following pages — to derive inequality measures for income distributions in the

USSR over time and across republics.<sup>1</sup> We begin in Section 2 by briefly reviewing some conceptual issues regarding the measurement of inequality and the particular problems encountered with the new Soviet data. This section also presents the technique we used to estimate the inequality coefficients for the USSR and the republics. The following sections discuss the results of estimation as they relate to income inequality in the USSR as a whole during the 1980s (Section 3) and income inequality within the Soviet republics in 1988 and 1990 (Section 4). Section 5 speculates how income inequality might be affected by illegal income.<sup>2</sup> Section 6 presents our conclusions. An appendix provides more detail on the estimation technique.

For Tables 1 and 2 see pages 14 - 17

## 2. MEASUREMENT OF INEQUALITY

As Atkinson (1970) first demonstrated, rankings of countries or other units on the basis of income inequality generally depend on the particular measure of inequality used in the analysis. Since different measures of inequality highlight different facets of the same reality, they may also lead to different rankings of the same countries. In this sense, there is no single "perfect" measure of inequality. However, it can be argued that any adequate inequality index should satisfy certain basic criteria, among which we would include the following: scale invariance, the principle of transfers, symmetry (anonymity), and invariance to replications of the population.<sup>3</sup> This paper employs two of the most popular measures that satisfy all of these criteria: the Gini coefficient and the Atkinson index.<sup>4</sup>



Normally, computation of these inequality measures is a relatively simple matter. However, the peculiar manner in which the official Soviet data are presented gives rise to a number of technical problems. Not only are the data grouped (presented as percentages of the total population falling into various income intervals), with no information provided about the distribution within the intervals (in particular, there is no information about the intra-interval means), but they are doubly censored (both the lower and upper income ranges are open-ended).

The difficulties caused by this manner of presentation may be seen in Tables 1 and 2. The distributions are variously censored on the right at levels of 200, 250, 300, and 400 rubles/month, and on the left at 50 and 75 rubles/month. The censoring on both the left and the right is quite severe in some cases. As Table 2A shows, for instance, 58.6% of residents of Tajikistan in 1988 were in the left-censored, "Under 50," range, while 33.6% of Estonians were in the open-ended right-hand range of "Over 200."

There are several techniques for dealing with grouped and censored data. Cowell and Mehta (1982), for instance, have suggested a simple and robust "split histogram" technique which approximates true inequality measures for grouped data very well. Their technique, however, requires knowledge of intragroup means — information which, as mentioned, is unavailable for the Soviet income distribution. The analyst is thus faced with having to make one of two assumptions. The first possibility is to assume the intragroup means, e.g., by choosing the midpoint of each interval. This, however, still leaves the problem of censoring; where are the midpoints in the open-ended intervals? The other option is to assume

some particular form for the underlying distribution of earnings from which the grouped data were drawn. We adopted the latter approach. Following a strong tradition in the Soviet literature (and in an effort to keep our estimation technique as simple as possible), we chose the lognormal distribution.<sup>5</sup>

A simple lognormal distribution is completely characterized by two parameters: the mean and the variance. In our case, however, because the minima of the income distributions are above zero, we had to determine one additional parameter—the displacement of the entire distribution to the right. Labeling this rightward displacement of the distribution from zero the minimum, we sought to find the mean, variance, and minimum of the lognormal distribution which best fit the available data. The technique we chose for estimation was based on minimizing the Kolmogorov–Smirnov statistic for goodness-of-fit between two distributions.<sup>6</sup>

In principle, the minimum Kolmogorov–Smirnov estimator can determine all three parameters of the displaced lognormal distribution. If the Soviet income distributions were exactly lognormal and if the data were correctly measured and not subject to rounding error, this would be adequate. However, given that neither of these conditions are true, we decided to use additional information available from Soviet sources to restrict the parameters of the lognormal curve. Mean per capita income for the entire USSR was reported in the same official sources from which the data in Table 1 were taken. For the individual republics, no figures for mean per capita income have ever been published and, consequently, we had to allow the estimator to determine the mean. There are also no official data on the minimum per capita income for either the USSR as a whole or

for the republics. By using the legal minimum monthly wage in the Soviet Union over the period in question, together with information on the structure of benefits and subsidies, we assumed a specific lower threshold for per capita income.<sup>7</sup>

Once we obtained the mean and variance of the best-fitting lognormal distribution for each set of data, simple formulae allowed us to compute the Gini coefficient and the Atkinson indices (at various values of inequality aversion) for a lognormal distribution with these parameters.<sup>8</sup> The results of estimation are presented in the following sections, where we also discuss the implications of these estimates for income inequality for the USSR as a whole (Section 3) and for the republics (Section 4).

### 3. INCOME INEQUALITY FOR THE USSR AS A WHOLE

While numerous analysts have written about the size distribution of wages in the USSR, until now little has been known about the size distribution of per capita income.<sup>9</sup> In any country, there are numerous factors which make it difficult to predict what the size distribution of per capita income looks like, knowing only the picture of wage distribution. In the Soviet case, this general problem is confounded by the confusion of statistical data. Soviet wage data include only state-sector workers and employees, and thus exclude collective farmers and pensioners, who represent approximately 35% of the adult population. Official income data, on the other hand, do include these latter groups. And in addition to state wages, "total income" includes legal private income (mainly income from private farm plots), and state and private transfer payments.<sup>10</sup> Even for

state workers, these sources of official non-wage income constitute some 20% of total income.

Table 3 presents our estimated inequality indices for per capita incomes in the USSR for various years in the 1980–1990 period, as well as the officially reported mean incomes.

For Table 3 see page 18

Table 3 shows that in the 1980–85 period there was a decline in income inequality. Interestingly, the ascension of Mikhail Gorbachev as Soviet leader in 1985 seems to have done little to change this trend. In the first three Gorbachev years — years during which only minor actual economic reform took place — inequality appears to have remained relatively stable. Then, after 1988 inequality seems to have continued its decline. At first glance, this pattern is hard to reconcile with the institutional developments then occurring in Soviet society. It was in 1988 that Gorbachev's first major economic reforms gave a substantial measure of autonomy to state enterprises, allowing these enterprises — among other things — to pay more differentiated wages. In addition, by 1988 a large number of Soviet citizens had begun to work in legal private businesses (so-called cooperatives), and there was generally a more tolerant attitude towards earnings derived from moonlighting or even full-time work in the private sector.

In particular, the Atkinson indices in Table 3 suggest more than minor shifts towards less inequality from 1980 to 1990. It is especially interesting

that the shift shows up most in the A=3 figures. They imply that there were relatively greater shifts from poor to rich inside the lower end of the distribution. One possible explanation is that while the very lowest income groups obtained more opportunities for official income — they could legally moonlight in a second state-sector job, they had more income from their private garden plots, etc. — the middle income groups were more limited in new income sources. Meanwhile, the highest income groups — e.g., the Communist Party elite, skilled workers — may have simply “left the distribution” by joining cooperatives, where much income (in cash or in kind) was not recorded. On the surface, though not in reality, this would produce a more equal distribution. We return to this issue in Section 5.

#### 4. INTRA-REPUBLICAN INCOME INEQUALITY

At a time when the successor states of the USSR are poised to enter the world of market economies, the publication of official data on income distribution broken down by republic (Tables 2A and 2B) is particularly valuable. As we shall demonstrate below, these data reveal some interesting regularities in the regional pattern of income distribution, regularities which may be worth keeping in mind when analyzing the propensity of various new nations to launch reforms.

To the best of our knowledge, no such republican income data had been released by the Soviets since the late 1920s. Even the mean per capita incomes by republic have not previously been available to Western researchers. By fitting these data to a lognormal distribution, we were able



to estimate mean incomes as well as various measures of income inequality by republic. Our results are shown in Tables 4A and 4B below.

For Tables 4A and 4B see pages 19 - 21

Before we begin analyzing our results, a word of caution is in order. As seen in Table 2A, the 1988 data are grouped into only five income ranges. Moreover, in that year more than 30% of the population of all Central Asian republics (excluding Kazakhstan) and Azerbaijan fell into the "Under 75 rubles" category, and over 28% of Latvian and Estonian residents belonged to the "Over 200 rubles" range. This makes the estimates for 1988 less reliable than those for 1990, when incomes were grouped into seven categories, and only Uzbekistan and Tajikistan had over 30% of the population in the "Under 75 rubles" range.

These caveats notwithstanding, the general pattern from Tables 4A and 4B is clear: the Baltic republics have the highest per capita incomes, the Slavic republics are second, the Christian southern republics (Georgia, Armenia, and Moldova) are third, and the Muslim republics (Central Asia plus Azerbaijan) are a distant last.<sup>11</sup> Both the richest group and the poorest group (except for Kazakhstan) are sharply separated from the two middle income groups. These same groupings apply in the case of income inequality: the Baltic and Slavic republics have the lowest inequality, the Christian southern republics fall into the middle, and the Muslim republics show the greatest inequality.

The far right columns of Tables 4A and 4B — average family size in the republics — introduce an additional factor into the discussion of income distribution. It is evident from the table that there is a positive relationship between low mean income, inequality as measured by the Gini coefficient and Atkinson indices, and large family size.<sup>12</sup>

The changes in mean republican incomes in the late 1980s are particularly interesting (cf. the second column in Table 4B). The six poorest republics (the Muslim republics) also had the six of the seven lowest rates of growth of per capita income between 1988 and 1990. Significantly, the one non-Muslim republic which showed such slow growth was Russia. Assuming that all republics experienced approximately the same rate of inflation during that period of time, this implies that the gap in the standard of living between the richest republics and the poorest republics widened with the onset of Gorbachev's economic reforms of 1988–90.<sup>13</sup>

The fact that Russian per capita income appears to have had one of the slowest growth rates during these reforms is also noteworthy. The relative deterioration of Russians' status might indicate that resources were redistributed away from Russia during the last years of the Soviet empire. If true, this may be part of the explanation for the relative lack of opposition on the part of most Russians to the other republics' demands for independence.

Finally, there is a general tendency for republics with lower rates of income growth (the Central Asian republics, Kazakhstan, Russia, and Belarus) to be more interested in preservation of the Commonwealth of Independent States than the other republics, although it is to be admitted

that there are major exceptions here (consider, e.g., the case of Azerbaijan).

## 5. ADJUSTMENTS FOR ILLEGAL INCOME

So far, this paper has dealt only with officially recorded income. In this section, we will discuss the possible impact of nonrecorded earnings — the illegal part of the so-called second economy — on the patterns of income inequality in the Soviet economy.<sup>14</sup>

Precise estimates of the size of illegal incomes in the USSR are, for obvious reasons, not possible to obtain. Soviet estimates of the annual turnover in the illegal part of the second economy in the late 1980s range from a conservative estimate of 56.5 billion rubles (by the statistics agency, Goskomstat) to a high of 350 billion rubles, with most estimates falling between 100 and 200 billion rubles [*Sotsial'noye...* (1990, p. 121); Koryagina (1990); Golovnin and Shokhin (1990, p. 51); Bineyev (1989, p. 5)]. An estimate in the 100–200 billion ruble range implies that illegal second economy income represents between 16% and 28% of aggregate personal income.<sup>15</sup>

But as imprecise as estimates of total income from the second economy are, the distributional effects of such unrecorded income are even more difficult to determine. Analyses of individual-level data have suggested that illegal earnings in many occupations in the Soviet economy are inversely correlated with official pay in those jobs. In other words, illegal earnings serve as a kind of compensating differential for the distorted administered wages.<sup>16</sup> However, this does not necessarily imply that illegal income



reduces inequality. If illegal income is large and if its variance is greater than that of legal income, illegal earnings may actually exacerbate the inequality. Bergson (1984) is of the opinion that the inclusion of private (legal and illegal) income leads to increased income inequality. We believe this conclusion is generally supported by our own research on the second economy.

Using household data from a survey of recent Soviet immigrants to the United States, we compared Gini coefficients based on legal income only with those based on all income (legal and illegal).<sup>17</sup> For residents of the Northern republics of the former USSR (mainly Russia, Belarus, and the Baltics), the inclusion of illegal income had virtually no effect on the Gini. For sample participants who resided in the Transcaucasus and Central Asian republics of the USSR, however, illegal income raised the Gini coefficient dramatically — from 0.30 to 0.37. This pattern of differences between North and South is consistent with the hypothesis that greater second economy activity is associated with greater inequality since, as other work on the Berkeley-Duke survey has shown, there was a much higher level of second economy activity — legal and illegal — in the Soviet South than in the North.

It is generally perceived that the underground economy in the Soviet Union grew rapidly during the 1980s. Hence, if it is true — as we suggest — that a larger second economy means more inequality, then it would be expected that this growth in the underground economy led to an increase in income inequality in the USSR as a whole. In other words, the estimates of household income inequality for the second half of the 1980s which we derived from the official Soviet data should be adjusted upwards. Also, we

can assume that the inclusion of illegal income would make the already relatively unequal income distribution in the Southern republics even more pronounced.<sup>18</sup>

## 6. CONCLUSIONS AND FURTHER OBSERVATIONS

The income inequality picture of the former USSR and its republics presented here provides a baseline for evaluating the redistributive effects of the current reforms. While the situation is still too fluid and the data too unreliable to attempt comparisons with the years under consideration in this study, such comparisons may prove quite instructive as economic and political conditions become more stable. The measures of inequality and mean incomes by republics should prove particularly useful for future analyses. It will be interesting, for instance, to follow what happens to the relative standards of living in the new countries. Did membership in the USSR tend to equalize incomes across republics, or did it exacerbate inequality? Our results provide the starting point for answering this question. At present, we conclude that sizeable gaps in income inequality across republics persisted (and may even have grown) in the late 1980s, despite the apparent efforts of the Soviet government to close those gaps. It is quite possible that cultural, historical, and demographic factors, as well as natural resource endowments, will prove to be more important in determining relative standards of living than the administrative status of the former republics.

Another intriguing issue is how income inequality within a republic might affect the population's willingness to embark upon radical market reforms. It might be argued that a high degree of income inequality (such as in the relatively poor Central Asian republics) indicates popular tolerance for such a state of affairs and would thus make it easier to implement radical reforms leading to unabashed capitalism. Similarly, the relative income equality in the Slavic and Baltic republics may reveal popular preference for a more egalitarian society, a factor that might make the transition to capitalism more difficult. On the other hand, the combination of lower income inequality and higher mean incomes may provide a better starting point for market-oriented reforms: after all, the public may be more willing to accept a competitive economic system as long as everybody's initial conditions are more or less similar.

Finally, we could not ascertain — somewhat to our surprise — any clear trends in income inequality in the USSR during the 1980s. These results are consistent with the view that genuine market-oriented reforms did not really begin in the USSR prior to 1991.

TABLE 1. Distribution of USSR Population by Per Capita  
Household Income — 1980, 1985, 1988, 1989, 1990  
(% in each income interval)

Rubles				Rubles			
per month	1980	1985	1988	per month	1985	1989	1990
Under 50	7.3	4.3	2.9	Under 75	17.9	11.1	7.7
50-75	18.5	13.6	9.7	75-100	19.8	13.7	10.6
75-100	23.2	19.8	15.7	100-150	34.3	31.3	28.1
100-125	19.5	19.3	17.6	150-200	17.1	22.1	23.9
125-150	13.2	15.0	15.7	200-250	6.9	11.8	14.9
150-175	8.2	10.4	12.2	250-300	2.6	5.7	8.0
175-200	4.7	6.7	9.0	300-350	1.0	2.7	4.1
200-250	4.1	6.9	10.1	350-400	0.4	1.2	2.1
Over 250	1.3	4.0	7.1	Over 400	0.0	0.4	0.6

SOURCE: Data from annual budget surveys conducted by the USSR State Committee on Statistics [Goskomstat]. Figures in the left-hand panel (1980, 1985, and 1988) presented in *Ekonomicheskaya gazeta*, No. 25 (June), 1989, p. 11. Figures in the right-hand panel (1985, 1989, and 1990) presented in Goskomstat press release no. 175 (10 June 1991).

TABLE 2A. Distribution of USSR Population by Per  
Capita Household Income in 1988, by  
Republic (% in each income interval)

	<u>Rubles per month</u>				
	<u>Under 75</u>	<u>75-100</u>	<u>100-150</u>	<u>150-200</u>	<u>Over 200</u>
USSR	12.6	15.7	33.3	21.2	17.2
RSFSR	6.3	13.1	34.0	24.6	22.0
Ukraine	8.1	16.8	38.5	22.4	14.2
Belarus	5.0	12.9	36.8	25.8	19.5
Uzbekistan	44.7	23.9	22.2	6.4	2.8
Kazakhstan	15.9	19.3	33.7	18.1	13.0
Georgia	16.3	17.4	31.6	18.1	16.6
Azerbaijan	33.3	22.2	27.3	10.9	6.3
Lithuania	3.6	10.7	34.6	27.1	24.0
Moldova	13.0	19.8	37.3	18.9	11.0
Latvia	3.2	9.5	31.8	27.2	28.3
Kyrgyzstan	37.1	23.1	26.0	9.2	4.6
Tajikistan	58.6	20.7	15.5	3.8	1.4
Armenia	18.1	21.5	34.7	16.2	9.5
Turkmenistan	36.6	23.0	25.8	9.4	5.2
Estonia	3.9	9.0	28.0	25.5	33.6

TABLE 2B. Distribution of USSR Population by Per Capita Household Income in 1990, by Republic (% in each income interval)

	Roubles per month						
	Under 75	75-100	100-150	150-200	200-250	250-300	Over 300
	75	100	150	200	250	300	300
USSR	7.7	10.6	28.1	23.9	14.9	8.0	6.8
RSFSR	3.2	8.2	27.2	26.0	17.3	9.6	8.5
Ukraine	2.7	8.6	31.2	28.0	16.2	7.9	5.4
Belarus	1.5	5.9	27.0	28.9	19.1	10.0	7.6
Uzbekistan	34.1	23.0	26.8	10.1	3.7	1.4	0.9
Kazakhstan	10.0	14.4	31.1	21.5	11.9	6.0	5.1
Georgia	6.5	11.2	28.7	23.1	14.5	8.2	7.8
Azerbaijan	29.7	19.7	26.8	13.0	6.0	2.7	2.1
Lithuania	1.2	4.5	20.9	25.8	20.5	13.3	13.8
Moldova	6.1	12.5	32.9	24.5	13.0	6.4	4.6
Latvia	0.9	3.8	19.5	26.1	21.3	13.9	14.5
Kyrgyzstan	24.8	21.7	30.8	13.7	5.5	2.1	1.4
Tajikistan	45.1	22.7	21.6	6.8	2.4	0.9	0.5
Armenia	5.4	11.3	31.6	24.6	14.3	7.1	5.7
Turkmenistan	26.9	22.3	29.6	12.7	5.1	2.0	1.4
Estonia	0.6	2.7	15.4	23.6	21.7	16.2	19.8

SOURCE: Data from annual budget surveys conducted by the USSR State Committee on Statistics [Goskomstat]. Figures for

Table 2A presented in Ekonomicheskaya gazeta, No. 25 (June), 1989, p. 11. Figures For Table 2B presented in Goskomstat press release no. 175 (June 10, 1991).



TABLE 3. Minimum and Mean Incomes and Estimated Inequality Coefficients for USSR Per Capita Income—1980, 1985, 1988, 1989, 1990

	Minimum	Mean	Atkinson indices			
	income	income	Gini	A=0.5	A=2	A=3
1980a	12.6	112	.290	.171	.327	.414
1985a,b	13.8	127	.284	.165	.316	.400
1988a	14.4	147	.290	.158	.315	.403
1989b	14.6	151.3	.275	.150	.294	.376
1990b	14.8	171	.281	.144	.295	.381

NOTES:

<sup>a</sup> Estimates based on data in left-hand panel of Table 1.

<sup>b</sup> Estimates based on data in right-hand panel of Table 1.

The Gini coefficients and Atkinson indices were derived by using a minimum Kolmogorov-Smirnov estimator to fit a lognormal curve, constrained by the exogenously supplied means and minima shown above, to the data in Table 1. The means for 1980, 1985, 1988 are given in *Ekonomicheskaya gazeta*, No. 25, 1989. The means for 1989 and 1990 are given in Goskomstat press release no. 175 of June 10, 1991. The minimum incomes for all years were estimated by the method explained in Alexeev and Gaddy (1991).



TABLE 4A. Mean income, inequality measures, and family size for  
republics of the USSR, 1988

		Mean	Atkinson indices			Family	
		income	Gini	A=0.5	A=2	A=3	size
1	Tajikistan	78	.318	.304	.459	.543	6.1
2	Uzbekistan	91	.306	.269	.420	.503	5.5
3	Kyrgyzstan	101	.312	.253	.414	.501	4.6
4	Turkmenistan	102	.316	.253	.418	.506	5.6
5	Azerbaijan	107	.317	.246	.413	.503	4.7
6	Armenia	125	.280	.208	.347	.426	5.5
7	Kazakhstan	134	.291	.203	.354	.438	3.8
8	Moldova	132	.264	.194	.321	.393	3.1
9	Georgia	141	.313	.194	.368	.463	3.9
10	Ukraine	142	.248	.179	.294	.361	3.0
11	Belarus	155	.242	.172	.283	.348	2.9
12	Russia	159	.264	.176	.305	.380	2.9
13	Lithuania	164	.244	.166	.278	.345	2.9
14	Latvia	174	.250	.157	.276	.347	2.7
15	Estonia	186	.278	.161	.307	.390	2.6

TABLE 4B. Mean income, inequality measures, and family size for republics of the USSR, 1990

		Mean	%	Atkinson indices			Family	size
		income	increase	Gini	A=0.5	A=2	A=3	
1	Tajikistan	92	18	.334	.282	.458	.551	6.1
2	Uzbekistan	105	15	.315	.251	.416	.504	5.5
3	Turkmenistan	115	13	.308	.234	.396	.484	5.6
4	Kyrgyzstan	119	18	.308	.229	.390	.479	4.6
5	Azerbaijan	119	11	.345	.245	.441	.542	4.7
6	Kazakhstan	158	18	.297	.188	.347	.435	3.8
7	Moldova	163	23	.267	.167	.301	.378	3.1
8	Armenia	169	35	.269	.169	.304	.381	5.5
9	Ukraine	175	23	.240	.155	.266	.331	3.0
10	Georgia	176	25	.291	.169	.326	.413	3.9
11	Russia	186	17	.259	.155	.284	.358	2.9
12	Belorus	189	22	.233	.145	.250	.314	2.9
13	Lithuania	212	29	.248	.139	.259	.329	2.9
14	Latvia	216	24	.240	.135	.249	.316	2.7
15	Estonia	234	26	.240	.130	.243	.311	2.6

NOTES: Mean incomes, Gini coefficients, and Atkinson indices were obtained by fitting a lognormal curve to the data in Tables 2A and 2B by a minimum Kolmogorov-Smirnov estimator as described in the text. Column 2 ("% increase") in Table 4B is the percentage growth in mean income from 1988 to 1990. The minimum income for all republics was assumed to

be 14.4 rubles/month in 1988 and 14.6 rubles/month in 1990. Family size (the same in both years) is computed from data from the USSR census presented in Narkhoz SSSR v 1989g., p. 17 (total population) and Vestnik statistiki, No. 1 (1992), p. 56 (number of families and single-person households).

## FOOTNOTES

1. "Income" [the Russian term is srednedushevoy sovokupnyy dokhod, or "per capita total income"] includes both wage earnings and most official (legal and recorded) sources of non-wage income. In addition to the issues discussed later in this paper, the data in Tables 1 and 2 suffer from the same problems of Soviet household income data described by Shenfield (1983).

2. This paper does not discuss two other key factors in the distribution of real income in the USSR — namely, state subsidies and privileges. While we recognize the importance of these factors, the lack of data makes careful analysis nearly impossible. The magnitudes involved, however, are considerable. For example, in 1987 residents of state-owned housing contributed less than one-quarter of the total expenditures on maintenance and management of their housing (Narkhoz 1987, p. 469). In 1989 food subsidies constituted approximately 11% of Soviet GDP (Ofer 1991, p. 287). Since privileges are normally bestowed on elite high-income groups (see Matthews, 1978), we can predict that adding privileges to official income would unambiguously increase inequality. Note, however, that queueing, which was widespread in the USSR, is in general an egalitarian rationing device. Also, some "privileges" are bestowed on lower income groups (e.g., World War II veterans). In any case, it is all but impossible to quantify all these effects. Bergson (1984, p. 1075) suggests that, on balance, subsidies tend to even out distribution of income. Alexeev (1990a) and a recent Goskomstat survey (1990) present some evidence in support of

this conjecture. But many Soviet economists (e.g., Rutgayzer et al., 1989, p. 61) maintain the contrary, especially with respect to food subsidies. It is to be noted, however, that even if we had access to complete official Soviet data, we might not be able to resolve this problem, owing to the possibility of "purchasing" state subsidies through the second economy (Alexeev, 1988).

3. Scale invariance requires that multiplying everyone's income by a constant does not affect the measure of inequality. The principle of transfers states that measures of inequality must increase when income is transferred from a poorer person to a richer one. Symmetry implies that switching incomes among individuals does not affect the inequality measure. Invariance to replications of the population is self-explanatory. For a more sophisticated discussion of the properties of various inequality measures, see Cowell (1980).

4. Each of these measures has its drawbacks. For example, even though the Gini coefficient satisfies the principle of transfers, it is more sensitive to transfers in the middle portion of the distribution than to transfers in the tails. Also, neither the Gini nor any other measure of inequality can provide an unambiguous ranking of alternative income distributions unless the underlying Lorenz curves do not intersect. Our data do not permit reliable estimation of the underlying Lorenz curves along the lines suggested by Kakwani and Podder (1976). The estimates we performed, however, did not permit us to rule out intersecting Lorenz curves at least for the all-Union income data (Table 1).

Despite their shortcomings, both the Gini coefficient and the Atkinson indices are far superior to the decile ratios which have so often been used in previous work to measure income inequality in the USSR. (The decile ratio—P90/P10—is defined as the ratio of the cutoff point for the 90th income percentile to that of the 10th percentile; see Bergson [1984] for references.)

5. The Soviet preference for the lognormal dates back many years. See Chapman (1977). But note that as recently as May 1989 the official statistics agency, Goskomstat, was still prescribing the lognormal distribution for evaluations of income distribution of Soviet households (Osnovnyye 1989). The Western literature has of course suggested a variety of more sophisticated and flexible distributions. McDonald and Ransom (1979) sum up much of the discussion on the “best” functional form.

6. The minimum Kolmogorov–Smirnov estimator is described in the Appendix. Aitchison and Brown (1957, pp. 51 and 94) describe some alternative techniques for estimating the parameters of a lognormal distribution from grouped data.

7. Fuller discussion of our assumptions regarding the actual minimum wage and adjustments for subsidies may be found in Notes 4 and 5 of the appendix to Alexeev and Gaddy (1991).

8. The Gini coefficient of a lognormal income distribution is completely determined by the variance alone. The formula for the Gini is  $Gini = 2 \cdot \Phi((\sigma/2)^{1/2}) - 1$ , where  $\Phi(\cdot)$  is the cumulative distribution function for a standard normal variable and  $\sigma$  is the variance of the lognormal



distribution. Incidentally, the Theil coefficient, another popular inequality measure, is also computed from the variance in the case of a lognormal distribution, and hence is monotonically related to the Gini.

9. Bergson (1984) and Chapman (1977, 1989) have made the most thorough studies of Soviet wage distribution data. It should be noted that at the same time the Soviet statistical agencies released new income data, they also published interesting new wage data, including distributions of wages by sex and age group. The wage data are presented in the same grouped and censored distributions as the income data discussed here and should be amenable to the same estimation technique as used here for income data. However, we found that the fit of the wage distributions to a lognormal distribution was much poorer than for the income data.

10. The total income figures also take into account income taxes. However, since the Soviet income tax was very modest and only mildly progressive, we would not expect taxes to have a major effect on income distribution.

11. Here and below, we use the term Central Asia to refer to the republics of Tajikistan, Uzbekistan, Turkmenistan, Kyrgyzstan, and Kazakhstan. The Baltic republics are Estonia, Latvia, and Lithuania. The Slavic republics are Russia, Belarus, and Ukraine.

12. Formal tests confirm the correlation. Pairwise Spearman rank correlation coefficients among all the columns of Tables 4A and 4B (except "% increase" in Table 4B) are significant at the .001 level (one-tailed test).

Although we raise the issue of family size, we do not discuss here the difficulty of comparisons of real income across households of differing

sizes and compositions. This is the basis of the debate on so-called equivalence scales. Deaton and Muellbauer (1980, Chapter 8]) point out that comparing per capita budget levels is fraught with problems. For example, they note that a comparison of per capita income ignores "the variation of need with age: babies need less than adults. Also there are likely to be opportunities for economies of scale in consumption. Three people do not need proportionately more bathrooms or cars than two people; buying or cooking food in bulk is cheaper; clothes can be handed down from older to younger children" (p. 192).

13. While it is reasonable to assume that there was a uniform inflation rate for the republics as long as they remained part of the USSR, the assumption would clearly not be applicable as of the second half of 1991.

14. The Soviet second economy is sometimes deemed to correspond to what in the West is known as the underground economy or informal economy. The Soviets themselves most frequently use the term "shadow economy." In this work, we follow the more precise definition offered by Gregory Grossman (1979): the Soviet second economy includes all economic activities which are either performed directly for private gain, or are illegal, or both.

15. Average per capita official income in 1988-89 was about 150 rubles/month. With a total population of around 290 million, this meant that aggregate official personal income was roughly 522 billion rubles ( $= 150 \times 12 \times 290$  million).  $100\text{bn} + (522\text{bn} + 100\text{bn}) = 16\%$ ,  $200\text{bn} + (522\text{bn} + 200\text{bn}) = 28\%$ .



16. The first clear statement of this hypothesis was in Grossman (1979). See also Trembl (1990a) and Gaddy (1991a) for two different approaches to empirically testing the hypothesis.

17. The data set used was assembled by the Berkeley–Duke Project on the Second Economy in the USSR and is based on an extensive questionnaire administered to members of over 1000 families which had emigrated to the United States from the Soviet Union in the late 1970s and early 1980s. It is particularly important to note for this study that the conditions reported by the survey participants relate to the late 1970s and that nearly all the participants were from urban areas of the Soviet Union.

18. Further information on the form taken by second economy growth in the 1980s might modify the conclusions of this paragraph. Gaddy (1991b), e.g., concludes that the growth of the underground economy in this decade was probably due to the addition of new participants, rather than an increase in per capita second economy incomes. That is, for individuals who were already deriving income from second economy activities, per capita real (inflation-adjusted) second economy incomes remained constant in the 1980s. At the same time, it is likely that new categories of Soviet citizens began to participate in the second economy during these years. While it is clear that the combination of these two trends would lead to a rise in the total volume of second economy activity, the effect might just as well be to attenuate, rather than exacerbate, overall income inequality.

## APPENDIX

### MINIMUM KOLMOGOROV-SMIRNOV ESTIMATOR

The minimum Kolmogorov-Smirnov estimator is based on the Kolmogorov-Smirnov one-sample test, which measures goodness-of-fit between the distribution of a set of sample values (in our case, the observed distribution of income) and a specified theoretical distribution (here, the lognormal) by comparing their cumulative frequency distributions. The Kolmogorov-Smirnov statistic finds the point of greatest divergence between the two. Siegel and Castellan (1988) provide a detailed description of the Kolmogorov-Smirnov statistic and its properties.

The Kolmogorov-Smirnov statistic can be formally described as follows. Let  $F(X)$  be the theoretical cumulative relative frequency distribution function. For any value of  $X$  (any income point) the value of  $F(X_i)$  is the proportion of wage-earners expected to have a monthly income less than or equal to  $X_i$ .

Let  $S(X)$  be the observed cumulative relative frequency distribution of a sample.  $S(X_i)$  will be the observed proportion of observations less than or equal to  $X_i$ .

If the sample has indeed been generated by the specified theoretical distribution function, we would expect that the value of the theoretical distribution,  $F(X_i)$ , would be close to the observed  $S(X_i)$ . The differences at each point,  $F(X_i) - S(X_i)$ , should be small for all  $X_i$ , within the limit of random error.

The Kolmogorov–Smirnov test looks at the largest of these deviations between the sample distribution and the theoretical distribution, a magnitude which we can label  $D$ . In other words,

$$D = \max |F(X_i) - S(X_i)|$$

The Kolmogorov–Smirnov estimator finds the parameters of the theoretical distribution which best fits the observed sample, where “best” is defined as the theoretical distribution yielding the smallest  $D$  when compared to the observed data. In our case, the estimation problem can be expressed

$$\min D = \min \{ \max | \Lambda(\mu, \sigma; X_i) - S(X_i) | \} \text{ w.r.t. } \mu, \sigma$$

where  $\mu$  is the mean and  $\sigma$  is the standard deviation of the lognormal distribution  $\Lambda$ . The problem was solved using numerical methods.

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