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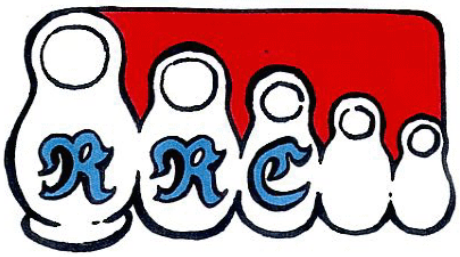

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Byung Yeon Kim
Yoshisada Shida

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HITOTSUBASHI UNIVERSITY
Kunitachi, Tokyo, JAPAN

Shortages and the Informal Economy in the Soviet Republics: 1965–1989*

Byung Yeon Kim (Seoul National University)

Yoshisada Shida (Hitotsubashi University)

Abstract

We measure the informal economy and shortages of consumer goods in the Soviet republics from 1965 to 1989 to estimate the relationships of these two variables. We use fixed-effect model and instrument variable approach and find that the informal economy and shortages reinforce each other. Results indicate that the Soviet central planning system is difficult to sustain in the long run. A substantial heterogeneity across the Soviet republics exists not only in the extent of the informal economy and shortages, but also in the associations of the two variables.

Keywords: shortages, informal economy, Soviet republics
JEL Codes: P21, P27, P36.

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* Byung Yeon Kim, Department of Economics, Seoul National University, South Korea, kimby@snu.ac.kr; Yoshisada Shida, Institute of Economic Research, Hitotsubashi University, Japan, shida@ier.hit-u.ac.jp.

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I. Introduction

Centrally planned economies (CPEs) are typically described as the system in which the central planning coordinates the economic activities of enterprises and households. Central planners draw comprehensive plans that contain detailed information on inputs and outputs, suppliers and consumers, and household income and the supply of consumer goods and services. Input producers supply the required inputs and deliver them to firms according to the plans. Goods and services produced using such inputs are supplied to consumers as central plans dictate. Hence, shortages in the consumer markets and the informal economy (or the so-called second economy) in the ideal type of CPEs are marginally possible.

However, ideal CPEs were inexistent. Central planning often suffered from inconsistency and lack of knowledge on the behavior and capacity of firms. Central planners accused firms of attempting to hide local information on themselves soon after the establishment of CPEs. Firm managers simultaneously complaint that inputs required to produce outputs were not delivered, but central planners still demanded that output targets be fulfilled. Households found that they were unable to purchase goods in official shops and thus conducted informal economic activities with enterprises; households and enterprises produced goods and services informally, that is, either against laws or outside the operational domain of central planners. Households and enterprises sold goods at markets to earn extra income. Households sold their products from private plots at collective farmers' markets, which were part of informal markets. Several households purchased goods in an official shop and resold them at higher prices in informal markets. Enterprises bought inputs from unofficial input suppliers (*talkachi*) and earned money by selling their goods at markets.

Shortages and the informal economy are the two important features of the Soviet economy (Grossman, 1977; Treml and Alexeev, 1994; Kim, 1999; 2002). The informal economy co-existed with central planning from the beginning of the Soviet socialism (Grossman, 1977; O'Hearn, 1980). Shortages have prevailed in consumer markets until the dissolution of the Soviet Union (Kim, 1999; 2002). The disequilibrium school argues that shortages could reduce labor supply because households facing shortages attempt to substitute money with leisure. A vicious circle is consequently generated because reduced labor supply implies reduced supply of consumer goods, which further intensifies

shortages. This argument indicates that CPEs suffering from shortages in the consumer market are inherently unstable and destined to collapse. However, several studies have argued that workers have difficulty in reducing working hours freely in the centralized Soviet system that is characterized by heavy regulations and harsh penalties (Howard, 1976). Furthermore, the informal economy helps keep the value of money; households can buy goods informally, although the official market has shortages of these goods (Alexeev, 1988).

Shortages and the informal economy have been studied separately; no research has analyzed the relationship between these two variables. Do these two variables reinforce each other and cause a vicious circle in CPEs? Alternatively, do they interact to produce a stable equilibrium? These questions are important for understanding the stability of CPEs. Moreover, the Soviet republics may have been different in terms of the extent of shortages and the informal economy, and the relationship of these two variables. The presence of heterogeneity has implications for the collapse of the Soviet economy.

We aim to contribute to the literature in two aspects. First, using previously unavailable archival material, we extend the estimates of Kim (1999; 2003) of the informal economy in the Soviet Union as a whole from 1965 to 1989 to all 15 Soviet republics in the same period. We combine these data with the measures of shortages and other variables at the republic level. Second, we estimate the determinants of the informal economy and shortages simultaneously as well as independently to understand the relationship between these two factors.

We find that shortages increase the informal economy and that the informal economy intensifies shortages. These positive relationships between these variables suggest that CPEs are an unstable system; the planned official sector shrinks in the long run as informal markets replace the planned sector. Yet, a large heterogeneity exists in the informal economy and shortages among Soviet republics. In particular, the informal economy and shortages interacted more intensively in Russia and Ukraine than in republics in Central Asia.

This paper is organized as follows. In Section II, we review the related literature. In Section III, we measure the informal economy using the material from Russian archives. In Section IV, we estimate the determinants of the informal economy and shortages in reduced and structural forms. In Section V, we summarize our findings and discuss their implications.

II. Literature Review

The Soviet informal economy (i.e., the second economy) began to be discussed in the literature following the pioneering work of Grossman (1977).[1] Grossman defined the second economy as a platform for "all production and exchange activities that fulfill at least one of the two following tests: (a) they intended directly for private gain; (b) they were conducted in some significant respect with understanding they were in contravention of existing law." Grossman estimated the amount of goods and services transacted in the informal economy. Afterwards, several related studies on the Soviet informal economy have been conducted mainly by Western researchers (Schroeder and Greenslade, 1979; O'Hearn, 1980; Ericson, 1983; Brezinski, 1985; Cassel and Cichy, 1986). The principal interests of these studies include the definition, the size of the informal economy, its causes and effects, and the classification of activities. However, their analyses are limited to describing the typologies and working mechanisms of informal economy, and providing rough estimations based on anecdotal evidence that appeared in Soviet newspapers and journal articles.[2]

The Soviet Interview Project and the Berkeley-Duke Émigré Survey collected data on the Soviet informal economy from Soviet immigrants in Israel and the United States in the 1970s, respectively; they substantially improved data availability and analytical rigor. Nevertheless, they suffered from problems arising from a non-representative sample. Although Soviet researchers began to pay attention to its second economy prior to the collapse of the regime, their work failed to provide reliable estimates of the second economy (Осипенко, 1989; Головнин and Шохин, 1990; Корягина, 1990). More reliable estimates were obtained because of the availability of previously classified data after the collapse of the Soviet Union. Kim (2003) used previously unpublished archival material of household budget surveys and classified the informal economy into three types, namely, informal production, illegal production, and rent-seeking activities. Kim reported that the latter two tended to increase during the period of Perestroika. Shida (2011) confirmed this finding at the republic level.

Several researchers have examined the effects of the informal economy on the entire economy to understand whether the informal economy stabilizes or

[1] Hereafter, we use "informal" and "second" economy interchangeably.
[2] Schroeder and Gleenslade (1979) and Rutgaizer (1992a; 1992b) reviewed the Soviet literature that contains information on the size of the second economy.

destabilizes the entire economy (Ericson, 1983; Cassel and Cichy, 1986; Galasai and Sik, 1988; Alexeev, 1988; Treml and Alexeev, 1994). The informal economy may affect the economy positively. It increases price flexibility, which drives the price of a good closer to its scarcity. It simultaneously eases inflationary pressures in the official market by absorbing a part of unspent money in the official economy, and reduces the supply multiplier, that is, the tendency of households to substitute money income with leisure when they are frustrated about the inability to purchase goods and services in the official economy. However, O'Hearn (1980) and Treml and Alexeev (1994) argued that the effect of the informal economy is detrimental. O'Hearn (1980) suggested that the role of the informal economy in the economy as a whole can be supplementary, depletive, or redistributive, depending on its characteristics. Following this line of approach, Treml and Alexeev (1994) indicated that an increase in the informal economy beyond a certain threshold could destabilize the official economy.

Early empirical studies on shortages in Soviet consumer markets have failed to find any evidence of shortages (Pickersgill, 1976; Ofer and Pickersgill, 1980). However, these studies suffered from data unavailability, measurement errors, and methodological problems arising from the non-stationarity of variables. Kim (1997; 2002) and Asgary et al. (1997) provided more reliable evidence of shortages in Soviet consumer markets.

Previous studies have failed to explore the shortage factor in considering the effect of the informal economy on the official economy. The disequilibrium model analyzes the relationship between shortages and the official economy, but failed to include the informal economy in its model (Davis and Charemza, 1989). The informalization hypothesis maintains that the Soviet economy collapsed because of its informalization, that is, the replacement of the official economy with the informal economy and its association with corruption and deterioration of support for socialist norms (Treml and Alexeev, 1994; Grossman, 1998). However, these studies have investigated only the relationship between the official and the informal economy, although the dynamics of the informal economy may have been associated with shortages.[3]

The informal economy is likely to interact with shortages in the official economy. An increase in the total supply of goods and services due to the existence of the informal economy could reduce shortages in the official

[3] Queue-rationing mechanism in the official and parallel markets is formally discussed in the literature (Stahl and Alexeev, 1989).

economy because household demand for goods and services in the official sector decreases. In more detail, households may work harder in the informal economy than in the official one, which increases the total supply of consumer goods and services available in the economy. Furthermore, the informal economy where prices are determined freely by supply and demand can absorb at least part of shortages in the official economy. These conjectures imply that shortages in the official economy decrease as those in the informal economy increase. However, using inputs taken away from the official economy for production in the informal economy intensifies shortages in the informal economy. In addition, firms prefer to sell their produced goods and services in the informal economy to increase profit (Harrison and Kim, 2006). Moreover, households accumulate money from activities in the informal economy and may use it in the official economy. Hence, an alternative conjecture can be established in that the informal economy intensifies shortages.

In sum, the issues of whether the net effect of the informal economy on shortages is positive or negative, and whether the development of the informal economy is stimulated by the intensified shortages remain unclear. These unresolved questions on the dynamic relationships between the informal economy and shortages are empirically examined in the subsequent sections.

III. Data

This section measures the informal economy and shortages at the level of the Soviet republics, and introduces various independent variables to estimate the relationships between the informal economy and shortages. We use declassified archival materials on household budget surveys from RGAE (Российский государственный архив экономики) to estimate the size of the informal economy and reconstruct our statistical database of household incomes, expenditures, and items traded by the republics. According to Kim (2003), the informal economy has three components, namely, the self-consumption of agricultural products, trading between citizens, and redistribution among citizens. We use only the second and third components to measure the informal economy to understand its relationship with shortages because the self-consumption of agricultural products is closely associated with the stage of economic

development.[4] The share of the informal economy (*informal*) refers to the ratio of the aggregated amount of the money expenditures of households at the informal market to the net material products (NMPs) of each republic.

Second, following Chawluk and Cross (1997), and Kim (2002), the shortage indicator (*shortage*) is defined as the ratio of household disposable money income to retail inventories at the state and cooperative retail networks. This indicator is the only one that allows comparison across republics. Kornai (1976) and Asgary et al. (1997) use alternative shortage indicators, for instance, the lengths of waiting lists and queues for scarce goods and evaluations of the goods availability collected through sample survey; however, these data are difficult to obtain for the long period and for every republic. We present the trend of the informal economy and shortages at the Soviet republics in Figures 1 and 2. The figures show a large heterogeneity across republics in the informal economy and shortages. For example, Figure 1 shows that the informal economy is much larger in Central Asia and Caucasian republics but relatively smaller in Baltic republics. In contrast, the shortage patterns across republics are difficult to characterize.

In our estimations, we use the above-mentioned dependent variables transformed into the natural logarithm and control various factors that may affect the informal economy and/or shortages. Conventional control (exogenous) variables introduced capture the economic, governance, and socio-demographic features (human capital, ethnicity, and crime) of the republics. Moreover, we introduce the following economic variables: real economic growth rate in the log form (official growth rate of the NMP evaluated in constant prices: *growth*); industrial structure, namely, the shares of industry (*industry*), agriculture (*agriculture*), and domestic trade, including food services (*trade*) in NMP; average official income level in real terms in the log form (*income*); tax rate for household in the log form (*tax*); income gap between workers/employees and collective farmers in the log form (*wagegap*);[5] *road* is the amount of goods transported by road divided by the number of retail shops; and housing condition

[4] Redistribution among citizens denotes the repayment of debts and loans borrowed from citizens. We assume that these debts and loans were mainly used for trading between citizens and constituted a part of informal financial services.

[5] High income gap may stimulate trade between high- and low-income groups. That is, the high-income group intends to purchase goods in the informal economy instead of queuing in the official shops, whereas the low-income group waits in a queue to take advantage of lower prices in the official shops.

(*dwelling*), which is the size of newly constructed housing divided by the number of population (m^2 per person).

The second group of variables is classified as governance factors. We use two variables, *budget* and *btransfers*. The former captures the governance stability of the republic from the viewpoint of the size of the budget balance (budget revenues minus budget expenditures) of the republic relative to NMP. The latter variable refers to the size of transfers from the republican budget to the federal budget relative to total budget expenditures.

With regard to social and demographic factors, we utilize population density in the log form (persons per km^2: *density*), and the number of graduates per population in the log form (*graduates*) is included as a proxy for the level of education in the republic. In less developed countries, people with less education often have difficulty in finding jobs in the official labor market and thus are forced to work informally. We also control for the ethnic factor: "slavification" index in the log form (*slav*) based on the extent to which Slavic languages (Russian, Ukrainian, and Belarusian) are used in published materials, such as books, journals, and newspapers.[6] This index captures the distance between central control (government) and local independence (community). Local networks may have incentives to protect illegal networks from central investigation. In addition, non-Russian culture indicates the prevalence of a more traditional lifestyle connected to the informal sector. The last control variable is the reported crime per population rate (*crime*) derived from Clark (1993). Variables employed in estimations and their descriptive statistics are shown in Table 1.

IV. Estimation Results

We first estimate the equation for the informal economy and one for shortages separately using fixed-effect model.[7] In doing so, we introduce control variables step by step to check the significance and the robustness of our key variables, that is, shortages in the equation for informal economy, and the

[6] A similar concept, the "Russification" is presented by Anderson and Silver (1983), which emphasizes the Russian ethnicity. In our examination, Russian, Ukrainian, and Belarussian ethnicities are considered as almost the same ones.

[7] Pooling regression models using Ordinary Least Squares are rejected, and fixed-effect models are preferred for both the equation for the informal economy and one for shortages.

informal economy in the equation for shortages. Fixed-effect model can successfully control for time-invariant factors that affect the dependent variable by transforming variables to deviations from the average within the unit, and thus help avoid endogeneity problems caused by omitted fixed effects. Moreover, the reverse causality from the dependent variable to control for variables can be reduced using fixed-effect estimations because they exploit within-group variation over time but do not use across-group variation that may reflect omitted variable bias. The results obtained using fixed-effect model are presented in Models 1 to 7. Furthermore, we use the system Generalized Methods of Moments (GMM) estimator in Model 8. The system GMM estimator controls for both republic-specific heterogeneity and potential endogeneity bias by combining in a system the original specification expressed in first-differences and levels and uses internal instruments, such as those based on the lagged values of endogenous explanatory variables.

Table 2 shows the results of estimations for the informal economy. The most important result is that the key variable, *shortage*, is positive and statistically significant at the 1% level in all models. This result indicates that shortages cause the informal economy to increase. Furthermore, the coefficient on shortages changes slightly, although we introduced economic variables in Models 2 to 6, and social and demographic variables in Model 7. Hence, the effect of shortages on the informal economy is independent of other confounding factors. These findings are likewise confirmed by the dynamic linear model using the GMM with one lag displayed in Model 8.

With regard to control variables, coefficients on real income are negative and statistically significant at the 1% level in all of the models. This finding suggests that the Soviet informal economy is associated with the motivation of households to earn extra income when the official income is low. This finding is likewise supported by the negative correlation of *growth* with the informal economy. The share of the trade industry in NMP is positively associated with the informal economy. In contrast, the shares of industry (mining and manufacturing) and agriculture in NMP are not statistically significant. These results imply that the Soviet informal economy has closer associations with trade sectors than the other ones. Finally, evidence suggests that income differences between the workers/employees and collective farmers (*kolkhozniki*) positively influence the informal economy.

We subsequently estimate the equation for shortages using fixed-effect models. The results are presented in Table 3. The coefficients on *informal* are positive and statistically significant at the 1% level in all of the models. This finding suggests that an increase in the informal economy intensifies shortages in the official economy. Hence, the informal economy fails to stabilize the national economy as argued by several studies, such as Ericson (1983), Cassel and Cichy (1986), Sampson (1986), and Galasi and Sik (1988). Rather, it destabilizes the economy by increasing shortages.

Coefficients on real income are positive and statistically significant at less than the 5% level in all of the models, excluding Models 1 and 7. In other words, the higher household income is, the more shortages in the official sector. Population density is negatively correlated with shortages. This finding can be explained by the higher prioritization for the supply of consumer goods of large cities with a high population density according to the Soviet central planning. In contrast to the finding from the informal economy equations, economic growth increases shortages; thus, demand pressure induced by high growth is larger than the positive effect of growth on the supply of consumer goods. The dominance of the heavy industry in Soviet growth may account for this result. Furthermore, the industrial structure matters because the share of the mining and manufacturing industry in NMP is positive and statistically significant at the 1% level. With regard to governance variables, budget balance and transfers from the republic budget to the federal budget are likewise positive and statistically significant at the 1% level in Models 6 and 7.[8] These findings are generally supported by the GMM estimation in Model 8.

We check the robustness of the preceding results using two methods, the instrument variable (IV) approach and structural equation approach. The IV approach endogenizes shortages and the informal economy using external instruments. We use two instruments for shortages, namely, population density (*density*) and the share of industrial production in NMP (*industry*). That is, we assume that these two instruments are exogenous to but account for the shortages of consumer goods. We likewise use two instruments for the informal economy, namely, wage gap between the workers/employees and the collective farmers

[8] We likewise examine the effects of budget-related variables on the informal economy. These two variables are not statistically significant in all of the models and thus omitted from our estimation results.

(*wagegap*) and the share of trade in NMP (*trade*). The diagnostics of Tables 4 and 5 suggest that the instruments are relevant and exogenous.

The results from the equation for the informal economy, reported in Table 4 (on the left-hand side), are similar to those in Table 2. Shortages affect the informal economy positively. The results regarding control variables are similar as well. Moreover, we find comparable results on the effect of the informal economy on shortages reported in Table 4 (on the right-hand side). Our key result of the positive association between the informal economy and shortages remain unchanged.

We further estimate both equations using a structural equation model in which both the informal economy and shortages are estimated simultaneously. The results are presented in Table 5. Both key variables are highly significant and positive in determining the other. This finding suggests that, by reinforcing each other, these two variables generate a vicious circle to the official economy and destabilize the Soviet system. These built-in destabilizing factors indicate the high instability of the Soviet economic system.

To analyze heterogeneity across the Soviet republics, we examine regional differences in the effects of shortages and the informal economy on the economy using a structural equation model with the republics dummies. The results in the left-hand side of Table 5 suggest that after controlling for standard explanatory variables, Uzbekistan and Georgia had the largest informal economy, followed by Turkmenistan, and the other Caucasian and Central Asian republics. In contrast, Estonia, Latvia, and Belarus had a relatively small informal economy. The right-hand side of Table 5 shows that shortages, which were unaccounted for by standard variables, were the most severe in Moldova, Ukraine, and Armenia, but households in Central Asia and Russia suffered from shortages to a lesser extent.

We further investigate the relationships between the informal economy and shortages using regional dummies and interaction terms. Each republic is clustered to the following regions: Slavic region as a reference group (comprising Russia, Ukraine, Belarus, and Moldova); Central Asia (Uzbekistan, Kazakhstan, Kyrgyzstan, Tajikistan, and Turkmenistan); Caucasus (Georgia, Azerbaijan, and Armenia); and Baltic region (Lithuania, Latvia, and Estonia). The estimation results confirm the regional variations of shortages and the informal economy. The largest informal economy is found in Central Asian and Caucasian republics,

followed by Baltic and European republics; meanwhile, shortages are more severe in Baltic and Caucasian republics.

The results in Table 6 can be used to understand the relationships between the informal economy and shortages that vary across the clustered regions. The magnitude of the effects of shortages on the informal economy can be computed by adding the coefficient on shortages in the informal economy equation to those on the interaction terms between regional dummies and shortages in the same equation. Similarly, we can compute the magnitude of the effects of informal economy on shortages by adding the coefficient on the informal economy in the shortage equation to those on the interaction terms between regional dummies and shortages in the same equation. The results are summarized in Table 7. All of the coefficients have positive signs and are statistically significant at least at the 5% level. The most important finding is that reference regions, that is, European regions, had the strongest spillover both from shortages to the informal economy and from the informal economy to shortages. The second strongest spillover effects are found in Baltic republics. However, the gaps in the magnitude of such effects between European regions and the other regions, including Baltic ones, are substantially large. These results imply that the official economy in European regions was hit hardest by the vicious circle generated by shortages and the informal economy in these regions. Hence, these regions had arguably the most vulnerable central planning system and may have had the strongest public support for changes in the economic system. This finding can explain why the Russian public supported the transition toward a market economy in the early 1990s, which terminated the Soviet economic system.

V. Conclusion

This study measures the informal economy and shortages of consumer goods from 1965 to 1989 at the level of the Soviet republics to estimate the relationships between these two variables. We apply fixed-effect estimator, instrumental variable approach, and structural estimator to these data.

The informal economy and shortages positively affect each other. In other words, the informal economy intensifies shortages in the official economy, whereas shortages increase activities in the informal economy. Thus, sustaining the Soviet economic system based on central planning is difficult in the long run. The shortages of consumer goods were caused not by policy mistakes but by

structural problems in the CPE. Similarly, activities in the informal economy emerged as a result of inherent problems in the Soviet economic system. The positive association of the informal economy and shortages indicates the existence of a vicious circle in the system.

A substantial heterogeneity likewise exists not only in the extent of shortages and the informal economy across the Soviet republics, but also in the relationships between these two variables. The results suggest that the official economy of the European regions, including Russia, Ukraine, Belarus, and Moldova, was hit hardest by the vicious circle generated by the positive interaction between shortages and the informal economy. This outcome explains why the Russian public supported Yeltsin, who decided to make a transition toward a market economy.

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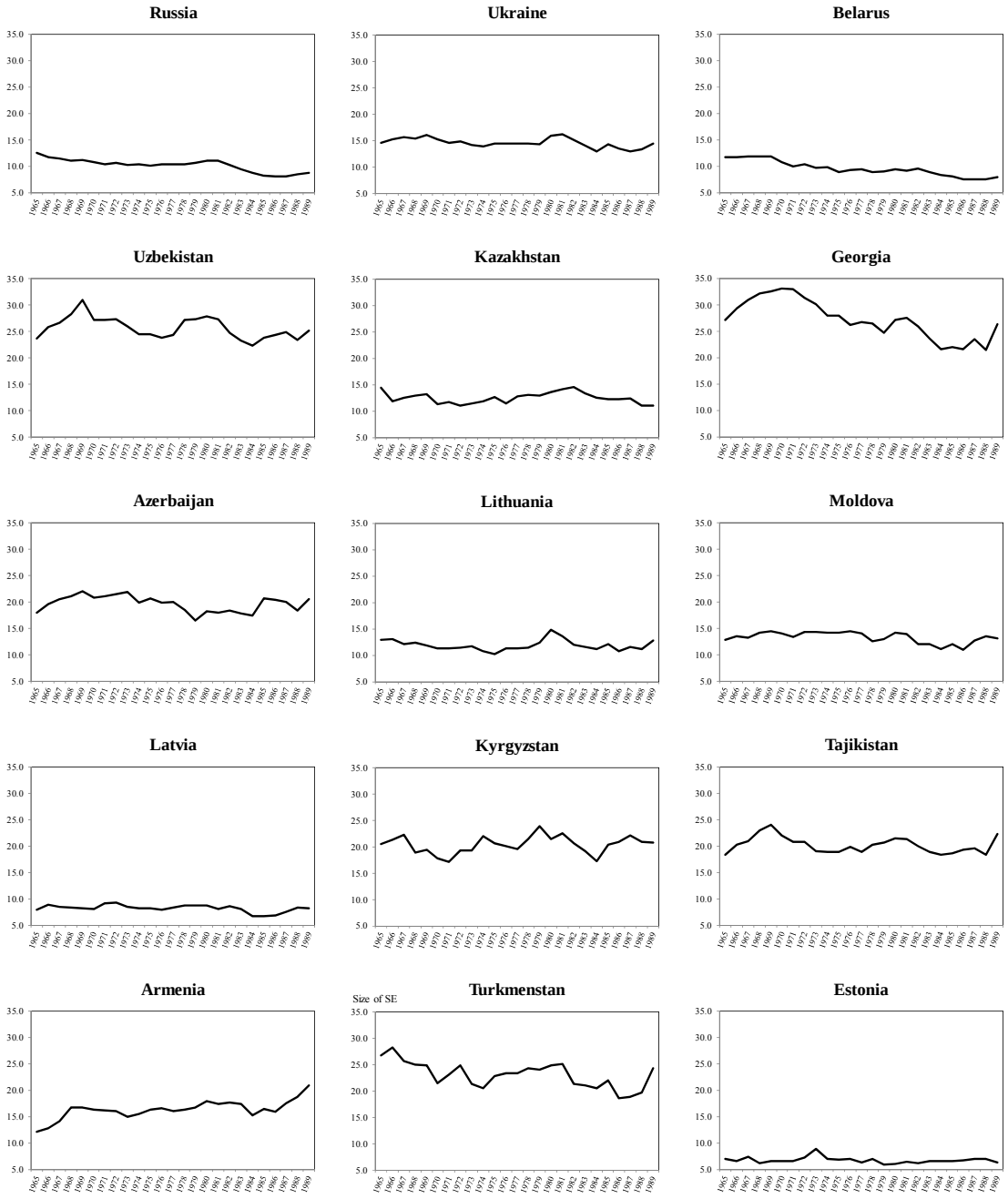
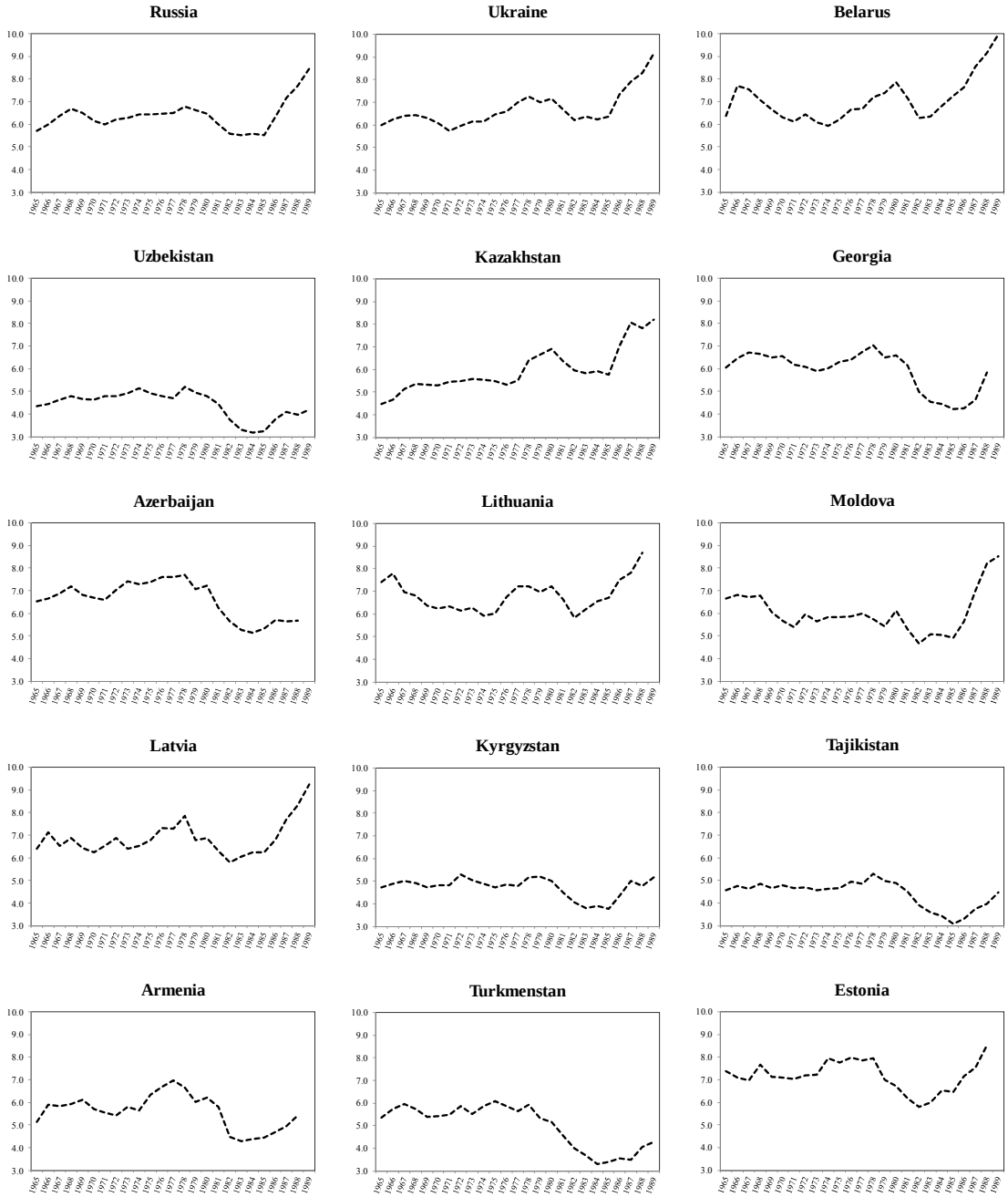
Figure 1: Trend of the size of the informal economy (market), as compared to NMP



Source: Author's estimation.

Figure 2: Trend of the shortage indicator



Source: Author's estimation.

Table 1: Data definitions and descriptive statistics

Variable	Definition	Source	Descriptive statistics					Pairwise correlation with: *	
			Obs.	Mean	Std. Dev.	Min	Max	informal	shortage
Endogenous variables									
informal	The size of the household's informal economy: aggregated household money expenditures at the second economy, divided by the amount of net material products; ratio.	Aggregated household money expenditures at the second economy: author's estimation based on archival materials of household budget survey; NMP: Classified statistical data provided by CIS Statistical Committee, and Kuboniwa. See also Ivanov and Khomenko (2009).	375	2.68	0.42	1.77	3.50	1.00	
shortage	Shortage indicator: aggregated houhosehold disposable money incomes, divided by retail inventories.	Aggregated household disposable money incomes: author's estimation based on archival materials of household budget survey; Retail inventories: Soviet and republican statistical yeabooks of the national economy, various issues.	370	1.77	0.21	1.13	2.30	-0.55 ***	1.00
Exogenous variables									
(1) Economic factors									
income	Household money income per capita in 1965 rubles.	Author's estimation using archival materials on the balances of money incomes and expenditures of the population (Shida, 2012). Deflator: authors' estimation.	375	6.70	0.44	5.84	7.83	-0.64 ***	0.45 ***
growth	Real growth rate of the NMP.	Classified statistical data provided by CIS Statistical Committee, and Kuboniwa. See also Ivanov and Khomenko (2009).	375	4.66	0.04	4.51	4.86	-0.01	0.11 **
industry	The share of industry in NMP.	ibid.	372	3.73	0.20	3.01	4.06	-0.45 ***	0.43 ***
agriculture	The share of agriculture in NMP.	ibid.	372	3.28	0.30	2.22	3.83	0.48 ***	-0.36 ***
trade	The share of trade in NMP.	ibid.	372	1.53	0.14	1.09	1.92	-0.23 ***	0.01
tax	Tax rate: income tax, family-related tax, agriculture tax, etc.	Author's estimation using archival materials on the balances of money incomes and expenditures of the population (Shida, 2012).	375	1.86	0.10	1.55	2.11	-0.63 ***	0.39 ***
wagegap	Monthly average wage gap between workers/employees and collective farmers.	Soviet and republican statistical yeabooks of the national economy, various issues.	375	0.24	0.20	-0.30	0.87	0.23 ***	0.06
road	Amount of goods transported by road per retail shop per retail shops.	ibid.	375	3.30	0.36	2.27	4.02	-0.46 ***	0.03
dwelling	Size of newly constructed housing per divided by the number of population .	ibid.	375	-0.91	0.21	-1.57	-0.46	-0.57 ***	0.39 ***
(2) Governance factors									
budget	The ratio of budget balance to NMP.	Soviet and republic state finance yearbook and above mentioned NMP data.	375	-0.02	1.12	-9.21	1.68	0.09 ***	-0.02
btransfers	The size of transfers from the republican budget to the federal budget relative to total repiublican budget expenditure.	ibid	375	-0.06	0.69	-2.17	2.07	0.29 ***	-0.05
(3) Socio-demographic factors									
density	Population density in the log form.	Soviet statistical yearbooks of the national economy, various issues.	375	3.46	0.98	1.35	4.86	0.00	0.21 ***
graduates	Number of graduates from universities and professional schools per population.	ibid	375	4.09	0.23	3.26	4.48	-0.28 ***	0.24 ***
slav	The extent to which Slavic languages are used in published material.	Author's estimation using Soviet statistical yearbooks of Printing, various issues.	375	3.41	0.78	1.99	4.61	-0.27 ***	0.15 ***
crime	Crime rate: Soviet official convictions, reported in newspapers.	Clark (1993).	375	0.19	0.59	0.00	4.42	0.18	-0.01

Notes

All variables except for crime are in the natural logarithm.

Coefficients of pairwise correlations Significance level: ***: 1%; **: 5%; *: 10%.

Soruce: Author's estimation.

Table 2: Informal economy equations: fixed effect and GMM models

Model	FE	FE	FE	FE	FE	FE	FE	GMM
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
informal (lagged)								0.570 ***
								(11.970)
shortage	0.135 ***	0.187 ***	0.156 ***	0.138 ***	0.128 ***	0.142 ***	0.139 ***	0.216 ***
	(3.970)	(5.270)	(4.670)	(4.100)	(3.880)	(4.740)	(4.610)	(4.800)
shortage (lagged)								-0.101 **
								(-2.090)
income	-0.133 ***	-0.211 ***	-0.268 ***	-0.301 ***	-0.149 ***	-0.130 ***	-0.136 ***	-0.100 ***
	(-8.290)	(-9.030)	(-10.880)	(-10.780)	(-3.230)	(-4.120)	(-3.800)	(-3.660)
density		0.148 ***	0.196 ***	0.135 **	0.082			
		(2.600)	(3.540)	(2.550)	(1.520)			
growth		-0.614 ***	-0.384 ***	-0.444 ***	-0.419 ***	-0.380 ***	-0.368 ***	-0.672 ***
		(-4.550)	(-2.970)	(-3.480)	(-3.350)	(-3.150)	(-3.050)	(-7.320)
industry			0.113					
			(1.340)					
agriculture			-0.037					
			(-0.730)					
trade			0.353 ***	0.361 ***	0.317 ***	0.351 ***	0.345 ***	0.198 ***
			(6.500)	(7.370)	(6.450)	(7.330)	(6.950)	(4.600)
tax				0.230 **	0.091			
				(1.810)	(0.710)			
wagegap					0.226 ***	0.211 ***	0.196 ***	0.092 **
					(4.070)	(4.170)	(3.780)	(1.860)
dwelling						-0.167 ***	-0.178 ***	-0.072 **
						(-5.310)	(-5.370)	(-2.430)
graduates							0.002	
							(0.060)	
slav							0.064	
							(1.110)	
crime							-0.012	
							(-1.500)	
constant	3.332 ***	6.111 ***	4.473 ***	5.070 ***	4.415 ***	4.337 ***	4.104 ***	4.353 ***
	(26.620)	(8.690)	(5.180)	(7.530)	(6.510)	(6.710)	(6.160)	(8.970)
R-sq within	0.198	0.262	0.382	0.373	0.402	0.442	0.448	
number of obs	370	370	369	369	369	369	369	339
F test	276.280 ***	275.140 ***	274.660 ***	313.200 ***	327.530 ***	328.100 ***	264.750 ***	
Wald chi-squared								597.540 ***

Significance level: ***: 1%; **: 5%; *: 10%.

Soruce: Author's estimation.

Table 3: Shortages equations: fixed effect and GMM models

Model	FE	FE	FE	FE	FE	FE	FE	GMM
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
shortage (lagged)								0.891 ***
								(26.970)
informal	0.315 ***	0.392 ***	0.377 ***	0.362 ***	0.378 ***	0.316 ***	0.320 ***	0.218 ***
	(3.970)	(5.270)	(4.650)	(4.610)	(5.020)	(4.220)	(3.810)	(3.810)
informal (lagged)								-0.364 ***
								(-6.660)
income	0.023	0.238 ***	0.199 ***	0.185 ***	0.123 **	0.174 ***	0.104	0.176 ***
	(0.860)	(6.750)	(4.850)	(2.690)	(2.000)	(4.830)	(1.280)	(5.280)
density		-0.600 ***	-0.651 ***	-0.666 ***	-0.694 ***	-0.643 ***	-0.669 ***	-0.114
		(-7.800)	(-8.100)	(-6.870)	(-8.160)	(-8.050)	(-6.790)	(-1.500)
growth		0.490 **	0.413 **	0.370	0.365 **	0.251	0.209	0.182 *
		(2.450)	(2.060)	(1.870)	(1.840)	(1.280)	(1.050)	(1.690)
industry			-0.235 ***	-0.317 ***	-0.317 ***	-0.230 ***	-0.309 ***	-0.115 **
			(-2.650)	(-3.300)	(-3.380)	(-2.610)	(-3.180)	(-2.350)
trade			0.065				-0.039	
			(0.790)				(-0.440)	
tax				0.504 **	0.558 ***		0.461 **	
				(2.440)	(2.740)		(2.070)	
wagegap				0.117			0.142	
				(1.290)			(1.540)	
dwelling				0.066			0.095	
				(1.150)			(1.570)	
road					0.008		0.129 *	-0.161 ***
					(0.140)		(1.870)	(-4.990)
budget						0.020 ***	0.023 ***	-0.004
						(3.180)	(3.300)	(-0.970)
btransfers						0.032 ***	0.032 ***	0.008
						(3.180)	(3.100)	(1.530)
graduates							-0.074	
							(-1.040)	
slav							0.042	
							(0.450)	
crime							0.007	
							(0.530)	
constant	0.766 **	-1.086	0.529	0.410	0.741	1.663	1.690	-0.081
	(2.330)	(-0.970)	(0.430)	(0.330)	(0.590)	(1.350)	(1.320)	(-0.120)
R-sq within	0.044	0.208	0.220	0.242	0.235	0.265	0.294	
number of obs	370	370	369	369	369	369	369	339
F test	21.030 ***	26.100 ***	25.540 ***	23.670	18.530 ***	27.130 ***	17.290 ***	
Wald chi-squared								1292.530 ***

Significance level: ***: 1%; **: 5%; *: 10%.

Soruce: Author's estimation.

Table 4: Structural equation model (1): IV/GMM estimation

Informal economy equation			Shortages equation		
informal			shortage		
shortage	0.175	**	informal	0.439	**
	(2.050)			(2.370)	
income	-0.131	***	income	0.198	***
	(-4.150)			(4.050)	
growth	-0.395	***	density	-0.649	***
	(-3.160)			(-8.130)	
trade	0.345	***	growth	0.323	
	(6.900)			(1.470)	
wagagap	0.209	***	industry	-0.240	***
	(4.130)			(-2.710)	
dwelling	-0.173	***	budget	0.018	
	(-4.940)			(2.400)	
			btransfers	0.031	***
				(3.040)	
number of obs	369		number of obs	369	
R-sq	0.440		R-sq	0.260	
Underidentification test (Anderson canon. corr. LM statistic)	43.440	***	Underidentification test (Anderson canon. corr. LM statistic)	57.434	***
Sargan statistic (overidentification test of all instruments)	0.486		Sargan statistic (overidentification test of all instruments)	2.541	
Instrument for shortage: density and industry.			Instrument for informal: trade and wagegap.		

Significance level: ***: 1%; **: 5%; *: 10%.
Soruce: Author's estimation.

Table 5: Structural equation model (2): Three-stage least-squares regression

Informal Economy equation (informal)			
shortage	0.191	(2.86)	***
income	-0.114	(-3.83)	***
growth	-0.404	(-3.35)	***
trade	0.332	(7.08)	***
wagegap	0.237	(4.97)	***
dwelling	-0.161	(-5.05)	***
Republic dummies			
Russia (reference)			
Ukraine	0.311	(14.41)	***
Belarus	-0.080	(-3.77)	***
Uzbekistan	0.930	(23.47)	***
Kazakhstan	0.214	(7.91)	***
Georgia	0.910	(40.36)	***
Azerbaijan	0.623	(14.94)	***
Lithuania	0.207	(9.39)	***
Moldova	0.267	(10.29)	***
Lativa	-0.196	(-8.81)	***
Kyrgyzstan	0.649	(16.83)	***
Tajikistan	0.615	(13.00)	***
Armenia	0.579	(20.93)	***
Turkmenisnta	0.851	(22.37)	***
Estonia	-0.352	(-12.56)	***
constant	3.923	(6.15)	***
number of obs	369		
R-sq	0.9716		
chi2	12633.9 ***		

Shortages equation (shortage)			
informal	0.295	(1.81)	*
income	0.133	(2.40)	**
density	-0.664	(-8.15)	***
growth	0.232	(1.12)	
industry	-0.231	(-2.72)	***
road	0.048	(0.87)	
budget	0.024	(3.52)	***
btransfers	0.034	(3.51)	***
Republic dummies			
Russia (reference)			
Ukraine	1.472	(7.73)	***
Belarus	1.220	(8.18)	***
Uzbekistan	0.234	(1.38)	
Kazakhstan	-0.545	(-6.03)	***
Georgia	1.037	(4.77)	***
Azerbaijan	1.267	(6.65)	***
Lithuania	1.136	(7.92)	***
Moldova	1.584	(7.38)	***
Lativa	1.127	(7.79)	***
Kyrgyzstan	-0.055	(-0.45)	
Tajikistan	0.163	(1.22)	
Armenia	1.358	(6.55)	***
Turkmenisnta	-0.868	(-5.73)	***
Estonia	1.056	(7.94)	***
constant	1.332	(0.92)	
number of obs	369		
R-sq	0.7154		
chi2	914.32 ***		

Significance level: ***: 1%; **: 5%; *: 10%.

Soruce: Author's estimation.

Table 6: Structural equation model with region dummies and interaction terms: Three-stage least-squares regression

Informal Economy equation (informal)				Shortages equation (shortage)			
shortage	2.234	(2.85)	***	informal	1.087	(3.84)	***
income	-0.310	(-4.15)	***	income	0.187	(2.99)	***
growth	-1.369	(-3.30)	***	density	-0.115	(-5.09)	***
trade	0.124	(0.95)		growth	0.786	(2.84)	***
wagegap	0.380	(4.19)	***	industry	-0.069	(-1.01)	
dwelling	-0.256	(-2.86)	***	road	-0.042	(-0.79)	
				budget	0.025	(3.04)	***
				btransfers	0.047	(3.54)	***
Regional dummies [(1)]				Regional dummies [(1)]			
European part (reference)				European part (reference)			
Central Asia	4.348	(3.09)	***	Central Asia	1.802	(3.01)	***
Caucasus	4.379	(2.72)	***	Caucasus	2.113	(2.69)	***
Baltic	3.285	(2.08)	**	Baltic	2.107	(3.30)	***
Interaction term with shortage				Interaction term with informal			
Central Asia	-2.084	(-2.74)	***	Central Asia	-0.932	(-3.74)	***
Caucasus	-2.062	(-2.36)	**	Caucasus	-0.910	(-2.98)	***
Baltic	-1.820	(-2.19)	**	Baltic	-0.827	(-3.15)	***
constant	6.221	(2.80)	***	constant	-4.876	(-2.60)	***
number of obs	369			number of obs	369		
R-sq	0.613			R-sq	0.329		
chi2	764.030	***		chi2	357.760	***	

Soruce: Author's estimation.

Notes:

Figures in parentheses on the right side to regression coefficients correspond to z-statistic.

Significance level: ***: 1%; **: 5%; *: 10%.

Reference region: Russia, Ukraine, Belarus, and Moldova; Central Asia: Uzbekistan, Kazakhstan, Kyrgyzstan, Tajikistan, and Turkmenistan; Caucasus: Georgia, Azerbaijan, and Armenia; Baltic: Lithuania, Latvia, and Estonia.

Table 7: Regional variations of effects of key variables

	effects of shortage	effects of informal
Reference (European) region	2.23	1.09
Central Asia	0.15	0.16
Caucasus	0.17	0.18
Baltic	0.41	0.26

Soruce: Author's estimation.

Note: Regional effects are calculated as follows: the coefficient of each variable plus the coefficient of the interaction term.

Appendix. Estimating the Informal Economy in the Soviet Republics

In this appendix, we provide a brief overview of our original database based on declassified archival materials on household budget survey and then describe the estimation method adopted in order to assess the size of the informal economy underlining Figure 1.

(1) Database reconstruction[9]

In order to provide a thorough evaluation of Soviet household behavior at the republic level, we collected archival statistical data on household budget survey for each republic for the period from 1965 to 1989 from the Russian State Archive of the Economy (RGAE: Российский государственный архив экономимки). All materials belong to the collection of the Central Statistical Directorate (Центральное статистическое управление СССР: fond 1562). The list of materials we used is shown in Table A-1.[10]

The materials collected consist of two types of aggregated survey data for four family categories. One type is total income and expenditure (совокупные доходы и расходы) series, from which incomes in kind from home production at private plots and self-consumption are measured. The other is money income and expenditure (денежные доходы и расходы) series, from which households' informal market activities are measured. Combining these two series enables us to estimate three components of the informal economy: the self-consumption of agricultural products, trading between citizens, and redistribution between citizens.

Data availability on each family category varies according to the timeframe for which each survey was conducted as follows: industrial workers for 1965–1968; workers and state employees for 1969–1989; collective farmers (kolkhozniki) for 1965–1989; the entire population (все население) for 1979–1989. Accordingly, the data formats are different. For example, money expenditure series for industrial workers in 1965–1968 contains 126 items of spending; that for collective farmers in 1965–1978 has 50 items; for workers and

[9] See Kim (1997; 1999; 2003). Shida (2011) follows Kim's method as much as possible in reconstructing the database for 1969–1988 at the republic level.

[10] Shida (2012) also reconstructed the statistical database of balances of money income and expenditure of the population for each republic in 1960–1989 (денежные балансы доходов и расходов населения). This database is used for evaluating average official income level for each republic, that is, money income paid from the official sector. The list of utilized materials is shown in Table A-1.

employees in 1969–1978 has 96 items; for workers and state employees, collective farmers, and the entire population in 1979–1989 has 46 items.

Hence, the first step of data reconstruction is transformation of each item into an identical format. Consequently, these varying formats were transformed into the latest version of 1989 with 46 expenditure items. In the second step, we reconstruct the household income and expenditure database for *representatives for the whole population* at the republic level. In doing so, we mainly follow Kim's (1997; 1999; 2003) method but with minor modifications. First, we integrate the datasets on families of workers/ employees and families of collective farmers into one category by weighting the numbers of households.[11] Then, transformed data are adjusted and converted to *representatives for the whole population* by considering each population's representation according to their proportion in the overall population. This converted data for the entire population correspond to the all population series (все население) in 1979–1989.

Two major differences in data reconstruction between Kim's methods and ours are as follows. First, data for workers and state employees in 1965–1968 are reconstructed retroactively based on growth rate of each statistical item of industrial workers' family in this period using data on workers' and state employees' families in 1969 as the benchmark year. This is because we could not obtain materials on industrial workers' families in 1969–1978 during our archival search. Second, self-consumption is evaluated at the official retail prices because of unavailability of the data on collective markets for each republic.[12]

(2) Estimates of the size of the informal economy

Based on the reconstructed database, each expenditure item is classified into official and informal items. Table A-2 shows the simplified structure of household expenditure, which consists of money expenditure and

[11] Because average household size (family members per households) varies among republics, it is not possible to use the year-average number of workers and state employees to weight republics. Instead, we use the weights of number of households obtained from *Population Census* in 1959, 1970, 1979, and 1989. Extrapolated weights are used between census years.

[12] The Soviet statistical yearbook of the national economy provides data on the share of the collective market in the total retail sales in the Soviet Union as a whole. This share is evaluated as per the effective and comparable prices. The latter is the share of the collective markets evaluated as per the official retail prices. Using this data, price level differences between official retail shops and collective markets are calculated. However, these data are not available from the republican statistical yearbook of the national economy.

self-consumption of privately produced goods. The money expenditure series provides us a separate dataset of spending based on the destination of household money expenditure. This series contains two types of money expenditure, namely expenditure paid to the state and cooperative organizations and paid to private citizens. The latter fulfills Grossman's (1977) definition of the concept of the Second Economy because this kind of payments is attributable not to public interests, but directly to private gains of citizens. Furthermore, according to their contents, items traded by private citizens are divided into either trading or redistribution between citizens. As Table A-2 shows, monetary consumption expenditure paid to private citizens is defined as the former components (A), while private money transfers between citizens, that is, repayment of debts and loans borrowed from citizens, are defined as the latter (B). Items in (A) are considered as household activities in informal goods markets, whereas items in (B) are considered as those in informal financial markets.

In order to examine empirically the relationship between the informal economy and shortages, we use the sum of (A) and (B) as informal economy (market) and exclude self-consumption. The relative sizes of the informal economy (*informal*) refer to the ratio of the aggregated amount of the households' money expenditure at the informal market to the net material products (NMP) of each republic.

Table A-1: List of archival materials used for reconstruction of household-related data sereis

Year	Opis' number	Delo number		
		Money income and expenditure balances of the population	Household budget surveys	
			Money income and expenditure	Total Income and expenditure
1965	44		3708, 3709, 3710, 3718, 3720	3733
	143	1965		
1966	45	126	3278, 3279, 3280	3275, 3303
1967	45	3644	6744, 6747, 6771, 6772	6737, 3769
1968	45	7065	10514, 10517, 10545, 10546	10512
1969	46	146	2156, 2157, 2195, 2197	2150
1970	47	151	1947, 1948, 1967, 1968, 1969	1971
1971	48	113	1972, 1973, 1991, 1992	1994
1972	49	113	2541, 2544, 2545, 2560, 2561	2563
1973	50	110	2241, 2242, 2266, 2257, 2568	2559
1974	55	110	2385, 2386, 2400, 2401	2403
1975	56	164	2614, 2628, 2629, 2630	
	57		692	691
1976	58	153	2097, 2098, 2113, 2114	2096
1977	59	430, 431	2583, 2585, 2586, 2601, 2602	2584
1978	60	179, 182, 183	2258, 2259, 2274, 2275, 2276	2287
1979	62	158, 160	2338, 2344, 2345, 2362, 2363	2341
1980	63	144, 145	2587. 2596, 2597, 2608, 2609	2625, 2628
1981	64	149, 150	2275, 2286, 2287, 2290, 2291	2309, 2311
1982	65	275, 276, 277	2743, 2755, 2756, 2759, 2760	2778, 2781
1983	66	119	2931, 2942, 2943, 2946, 2947	2965, 2966
1984	67	117	2435, 2446, 2447, 2450, 2451	2471, 2742
1985	68	83		
	70		1887, 1898, 1899, 1902, 1903	1921, 1922, 1923
1986	68	1773		
	70		3263, 3264, 3265, 3266, 3267, 3268, 3281, 3282	3301, 3303
1987	68	2565		
	70		4881, 4882, 4897, 4898	4912, 4914
1988	65	3557		
	68		4119, 4120	4151
	70		6085, 6086	
1989	68	4490	5239, 5240, 5241, 5242, 5245	

Compiled by the author.

Table A-2: The Structure of household expenditures

	Total expenditure	Money expenditure		
		at official sector	at the non-official sector	
Consumption expenditure (1-26, 36-37) Foods, beverage and alcohol (1-3, 6) Non-food (4-5, 7-10) Service (11-26) Other expenditure (36-37)		Spending at official retail shops	(A) Trading between citizens	(C) self-consumption
Tax etc (27-35)				
Bank deposit (39)				
Financial transaction/transfer (40-42)			(B) Redistribution between citizens	
Total expenditure (43: sum of 1-42)			(A) + (B)	(C)
Currency holding at the end of the year (44) Income and expenditure balance (45) Residuals (46)				

Note: The values given in parentheses are the item number of money expenditures.

Compiled by the author.