ПРАКТИЧЕСКИЙ АНАЛИЗ

A Microeconometric Approach to the Incentive Effect of Shortage on Fertility[1)]

Mokhtari M., Asgary N.

This paper provides empirical evidence on the effects of quantity constraints on fertility. The results show that quantity constraints and fertility are positively related. Moreover, it is found that family earnings, male labor-force participation, and large living spaces positively affect fertility. However, divorced respondents appear to have fewer children. We also find that respondents who use birth control have more children.

1. Introduction

The purpose of this study is to analyze the determinants of fertility in the former Soviet Union using both conventional factors and factors unique to both command economics and times of economic disruption, such as rationing. Following the western literature, conventional factors are identified as income, age, education, and living space. The impact abortion and birth control on the fertility is also investigated. The Economic Information Appended by Rationing (EIAR) variables are quantity constraints, privilege, and the underground economy. Combination of these factors and a cross-sectional survey of 2793 former Soviet citizens provide a unique opportunity to analyze the determinants of fertility under the condition of shortage.

Social scientists discussing the theories of fertility, argue for the role of children and their human capital as the causes of fertility decline in the second half of this century [6, 46, 9, 8]. There are many empirical studies that have investigated the determinants of fertility in developed and developing countries [18, 29, 12, 44, 21, 45, 4], but there are few studies that have examined the determinants of fertility in the former Soviet Union [35, 15, 22, 11, 30, 27]. There is no study that investigates the effects of abortion and birth control and the EIAR, such as consumer goods shortages, on fertility.

Mokhtari M. – Associate Professor University of Maryland, College Park.
Asgary N. – Director of the Center for International Business and Tenured Associate Professor, Jones School of Business, State University of New York – Geneseo.

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[1)] We thank the Editor and anonymous referees for helpful comments and suggestions. This research was done when Mokhtari was Visiting Associate Professor in the Department of Economics at the Princeton University, Princeton, New Jersey, USA and Visiting Research Professor an the New Economic School, Moscow, Russia. The authors equally contributed to the content of this paper and they both share the responsibility for any remaining error.

The net reproduction rate was greater than one from 1920s through 1950s in the former Soviet Union. Conversely, during 1960s the net birth rate became less than one for the European republics of the former Soviet Union. Apart from the Southern part (Caucasus), in 1970s the European republics experienced one of the lowest fertility rates in the world [22][2)]. In the meantime, the former Soviet Union experienced several goods shortages that led to an active underground economy. Although any economy suffers to some degree from shortages and the rise of an underground economy, the question of their impact on fertility has never been examined. The findings of this study should provide some explanation why the fertility rate declined so rapidly during 1970s.

While the western theories are also applicable to the households of the Former Soviet Union [22], one may expect that several economic factors affect fertility differently in the former Soviet Union than in Western countries. First, on the average, Soviet parents spend relatively more time child rearing than engaging in other forms of consumption, compared to their Western counterparts[3)]. Second, the relative share of wife income to total family income is higher than their counterpart in the West [3]. Third, nonlabor incomes were almost zero in the former Soviet Union, while this is not true in the West. Fourth, the existence of free medical care, education, and subsidies for essential goods and services are different for Western countries. Fifth, the existence of quantity constraints and other Soviet specific-factors should affect fertility. Finally, abortion laws were more lenient than most of the Western countries [14]. While knowledge of whether the economic demographic factors have the same impact on households' behaviors in the former Soviet Union and those in Western countries is of interest, knowledge of the impact of EIAR factors on fertility is of interest as well. In particular, given that transitions to a market economy will eventually mitigate such specific factors by measuring their impact, we can gain the same predictive power over the future course of events.

In the former Soviet Union, centrally-planned-economy households were free in most major decisions regarding their allocation of income, labor supply, and the reproduction of children [11]. Researchers have shown that, in general, Western economic theories of household behavior are applicable to households in centrally planned economies [22, 24, 41, 38, 2][4)]. In general, households' microeconomics decisions are the same regardless of place of residency. The rules, regulations, and constraints require households to revise their decisions based on the existing constraints in each society.

[2)] The birth rates for Eastern European countries have been following the same pattern as the European republics of the former Soviet Union up to mid-1960s. Thereafter, Eastern European governments (except USSR and Poland) implemented policies to increase their net birth rates [22, p. 18].

[3)] The first three factors are discussed by Berliner [11, p. 152]. He states that in USSR and U.S., fathers spend less time with children than mothers. However, Soviet fathers spend 4,4 times more in housework per unit of consumption than their American counterpart. Moreover, Soviet fathers spend three times more in child care per day than American father do. Overall, Soviet fathers spend 4,5 times more per child than the American fathers, of course, adjusting for the difference in the number of children (p. 137).

[4)] Regarding human capital and economic demography, Gregory concludes that «... Eastern and Western theories of human capital and economic demography have "converged" in recent years, despite the denials by socialist theorists» [22, p. 21].

Following the western literature, first, we forward a rational choice model, which uses the concept of virtual prices [40] for capturing the opportunity cost of goods shortage. Our model is based on an extension of theory of consumer behavior, which allows us to study the long-run consequence of consumer goods shortage on the fertility. Second, for the empirical estimation of the model, we employ the Poison estimation technique [33]. Most of the empirical researchers who examined the determinants of fertility have used Ordinary Least Squares, Tobit Maximum Likelihood, Sequential Logit, and count data econometric techniques – among others, see [47, 42, 31, 50, 51]. However, our use of Poison estimation technique allows us to take into account the nonsymetrics and discreet aspect of the distribution of the dependent variable.

This paper is organized as follows: Section II presents a brief survey of relevant literature. Section III contains our extended rational choice model of fertility under the condition of shortage. The description of the data, econometrics issues, and empirical results are presented in Section IV. Conclusions are presented in Sections V.

2. A Survey of Literature

Since 19th century, two fertility theories have dominated the world: Malthusian and neoclassical. Malthusian theorists argue that fertility rises as income rises, and falls as income falls. In practice, however, Malthusian theory has been rejected over the past one-and-one-half century. In the neoclassical model, the key issue regarding the determinants of fertility is the opportunity cost of a woman's time at home. A woman will enter the labor force if her market wage exceeds the opportunity cost of staying and working at home. A model complementary to both Malthusian and neoclassical models is discussed by Becker et al. (1990), who argue that their analysis has elements from both theories in which they examine the role of human and physical capital. Becker et al. (1990) discuss that «Our analysis contains elements of both the Malthusian and neoclassical models since fertility is endogenous and rates of return on investments in physical capital decline as its stock increases. The endogeneity of fertility also leads to multiple steady states: A "Malthusian" undeveloped steady state with high birth rates and low levels of human capital, and a developed steady state with much lower fertility and abundant stocks of human and physical capital». They further go on and state that their «...approach relies on the assumption that higher fertility of the present generation increases the discounts on per capita future consumption in the intertemporal utility functions that guide consumption and other decisions. Therefore, higher fertility discourages investments in both human and physical capital. Conversely, higher stocks of capital reduce the demand for children because that raises the cost of the time spent on child care».

The neoclassical theory of fertility has been widely discussed and tested in both the East and West. Mazur [34, 35] employed cross-section data from the 1959 USSR census that lists 36 different nationalities. Respondents who are included in his study are 16 years old and older. He investigated the effects of age on marriage, education, and religion on fertility[5]. He concluded that among married women ages

[5] The data that Mazur used has been reported in *Itogi Vsesoyuznoy Perepisi Naseleniye 1959 God* (Moscow: Gosstatizdat 1963).

16 to 19 (married for the first time), the birth rates in rural areas of Azerbaijan, Armenia, Central Asia, and the autonomous-nationality republics of Russia are more than four times higher than for women in Moscow. Moreover, he finds that there is a negative correlation between age at the time of first marriage and fertility. With regard to religion, he found that fertility is highest among Muslims and Buddhists and lowest among Protestant Latvians and Estonians[6)].

Gregory [22] used a combination of time series-cross section data of seven Eastern European countries for the period of 1950 to 1977 and examined fertility and labor force participation rates. He employed a system of simultaneous equations for his empirical analysis of fertility, labor force participation rate, and marriage rate equations. His empirical findings are that wage rates, infant mortality, and marital instability impact fertility negatively. He also concluded that higher education levels lead to higher rates of fertility.

Berliner [11] examined the effects of education on labor force participation and fertility in the former Soviet Union by using 1970 census data. His surprise finding was that for urban populations, fertility is positively correlated with female education and negatively with male education. This finding contradicts Western findings. Overall, his findings showed that there was a reduction in the USSR urban fertility during 1970s. For the rural areas, he concluded that «The result implies a backward-bending female labor-supply curve» (p. 151).

Kuniansky [30] used cross-section data from the 1970 census of 72 oblasts of the Russian republic to investigate «the effects of changes in exogenous variables on Soviet fertility and labor supply» (p. 114). The exogenous variables are the availability of housing and childcare facilities, urbanization ratio, and male and female education. All of the exogenous variables that she used are statistically significant except for the housing facility[7)]. She used educational attainments as a proxy for market wage rates for both males and females. Her estimation supports Berliner's finding regarding the backward bending labor supply curve. Moreover, she found that «...a 1% increase in LFP (labor force participation) reduces fertility by 7%» (p. 124). Findings of the backward-bending labor supply curve by Berliner and Kuniansky are also supported by Mokhtari and Gregory [39], who used the SIP data for estimating a labor supply for former Soviet households.

The above papers and other studies, such as [14, 20], show that a woman's income, socioeconomics, demographic factors, and place of residency affect fertility. As the opportunity cost of working at home for a woman increases, labor force participation will increase and, therefore, fertility will decrease. There is a direct and

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[6)] Also, Mazur finds that «... evidence supports the modified hypothesis that the variations in fertility attributable to the traditionally religious values can be explained in terms of the marriage and educational differences known to have existed for a long time among the Soviet nationalities» [35, p. 115].

[7)] Kunjansky's [30] simulation results show «Increase in child-care facilities raises both LFP and BR and thus move both endogenous variables in the direction desired by the state. Increase in FEMED, however, move LFP and BR in the wrong direction. As FEMED rises, women withdraw from the labor force, and one would expect this withdrawal to raise BR; however, FEMED raises the opportunity costs of fertility sufficiently to neutralize this effect. Increased urbanization does not affect participation in as significant way, but it does retard fertility. Increases in MALEED raise participation but lower fertility» (p. 127).

an indirect effect of education on fertility [11]. The direct effect is due to educational attainment, which increases the earning power of women and thus, leads to a higher opportunity cost of having children. The indirect effect is through the influence of educational attainment on female labor supply – a higher level of education increases the probability of labor force participation and job retention.

Empirical studies for most of the Eastern European countries have shown that there is a negative non-linear relationship between fertility and education [11]. Also, there is an inverse relationship between age at the time of a first marriage and fertility [35]. The availability and affordability of housing and quality childcare centers should have a positive effect on fertility, since they reduce the cost of having children. Fertility is lower in urban areas than in rural areas, but the difference, however, is less for young women [35, 48].

Marital instability would increase the cost of children for both parties over the long run and therefore reduce fertility. The cost of divorce and the resulting financial ramifications should lead to lower fertility rates. However, we can conclude that if the motive of marriage is to procreate, then being infertile could lead to divorce. Therefore, the same variables that affect fertility may affect divorce, and this implies a simultaneous determination of fertility and divorce.

Liberal family planning laws for abortion lead to low fertility, while more conservative laws that increase the legal and financial cost of abortion lead to higher fertility. Fertility tends to be highest among Muslims and Buddhists and lowest among Protestant Latvians and Estonians [35][8)]. As infant mortality rates increase, fertility rates decrease.

Despite the significant achievement in understanding fertility, the current literature contains no reference on fertility behavior under the conditions of economic disruption and shortage. In particular, the literature does not address the impact of EAIR on fertility. By providing theory and evidence on the determinants of fertility in a centrally planned economy, we fill this void in the literature.

3. A Neoclassical Model of Fertility and Shortage

Here, we study the long-term consequences of consumer goods shortage on the fertility of former Soviet families by forwarding a rational choice model. In Western economies, an abundance of consumer goods is often associated with a decrease in fertility. When children are considered to be normal goods, the choice-theoretic model of fertility under consumer goods shortage, such as that experienced by former Soviet families, yields counterintuitive results.

Our theoretical model is an extension of the theory of consumer behavior under rationing to the theory of fertility. Following rational choice (neoclassical) framework, we examine the effect of changes in consumer goods shortages, *i.e.,* the ration level ($\bar{C}$), income (I), and the opportunity cost of childbearing (q) on the de-

[8)] Mazur [35] concluded that «With respect to religion, it has been established for several years in the past that fertility tends to be highest for Muslims and Buddhists and lowest for Protestant Latvians and Estonians» (p. 115).

mand for children (M) by the former Soviet families. Given the general level of shortage, we are in effect interested in the impact of ($\bar{C}$), I and q on conditional demand for children ($\bar{M}$), *i.e.*, $\partial \bar{M} / \partial \bar{C}$, $\partial \bar{M} / \partial I$ and $\partial \bar{M} / \partial q$.

We assume that in the absence of rationing a representative Soviet family attempts to minimize its expenditure, ($pC + qM$), subject to a utility function given by $U(C, M)$. This minimization is known to give the Hicksian demands for C and M, $C_h = C(q, p, U)$ and $M_h = M(q, p, U)$ as the solution which by substituting in ($pC + qM$) yields the expenditure function $e(p, q, U)$, *i.e.*, which is the least cost way of attaining U with given p and q:

$$e(p, q, U) = \min [p C + q M; U(C, M) = U] = p C_h(q, p, U) + q M_h(q, p, U).$$

Similar results are obtained if $U(C, M)$ is maximized subject to ($pC + qM$). But now the solutions are known as the Marshallian demands, $C_m(q, p, I)$ and $M_m(q, p, I)$. In equilibrium, $M_h(q, p, U) = M_m(q, p, I)$, where by replacing I with e we get

$$M_h(q, p, U) = M_m[q, p, e(p, q, U)]. \tag{1}$$

However, for the *rationed* Soviet families $C = \bar{C}$, a *conditional* expenditure function $\bar{e}(p, q, U, \bar{C})$ is obtained. That is

$$\begin{aligned} \bar{e}(p, q, U, \bar{C}) &= \min [pC + qM; U(C, M) = U, C = \bar{C}] = \\ &= p\bar{C} + \min [q M; U(\bar{C}, M) = U] = p\bar{C} + q\bar{M}_h(q, p, U, \bar{C}) \end{aligned} \tag{2}$$

which yields *conditional* Hicksian demands for C and M:

$$\partial \bar{e} / \partial p = \bar{C} \tag{3}$$

$$\partial \bar{e} / \partial p = \bar{M}_h(p^*, q, U, \bar{C}). \tag{4}$$

In (2) and (3), $\bar{C}$ would be purchased if p were set at the *virtual prices*, p^*, which is defined by Neary and Roberts [40] as «those prices which would induce an unrationed household to behave in the same manner as when faced with a given vector of ration constraints» (p. 26). Using virtual prices, conditional Hicksian demand $\bar{M}_h$ can be written as

$$\bar{M}_h(p, q, U, \bar{C}) = M_h(p^*, q, U) \tag{5}$$

which, for the rationed families, lets (2) to be rewritten as,

$$\begin{aligned} \bar{e}(p, q, U, \bar{C}) &= p^*\bar{C}\ (P^*, q, U) + q\bar{M}_h(p^*, q, U) = \\ &= \bar{e}(p^*, q, U) + (p - p^*)\bar{C} \end{aligned} \tag{6}$$

indicating that a change in the ration level has an income effect which is equal to the gap between administered prices and their virtual counterpart, $\partial \bar{e} / \partial \bar{C} = p - p^*$, which is zero or negative, because $p^* \geq p$.

To find $\partial \bar{M} / \partial \bar{C}$, we start by differentiating (5) with respect to $\bar{C}$,

$$\partial \bar{M}_h / \partial \bar{C} = (\partial M_h / \partial p^*)\,(\partial p^* / \partial \bar{C}).$$

Rewriting (5) as $\bar{M}_h(p, q, U, \bar{C}) = \bar{M}_m[\bar{C}, p, q, \bar{e}(\bar{C}, p, q, U)]$ and differentiating with respect to $\bar{C}$ yields, $\partial \bar{M}_h / \partial \bar{C} = \partial \bar{M}_m / \partial \bar{C} + (\partial \bar{M}_m / \partial I)(\partial \bar{e} / \partial \bar{C})$ and, since, $\partial \bar{e} / \partial \bar{C} = p - p^*$,

$$\partial \bar{M}_h / \partial \bar{C} = \partial \bar{M}_m / \partial \bar{C} + (\partial \bar{M}_m / \partial I)(p - p^*) \tag{7}$$

or

$$\partial \bar{M}_m / \partial \bar{C} = \partial \bar{M}_h / \partial \bar{C} - (\partial \bar{M}_m / \partial I)(p - p^*) \tag{8}$$

where, we expect $\partial \bar{M}_h / \partial \bar{C} < 0$, $(p - p^*) < 0$ and $\partial \bar{M}_m / \partial I > 0$. Now, assuming that children and consumer goods are normal and net substitutes, $\partial \bar{M}_h / \partial \bar{C} < 0$ indicates that a decrease in the availability of consumer goods increases demand for children. Moreover, the tighter the ration level, the higher is p^* and, hence, the lower is real income. Therefore tightening the ration level has an income effect, *i.e.*, $-(\partial \bar{M}_m / \partial I)(p - p^*) > 0$.

This analysis shows that, rationed families hold more children only if $|\partial \bar{M}_h / \partial \bar{C}| > [-(\partial \bar{M}_m / \partial I)(p - p^*)]$. This is because $\partial \bar{M}_h / \partial \bar{C} < 0$ and $-(\partial \bar{M}_m / \partial I)(p - p^*) > 0$. However, in reality, number of children of the rationed families can be higher, lower, or the same as families who do not find rationing as an extra impingement on their budget constraints.

To find $\partial \bar{M} / \partial I$, we note that

$$\bar{M}_m(\bar{C}, p, q, I) = \bar{M}_m[p^*, q, I - (p - p^*)\bar{C}] \tag{9}$$

where,

$$\bar{C} = C[p^*, q, I - (p - p^*)\bar{C}]. \tag{10}$$

Using (10) and differentiating (9) with respect to I, after rearrangement, yields,

$$\partial \bar{M}_m / \partial I = \partial M_m / \partial I - (\partial \bar{M}_h / \partial C)(\partial C / \partial I) \tag{11}$$

showing that, for $(\partial \bar{M}_h / \partial C) < 0$, an increase in income increases number of children in two ways: first, directly $(\partial M_m / \partial I)$ and, then, indirectly $[-(\partial \bar{M}_h / \partial C)(\partial C / \partial I)]$.

To find $\partial \bar{M} / \partial q$, we differentiate (9) with respect to q, to get, after rearrangement,

$$\partial \bar{M}_m / \partial q = \partial M_m / \partial q - (\partial \bar{M}_h / \partial C)(\partial C / \partial q) \tag{12}$$

which by assuming, $\partial \bar{M}_m / \partial q < 0$, $\partial \bar{M}_h / \partial C < 0$ and $\partial C / \partial q > 0$, leads to the conclusion that the impact of an increase in q on the conditional demand for children by the rationed families cannot be determined *a priori*. It is worth noting that, If $|\partial M_m / \partial q| < [-(\partial M_h / \partial C)(\partial C / \partial q)]$, then a higher q causes rationed families to demand more children.

Our theoretical analysis shows that changes in $\bar{C}$ and opportunity cost of children (q) both have ambiguous impacts on number of children of rationed families. However, number of children expand in response to an increase in the income level. Clearly, empirical analysis can play a crucial role in disentangling this complicated process and shedding light on the fertility trend in the successor states of the USSR.

The theoretical implications predict a more complicated reaction to increased availability of consumer goods than that suggested by the standard theory of consumer behavior. For a rational Soviet family, an increase in the availability of consumer goods might lead to higher, lower or the same fertility. Without further assumptions about Soviet families' preferences, or knowledge of actual behavior, no reasonable prediction about fertility trends can be made. Hence, our empirical analysis provides a vital component for understanding the future course of events.

Analysis of the SIP data, which includes information on economic and demographic characteristics (including fertility) of families as well as their perceptions of shortage, is uniquely suited to testing implications of the rational choice model. Comparison of fertility among households perceiving severe consumer goods shortage and those perceiving no significant shortage would significantly improve our knowledge of potential fertility in the former Soviet states. Our theoretical and econometric analysis will provide valuable information on long-term trends in fertility that one might expect if new market reform improves the availability of consumer goods in the successor states of the USSR and Eastern Europe.

4. Data, Econometrics Issues, and Empirical Results

The Soviet Interview Project implemented a retrospective survey of 2793 former Soviet citizens who left the former Soviet Union during the late 1970s and early 1980s. The survey was conducted between April and December 1983. Respondents were questioned in detail about the *last normal period* of life, meaning the last normal year before deciding to leave the former Soviet Union. The SIP has been gainfully used and examined by Gregory and Kohlhase [24], Gregory and Collier [23], Mokhtari and Gregory [39], Mokhtari and Asgary [38], Mokhtari [37], Asgary, Gregory, and Mokhtari [3], Asgary and Asgary [2].

Prior studies using the SIP data set have concluded that the reported data closely follow the USSR's population attributes. Gregory and Kolhase [24] show that the SIP mean characteristics mirror the urban population residing in medium to large cities in the European republics of the USSR. These finding has been also corroborated by the aforementioned studies and Millar [36], Gregory, et. al [25]. Several studies using the SIP data set have concluded that potential interpretation of the *last normal period* and or the immigrant nature of respondents are do not exert undue influence on the results (e.g., see [36]). The fact that we use multiple regressions in our analysis and that we control for many factors in the data, clearly, help with our ability to gauge the impact of shortage and other variables of interest on fertility. The sample possessed many characteristics in common with the former Soviet urban population because they came from large to medium-size cities. Similarity of observations from the SIP and those obtained by the Soviet Census corroborate the usefulness of the SIP for conducting empirical analysis and inference.

Respondents to the SIP survey were questioned concerning their number of children, income, total wealth, household size, education, occupation, labor-force participation, square meters of living space, hours of work, consumer goods shortages, participation in the underground economy, privilege, etc.

After dropping the households with incomplete information, the total number of useable observations used for the empirical work was 1561. Similar number of observations were also used in other studies of the SIP (e.g., [38, 39, 37, 3]). These studies, which have used the SIP database, indicate that sample selection is not a significant problem in this context. Out of this one thousand five hundred and sixty one households, eight hundred-twenty eight reported that they had between one to five children, and the remainder reported no children.

The respondents were between the ages of 20 and 59, with a mean age of about 37. The means for the number of children (NC), household size (HH), and income (Y in rubles) are 0,68, 3,54, and 356, respectively (see Table 1). Sixty percent of the sample expressed dissatisfaction with the availability of goods, and fifty-nine percent said they participated in the underground economy. Quantity-constrained (QC) respondents are classified as those respondents who declared themselves *very dissatisfied* with the availability of goods. Privileged respondents (PR) are classified as those who had legal access to: a) special shops, b) medical clinics, c) use of official cars, and d) permission to travel to the West. This variable (PR) represents those respondents who reported receiving at least one of these perks. The variable (NA) consists of those respondents who stated that they participated in the underground economy[9)]. Statistical description of the data is presented in Table 1.

Table 1.

Statistical Description for the Soviet Interview Project (SIP) Data (No. of observations: 1561)

Variables	Mean	Standard of Deviation
NC: Number of children ages four to fifteen	0,68	0,71
Y: Gross monthly income per capita (rubles)	356,00	187,16
HH: Family Size	3,54	0,99
QC: Very dissatisfied with availability of good	0,60	–
PR: Privileged – access to closed shops/clinics, etc.	0,13	–
NA: Participated in the underground economy	0,59	–
WT: Total wealth	12017,20	15728,4
AGF: Age of female respondent	33,44	17,2
MH: Male weekly hours of work	50,00	29,71
FH: Female weekly hours of work	42,00	23,3
LS: Square meters of living space	40,00	41,00
SF: Female (=1)	0,44	–
RE: Residing in Moscow (=1)	0,45	–
WH: White collar worker (=1)	0,26	–
FHE: Continued education beyond high school (=1)	0,21	–

[9)] For an in-depth discussion of these variables (PR, NA and QC), see [3, 37, 38, 39].

Continued

Variables	Mean	Standard of Deviation
DIV: Divorced (=1)	0,06	–
AB: Had an abortion (=1)	0,11	–
C: Used birth control (=1)	0,26	–
BG: Believe in God (=1)	0,14	–

Note: WT: «total wealth» is the sum of cash, savings, 3 percent bond, valuables and collectibles – the resale value of them.

To estimate the determinants of fertility in a quantity-constrained environment, we constructed an empirical model that incorporates socioeconomics and Soviet-specific factors as independent variables. The dependent variable is the number of children (NC). All of the independent variables are assumed to be exogenous except family income (Y), female labor force participation (FH), male labor force participation (MH), divorce (DIV), use of birth control (BC), abortion (AB), and quantity constraints (QC).

Family income, male and female labor force participation and divorce are endogenous because these variables are impacted by other factors in the family and individual life. Family income which is dependent on male and female behavior (e.g., cultural) might be impacted by underground economy. Therefore, it is assumed to be endogenous. Divorce is endogenous because of individual's behavior, economic factors, medical reasons, age, and public policy.

Because some of the respondents may decide to use birth control after having a certain number of children, while others may decide to have none, this variable (birth control) is also an endogenous variable. The same argument is true for abortion, which might be based on a medical reason – hence, abortion is an endogenous factor as well. Quantity constraints are also endogenous and have been discussed and used by others [39, 37, 3, 2]. The quantity constraint (consumer goods shortage) variable is assumed to be endogenous because it is likely that the people who want to have more or fewer children could be the ones who feel the pressure of the quantity constraint[10]. Therefore, unobservables that affect the demand for children also affect the quantity constraint.

For the estimation of all of the endogenous variables (family income, female and male labor force participation, divorce, use of birth control, abortion, and quantity constraint), the instrumental variable (IV) estimation technique is utilized[11].

[10] Others [39, 3, 2] discussed the endogeneity of this variable and used it in their empirical model.

[11] The instruments included for the usage of birth control are SEXFH, NUMMOVE, NOUNEMP, SEXFAGE, HAGE715, HAGE1659, SEXFAGE2, CLOSSHOP, CLOSCLIN, USECAR, SQMETERS, ED456, ED78, YP, YT, INH, BELNS, BELH, BELAT, WHITE, SPY, NCLNP, REG2, REG3, REG4, REG5, and REG6. The instruments used for abortion are SEXFH, AGE, AGE2, NOUNEMP, HAGE715, HAGE1659, CLOSSHOP, CLOSCLIN, USECAR, SQMETERS, ED456, ED78, YP, YT, INH, BELNS, BELH, BELAT, WHITE, SPY, NCLNP, REG2, REG3, REG4, REG5, and REG6. Set of instruments included for QC are age, age square, experience, experience square, MA, EDC, ED04 (respondents that their highest educational achievement were eight years of general school), occupation, interaction of occupa-

Given that, DIV, BC, AB, and QC are binary variables (0, 1), a logit model for each one of them was created, and the maximum likelihood estimates for each one was computed. The estimated values of these maximum likelihood models, which are continuous and normally distributed, have been substituted for the values of DIV, BC, AB, and QC in the empirical model.

Table 2 column 2, reveals that fertility is positively related to gross monthly family income per capita – before estimation, family income (Y) was replaced by its predicted values PY. Therefore, as family income increases, fertility increases as well. Also, the estimated parameter for male labor-force participation (MH, which is replaced by its predicted values PMH) is positive and statistically significant at the 1% level. These results indicate that in a socialist society, higher income and male labor-force participation would lead to higher fertility. The theoretical model justifies empirical results. Equation (11) $[\partial \bar{M}_m/\partial I = \partial M_m/\partial I - (\partial \bar{M}_h/\partial C)(\partial C/\partial I)]$ shows the finding of the mathematical model. This equation shows that for $(\partial \bar{M}_h/\partial C) < 0$ an increase in income increases number of children in two ways: first, directly $(\partial M_m/\partial I)$ and, then, indirectly $[-(\partial \bar{M}_h/\partial C)(\partial C/\partial I)]$. The estimated parameter for blue-collar workers (BCW) is positive and statistically significant at the 1% level. White-collar workers (WCW) are those who perform clerical or knowledge based work (i.e., professional, managerial or administrative positions) while blue-collar workers are those who perform manual or technical labor. Since this variable is binary, the magnitude of the estimated coefficient indicates that blue-collar workers, on average, would have 0,126 more children than the white-collars, holding everything else constant (Table 2).

Our empirical estimation reveals that the estimated parameter for Moscow residents is negative and statistically significant. This supports Berliner's [11] findings that overall urban fertility declined in the USSR during 1970s. The opportunity cost of having more children is higher in urban/large cities than in rural/small cities due to the higher cost of child bearing/rearing. Also, the opportunity cost in terms of forgone female/male wages is higher in the urban/large cities compared to rural/small cities.

The estimated result for divorced respondents (where, DIVP denotes predicted values for DIV) is negative and statistically significant at the 1% level (Table 2). This finding justifies that having fewer or no children would make divorce less costly (emotionally and financially) for both parties.

The estimated parameter for birth control (where, BCP denotes predicted values for BC) is positive and statistically significant. Respondents who use birth control (BCP) have one or more children and have decided early on how many children they would like to have. The same finding does not appear to carry over when we focus on the parameter estimate for abortion (ABP). The estimated parameter for the predictor of abortion (ABP) is statistically insignificant. Among other things, this finding (lack of significance) could be attributed to any of the following reasons[12)]: Relative to BCP, which was found to be significant, only a smaller percent-

tion and income, and number of adults and children in the family; also, dummy variables for place of residency, satisfaction with the standard of living and occupation, spouse's income, and privilege.

12) Also see [28] for economic theories that indicate a positive relationship between abortion and pregnancy (thus, fertility).

age of our sample use abortion as an effective means of determining the number of children in the family – lack of sufficient variation could lead to less than satisfactory results. Moreover, a portion of (or lack of) variation in the data could be due to the use of a survey of immigrant to capture the impact of abortion on fertility. This may not be fully representative of the population; although, based on this and other studies, the SIP data set appear to be adequate for the specific purpose for which this paper has been written for. However, one must exercise some caution in interpreting this (abortion) finding.

Table 2.

Poisson Regression: Dependent Variable is Number of Children Between Ages Four to Fifteen (NC)
(No. of observations: 1561)

Variable	Model 3
Intercept	−1,15
	(0,81)
PY: Predicted gross monthly income	0,0011
	(0,0006)*
PMH: Predicted male labor force participation	0,0083
	(0,0025)***
PFH: Predicted female labor force participation	4,65
	(4,67)
AGF: Age of female respondent	−0,027
	(0,33)
AGF^2: Age of female respondent squared	0,00042
	(0,0048)
FLE: Female respondent not continuing education beyond high school	0,135
	(0,11)
BCW: Blue collar worker	0,126
	(0,08)***
RE: Residing in Moscow	−0,81
	(0,08)***
LS: Square meters of living space	0,00243
	(0,0009)***
BG: Believe in God	0,009
	(0,095)
DIVP: Predicted divorce	−3,78
	(0,66)***
BCP: Predicted use of birth control	1,15
	(0,397)**
ABP: Predicted abortion	0,50
	(0,37)
QCP: Predicted level of dissatisfied with availability of goods	0,63
	(0,31)**
-2 Loglikelihood	−883,75

Note: NC : Number of children between ages four to 15; eight hundred-twenty eight of the respondents reported that they had between one to five children, and the remainder reported no children.
(.) are adjusted estimated standard errors of parameter estimates; and, *, **, and *** indicate the significance levels at the 10, 5, and 1 percent respectively.

The estimated parameter for quantity constraints (where, QCP denotes predicted values for QC) is positive and statistically significant (Table 2). Shortages in consumer goods increase the value of goods that are attainable. This result can be interpreted in two ways: a) having more children means you can acquire the same amount of goods per person, due to rationing, while the expenditures of the younger children may not be as high as those for older ones, thus the family is better off overall, b) having more children would lead to higher number of laborers in the family. Both arguments are plausible. This finding is consistent with our theoretical model results which show that, rationed families hold more children only if $|\partial \bar{M}_h / \partial \bar{C}| > [-(\partial \bar{M}_m / \partial I)(p - p^*)]$. This is because $\partial \bar{M}_h / \partial \bar{C} < 0$ and $-(\partial \bar{M}_m / \partial I)(p - p^*) > 0$. However, in reality, number of children of the rationed families can be higher, lower, or the same as families who do not find rationing as an extra impingement on their budget constraints.

5. Conclusions

A major contribution of this paper to the human capital and economic demography literature is in the examination of the effects of Economic Information Appended by Rationing (EIAR), such as quantity constraints, on fertility. Other contributions consist of using SIP database in the context of investigating the impact of birth control and abortion on fertility.

Our empirical investigation shows that family earnings and male labor-force participation affect fertility positively. Moreover, divorced respondents appeared to have fewer children compared to those who were not. Additionally, we find that large living spaces lead to a higher number of children. Furthermore, respondents who use birth control appeared to have more children. Finally, our findings show that quantity constraints and fertility are positively related.

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