The Distribution of Wealth: An Intergenerational Analysis Using Microsimulation

Kelly Bowling

5/4/01

Individual Study

Introduction

For many years, researchers have struggled to find a model that accurately explains the distribution of wealth in the United States. The recent rise in economic inequality has provoked increased interest in this subject, raising concerns over the factors that account for its trends and patterns over time. Although a great amount of research has been completed on the subject, the question remains as to what explains this growing wealth inequality and what accounts for its varied distributions. Economists are yet to find a model that accurately accounts for the underlying determinants that affect the long-run distribution of wealth and its patterns of intergenerational accumulation.

When developing a model to explain the distribution of wealth, the researcher must account for how property is acquired, and why its ownership is so unequally spread. While it is easy to describe the extremes of the wealth distribution, it is often hard to accurately account for its variability over time. Precise measurement is made difficult due to the absence of comprehensive survey data on the American population (Osberg 1984). Because of this limited amount of data, present theories are inadequate in explaining the long-run patterns of intergenerational property acquisition.

This paper uses microsimulation as a tool to account for the variability in societal wealth distribution. The purpose of this paper is to modify an existing economic simulation model to help explain what factors are the most influential in affecting the long-run distribution of wealth. Specifically, this analysis will focus on the impact of different savings patterns, fertility rates, marriage patterns, and inheritance patterns on the long-run wealth distribution. By adjusting the parameters and variables of interest in the simulation model, this paper will attempt to provide insight into the determinants of property acquisition and explain the patterns of wealth distribution over many generations.

Theories of Wealth Distribution

Although there is not a complete and well-specified theory of wealth distribution over many generations, several economic theories lend a helpful explanation in this analysis. Two of the theories that will be focused on in this paper include the life-cycle savings model and the theory of inheritance. However, these theories only partially account for the factors that influence the intergenerational distribution of wealth in society. When combined with each other and modified to include certain socioeconomic characteristics, a more accurate and useful picture of intergenerational property acquisition will be developed. This section will introduce the elements that are necessary to form a more accurate theory of wealth distribution.

The first of these vital elements is to account for the accumulation of wealth over the lifetime of an individual. The life-cycle savings model, a widely used theory of wealth distribution, provides an explanation for this lifetime wealth accumulation. According to this model, individuals finance their consumption after retirement by accumulating savings during their productive working years. It argues that property is accumulated through individual saving from labor earnings. Specifically, it concludes that net worth is positively related to age and its distribution will be more equal within similar age groups than within the general population (Osberg 1984). In other words, individual savings for retirement explains private wealth and this wealth inequality is a result of age. The graphical representation of this model is illustrated in Figure 1:

Figure 1

The Life-Cycle Savings Model

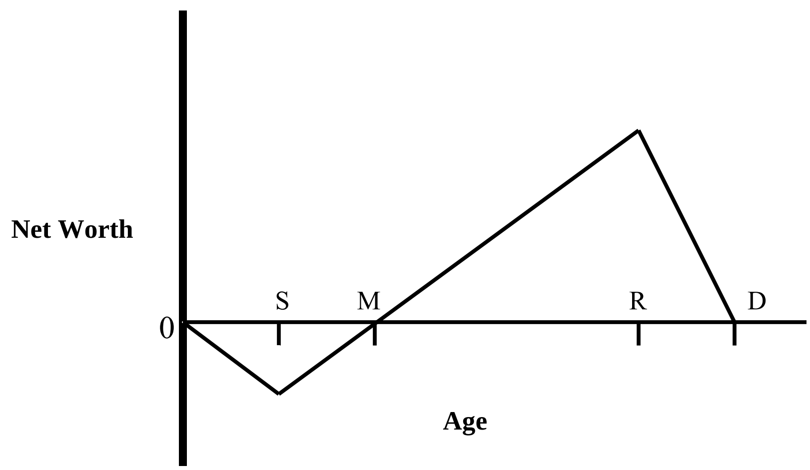


Figure 1 graphs the average individual's net worth according to this theory. From period 0S, the individual goes into debt to finance consumption and acquire human capital during the early periods of their life. In this period, the individual is assumed to have low earnings, accounting for the negative net worth. At S, the individual begins to pay off these debts until they reach a positive net worth at age M. The individual saves for their retirement in period MR and retires at age R. From RD, which represents the remainder of the individual's retired life, he or she will live off this accumulated savings (Osberg 1984).

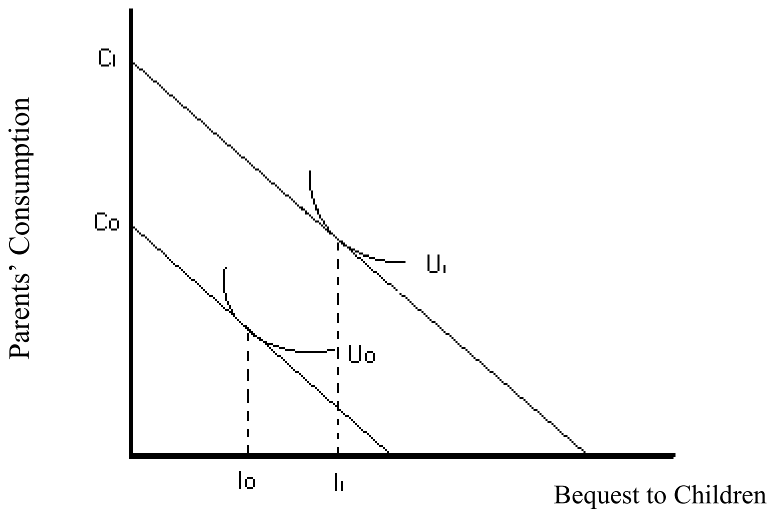
There are several ambiguities in this model that may lead to inaccurate conclusions regarding the long-run distribution of wealth. According to one researcher, the life-cycle model explains only 19% of total wealth in the United States, neither explaining the large percentage of the population with a low net worth at all ages, nor the existence of very large fortunes (Osberg 1984). It also fails to accurately depict savings behavior. Due to different socioeconomic backgrounds, people have different propensities to save. This one-generation life-cycle model does not account for such differences in the population. It only explains the wealth accumulation of one generation, ignoring the effects of intergenerational transfers. To account for the effects of bequests, this model needs to be expanded. Additionally, it does not work well empirically. Because this model only partially explains the distribution of wealth, other theories are needed to fully account for these intergenerational patterns.

Another vital element needed to attain a fully specified theory is to analyze the effect of social behavior on the long-run wealth distribution. To fully explain the patterns of wealth accumulation, one needs to determine the impact that inheritance produces on the wealth distribution of subsequent generations. The amount of wealth passed down from generation to generation, inheritance customs, combination of inheritances in current families, and the rates of accumulation of inherited property need to be accounted for (Osberg 1984). Out of the completed research that accounts for the effects of inheritance on the distribution of wealth, the neoclassical theory of inheritance is one of the most commonly used theories. This neoclassical approach to the inheritance process is illustrated in Figure 2:

Figure 2 – Neoclassical Theory of the Inheritance of Property

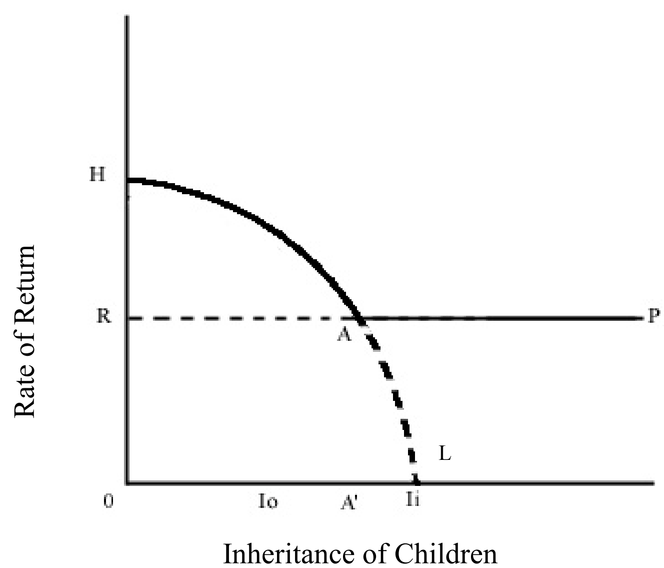
A)

Parental Choice



B)

Rate of Return on Inheritance



The neoclassical theory of inheritance explains parental choice as a function of their utility (Figure 2A). This graph represents parental choice between the parent's own consumption (vertical axis) and bequests to their children (horizontal axis). If parents greatly care about the welfare of their children through a strong desire to leave an inheritance, their utility depends on both their own consumption and that of their children. Their relative tastes, which are represented by the indifference curves U_0 and U_1, are combined with the budget constraints of C_0 and C_1 to determine the amount of the bequest (Osberg 1984). The budget constraint represents the amount of the parents' wealth. They could either give their all their wealth to their children, consume it all themselves, or leave part of it as a bequest. Each indifference curve represents different combinations of the parent's consumption and bequests to the children that provide the parents with an equal amount of utility. The amount of the bequest is represented by I_0 or I_1 in Figure 2A, where the indifference curves of U_0 and U_1 are tangent to the budget constraint. A bequest tends to be greater the larger one's human capital and property wealth.

In Figure 2B, the line RAP indicates the rate of return on inheritances received in the form of property. The rate of return will be constant at the rate R if capital markets are competitive. The line HAL represents the marginal net return on investments in children's human capital. At point A, the marginal return to investment in human capital equals the market rate of return on property. The rate of return on human capital exceeds that on property over the range 0A. Thus, parents who leave less than 0A to their children will leave a zero inheritance of property but invest Io in their children's human capital. This model explains why most people receive next to nothing in property inheritance. However, wealthier families will leave both human capital and property. For example, an inheritance of I_1 will be composed of OA′, which is invested in human capital, and A′ I_1, which is left as property (Osberg 1984).

Theories of the inheritance of property, such as this neoclassical model, conclude that most people inherit very little property and that wealthy children inherit both earnings capacity and property. While this model accounts for different levels of bequests among children, it ignores different customs of inheritance and how they lead to a great accumulation or reduction in wealth accumulation. Additionally, it fails to account for other aspects of social behavior, such as marriage patterns, and their relative influence on the long-run wealth distribution. Both of these factors are vital in forming an accurate model of the distribution of wealth.

After examining these widely used models, it becomes evident that there are definite limitations in their scope. To develop a more accurate model that explains the overall distribution of wealth, these models need to be combined and modified to include certain socioeconomic variables that significantly affect its distribution over time. When analyzing the distribution of wealth, alternative social customs of inheritance need to be analyzed, along with different marriage patterns. Along with these commonly omitted socioeconomic variables, the distribution of wealth also depends on the propensity to save, and differential fertility rates. After these factors are accounted for, a more accurate analysis of property acquisition and wealth accumulation can be derived.

While many researchers have attempted to develop a model incorporating these vital determinants, they often run into difficulty with their mathematical specifications. Unfortunately, availability of data is a significant constraint in developing an accurate model to account for all these socioeconomic factors. Minimal and inaccurate surveys have been performed on the general population's wealth, causing many researchers to estimate wealth distribution through the use of an "estate multiplier" (Osberg 1984). While the "estate multiplier" method estimates the upper end of the wealth distribution, it is inadequate when explaining those estates too small to be subject to taxation. To remedy these data dilemmas, it is often to the advantage of the researcher to stray from the more conventional methods of economic analysis and assume a more inductive approach to explaining this economic behavior. One such approach, and the one used in this analysis, is the process of microsimulation.

The Process of Microsimulation

Microsimulation is an alternative method of analysis that provides greater flexibility when modeling economic behavior in cases where data is often hard to find. The nature of an economic model is to provide a close and accurate representation of an economic system while taking into account all relevant variables and conditions that may affect its specifications. Economic systems are extremely hard to model due to the numerous components that influence their construction. Because it is quite difficult to mathematically model an economic system while accounting for the many factors that affect it over time, simulations are a welcome alternative to other research methods. They allow the researcher to include particular parameters of interest without many of the simplifications that often prevail in these more conventional methods of analysis (Bergman 1990).

The first step in conducting a simulation is to specify the initial conditions of the model, along with the values of the parameters. One can think of these assumptions as a set of behavioral rules that can be applied to specific agents of interest in the study. These "rules of life" are usually based on economic theory, a reasonable representation of rational utility-maximizing behavior, or other behavioral patterns of interest (Bergman 1990). These rules can be manipulated to provide insight into the specific parameters of interest and modified at the discretion of the researcher.

The variables used in the analysis also need to be specified before a simulation can be conducted. These variables are used to describe outputs, generate behavior, and describe the state of the conditions at any point in time both internally and externally (Orcutt 1960). However, to generate behavior, the model must also specify the nature of the relationships between these variables. These relationships can be in the form of identities or operating characteristics. While identities are usually in the form of accounting-type relationships, operating characteristics specify more of an assumption about human behavior (Orcutt 1960). While the identities of variables can be directly observed in an economy, the operating characteristics must be inferred from inductive studies. Due to the need for inductive analysis when specifying these operating characteristics, microsimulation is often a useful approach for modeling economic behavior. When models contain a large number of components, variables, and relationships, simulation techniques make it more feasible for researchers to perform their analysis.

Additionally, microsimulation allows the researcher to perform sensitivity analyses on the model. At desired intervals, statistical reports are generated from the computer simulations, providing insight into interactions as they occur. These reports are then used to make generalizations about the simulated economic behavior. The simulations can be run many times with the values of the parameters being altered between runs. The variations in the output of the different specifications can be more easily observed through these sensitivity analyses and allows the researcher to experiment with trial-and-error procedures (Orcutt 1960). Thus, many simulation models have been constructed to analyze subjects that conventional methods often unsuccessfully attempt to explain.

For the purposes of this study, a microsimulation will be conducted to analyze the factors that affect the distribution of societal wealth. Because of the many components, variables, and relationships that need to be accounted for in this model's construction, microsimulation is a more feasible and accurate method of analysis. An excellent example of a simulation model used to explain the distribution of societal wealth is Frederick Pryor's "Simulation of the Impact of Social and Economic Institutions on the Size Distribution of Income and Wealth" (Pryor 1973). His simulation model will be used as a foundation for this paper and a starting point in the analysis of wealth distribution over many generations.

Pryor's Simulation Model

Frederic Pryor used microsimulation to study the effects of different socioeconomic variables on the size distribution of income and wealth through several generations. Pryor's purpose was to use a simulation model in which the distributions of income and wealth are analyzed together. He explored the effects of intergenerational transfers of income and wealth, inheritance rules, patterns of mate selection, differential fertility of various income classes, and patterns of governmental redistributions of income and wealth (Pryor 1973). Since there is no collected data analyzing the impact of these variables over subsequent generations, microsimulation is a particularly useful model in this analysis. Conventional methods are unable to depict an accurate portrayal of the effects of these socioeconomic factors over more than one generation. Thus, Pryor's model allows for a more accurate and attainable method of analyzing their impact.

In Pryor's model, marriages are arranged according to one of three different rules: a person can only marry another next on the income scale (no-choice rule), the person has an equal chance of marrying anyone (equal-choice rule), or the person can marry anyone but most likely another close on the income distribution (limited-choice rule) (Pryor 1973). Additionally, families have children according to several different patterns in Pryor's model. After ranking families according to income, they are divided into three groups. The rich can be designated to have more or fewer children than the poor and vice versa (Pryor 1973). These differential fertility rates are thought to play a significant role in the long-run distribution of societal wealth. Pryor also investigates polygamy for the wealthy families.

Once the parents are removed from the model through death, wealth is divided according to one of three rules: one child can receive everything (primogeniture rule), the property can be divided equally among all children (equal-division rule), or the first child can receive half of the wealth with the remainder divided equally among the rest (compromise rule) (Pryor 1973). Lastly, Pryor analyzes the effects of governmental redistributions of wealth.

Pryor wanted to determine if a stable distribution of income and wealth could be achieved through the simulations of these different case scenarios. With only a few exceptions, his simulation processes converged toward an equilibrium distribution that was maintained for the following generations. He ran each simulation twice, starting from both a highly unequal initial distribution of wealth and also from a fairly equal wealth distribution. These simulations were each run for 30 generations, with the end results averaged. Using Gini coefficients as a measure of the income inequality, he then discussed the patterns of his simulations by analyzing the equality of the income distributions. He altered the parameters and the relationships between the different socioeconomic variables to infer conclusions about the rates of convergence to an equilibrium distribution.

Program Analysis

The program used in this analysis is a reconstruction of Pryor's model, written by Barbara Bergman in the BASIC language. The variable definitions used in the BASIC program are listed in Table 1, and the program itself is listed in Table 2.

Table 1
Variables Used in Pryor's Model

FERTIL	average number of children per family
SAVMP	marginal propensity to save out of above-average income
STDEV	standard deviation of "talent" to earn income
IPAR	parent's generation
IPOP	population
IGEN	generation
PROD	national income
TCAP	total amount of capital stock
TLAB	total amount of labor
XLAB	individual labor
RNNUMB	random number generator
XMPC	marginal productivity of capital
XMPL	marginal productivity of labor
AVINC	average income of economy
XINC	total income
BIG	person with highest income
IBIG	person's rank in income distribution
SUMI	sum of income
SUMK	sum of capital
CAPAVG	average of total capital

AVINC	average of total income
GINIK	gini coefficient for capital
GINII	gini coefficient for income
ISPOU	chose spouse
ICHOSE	randomly choose spouse
FAMINC	family income
SAVING	total savings
ICHIL	Ith child
ICOUNT	determines number of chilren
FUND	fund for all capital not bequeathed
NCHIL	number of children
IPOIS	random number w/ poisson distrubution
CFAM	family capital
KCHIL	Kth parent’s capital
SUM	generates unit normal random deviate

Table 2
BASIC Program of Pryor’s Model

```
10 'Program for Pryor AER article reconstructed by Bergmann.
20 'Lines 40-70 contain computer arrangements.
30 '#######################################
40 DEFINT I-N
50 DIM CAP(2,500),XLAB(500),XINC(500),ISPOU(500)
60 RANDOMIZE 18
70 OPEN "simout" FOR OUTPUT AS #1
80 '#######################################
90 'Set parameter values: FERTIL is the average number of children per
family; SAVMP is the marginal propensity to save out of above-average
income, STDEV is the standard deviation of the "talent" to earn income.
100 '#######################################
110 FERTIL=2!: SAVMP=.2:STDEV=.2
120 '#######################################
130 'Set up initial conditions. Half the population is assigned some
capital.
140 '#######################################
150 IPAR=1:IPOP=100
160 FOR J=1 TO IPOP
170 IF J>IPOP/2 THEN GOTO 190
180 CAP(IPAR,J)=2
190 NEXT J
200 '#######################################
210 'Here we start the activities of each generation: production,
income distribution, marriage, saving, procreation, dying and passing
capital to the next generation.
220 '#######################################
230 FOR IGEN= 1 TO 30
240 PRINT:PRINT "generation ";IGEN; " = ";IPOP;" persons"
250 '#######################################
260 'We compute the total amount of capital and labor (lines 280-340).
National income PROD is computed, using Cobb-Douglas function (line
350). We also compute the marginal productivity of capital (line 360)
and labor (line 370).
270 '#######################################
280 TCAP=0:TLAB=0
290 FOR M= 1 TO IPOP
```

```
300 TCAP=TCAP+CAP(IPAR,M)
310 GOSUB 1160
320 XLAB(M)=1+RNNUMB*STDEV
330 TLAB=TLAB+XLAB(M)
340 NEXT M
350 PROD=TLAB^.5*TCAP^.5
360 XMPC=.5*PROD/TCAP
370 XMPL=.5*PROD/TLAB
380 AVINC=PROD/IPOP:PRINT "average income =";AVINC,"capital
stock=";TCAP
390 '########################################
400 'Compute individual incomes.
410 '########################################
420 FOR K=1 TO IPOP
430 XINC(K)= XLAB(K)*XMPL+CAP(IPAR,K)*XMPC
440 NEXT K
450 '########################################
460 'The person with the highest income is found (lines 500-20) and put
first in the array (lines 530-40), the second highest second and so on.
This helps to compute the Gini, and arrange assortative mating by
income, if that is to occur
470 '########################################
480 FOR I=1 TO IPOP-1
490 BIG =-999:IBIG=I
500 FOR J=I TO IPOP
510 IF XINC(J) >= BIG THEN BIG=XINC(J):IBIG=J
520 NEXT J
530 S=CAP(IPAR,I):CAP(IPAR,I)=CAP(IPAR,IBIG):CAP(IPAR,IBIG)=S
540 S=XINC(I):XINC(I)=XINC(IBIG):XINC(IBIG)=S
550 NEXT I
560 '########################################
570 'Compute Gini coefficient.
580 '########################################
590 SUMI=0: SUMK = 0
600 FOR J=1 TO IPOP
601 SUMI = SUMI + J*XINC(J)
610 SUMK = SUMK + J*CAP(IPAR,J)  : NEXT J
615 CAPAVG = TCAP/IPOP : INCAVG = PROD/IPOP
621 GINIK =-1*( (2/(IPOP*(IPOP-1)*CAPAVG))*SUMK - (IPOP+1)/(IPOP-1))
622 GINII = -1*((2/(IPOP*(IPOP-1)*AVINC))*SUMI - (IPOP+1)/(IPOP-1))
630 PRINT#1,USING "#####.##";IGEN;IPOP;XMPL;AVINC;TCAP;GINII;GINIK
638 PRINT "capavg",CAPAVG, "prod",PROD
640 PRINT "wage =";XMPL,"Ginii =";GINII;"ginik =";GINIK
650 INPUT B
660 'Spouses are chosen. In this version, they are picked at random
(lines 710-750). Family income is calculated (line 760). Those families
with above average income save, and add the saving to their capital
(lines 770-790).
670 '########################################
680 FOR I=1 TO IPOP
690 ISPOU(I)=0:NEXT
700 FOR I=1 TO IPOP
710 IF ISPOU(I)<>0 THEN GOTO 800
720 ICHOSE=INT(RND*IPOP+1)
730 IF ISPOU(ICHOSE)<>0 THEN GOTO 720
740 IF ICHOSE = I THEN GOTO 720
750 ISPOU(I)=ICHOSE:ISPOU(ICHOSE)=I
```

```
760 FAMINC=XINC(I)+XINC(ISPOU(I))
770 IF FAMINC < 2*AVINC THEN GOTO 800
780 SAVING = SAVMP*(FAMINC - 2*AVINC)
790 CAP(IPAR,I)=CAP(IPAR,I)+SAVING
800 NEXT I
810 '########################################
820 'Computer arrangements for the next generation. There are two
arrays for capital - one for the parents and one for the children.
ICHIL is the variable that tells in which array the capital of the new
children will be recorded.
830 '########################################
840 ICHIL=(IGEN MOD 2)+1
850 ICOUNT=0:FUND=0
860 FOR I=1 TO IPOP: NCHIL=0
870 IF ISPOU(I)< I THEN GOTO 1020
880 '########################################
885 'Children are born. The number of children a family has is a random
number with Poisson distribution, generated by a call to a subroutine.
890 '########################################
900 GOSUB 1230
910 NCHIL=IPOIS
930 CFAM=CAP(IPAR,I)+CAP(IPAR,ISPOU(I))
940 IF NCHIL =0 THEN FUND=FUND+CFAM:GOTO 1020
950 '########################################
960 'Children inherit capital. The Kth parent's capital is stored in
CAP(IPAR,K) while the Ith child's capital is stored in CAP(ICHIL,I). In
one generation IPAR=1 and ICHIL=2. In the next generation the values
are reversed.
970 '########################################
980 FOR KCHIL = 1 TO NCHIL
990 ICOUNT=ICOUNT+1
1000 CAP(ICHIL,ICOUNT)=(CFAM+FUND)/NCHIL
1010 NEXT KCHIL:FUND=0
1020 NEXT I
1030 IF FUND > 0 THEN CAP(ICHIL,1)=CAP(ICHIL,1)+FUND
1040 '########################################
1050 'The next two lines prevent a population with an odd number of
people. This allows the search for a spouse to be simple.
1060 '########################################
1070 IF ICOUNT MOD 2 = 0 THEN GOTO 1120
1080 IF RND(1)<.5 THEN CAP(ICHIL,ICOUNT-1)=CAP(ICHIL,ICOUNT-
1)+CAP(ICHIL,ICOUNT):ICOUNT=ICOUNT-1 ELSE
ICOUNT=ICOUNT+1:CAP(ICHIL,ICOUNT)=0
1090 '########################################
1100 'The children are now grown and ready to start their own
production and reproduction. The new cycle starts back on line 210.
1110 '########################################
1120 IPAR=ICHIL: IPOP=ICOUNT
1130 NEXT IGEN
1140 END
1150 '########################################
1160 'Subroutine generates unit normal random deviate.
1170 '########################################
1180 SUM=0
1190 FOR I=1 TO 12
1200 SUM=SUM+RND:NEXT I
1210 RNNUMB=SUM-6:RETURN
```

```
1220 '########################################
1230 'Subroutine computes random number IPOIS having Poisson
distribution with mean FERTIL.
1240 '########################################
1250 B=1
1260 FOR IPOIS=0 TO 30
1270 B=B*RND
1280 IF B<EXP(-FERTIL) THEN RETURN
1290 NEXT IPOIS
1300 RETURN
```

The first step in the simulation model is to specify the computer arrangements (lines 40-70). Because BASIC has a limited amount of memory, the data will be stored in arrays for capital, labor, income, and spouse. An array is a table of data that is stored in the computer's memory. Its dimensions need to be defined at the beginning of the program to properly accumulate storage for the variables in the BASIC program (lines 40-50). The variables are defined in the array by use of a DIM statement, which specifies the dimensions of the array. To generate events whose outcomes are random, the RANDOMIZE statement is programmed into the model. Each time the program is run, it starts with a different random number. These numbers are random because the computer uses an unbiased selection procedure to generate the outcome (Goldstein and Goldstein 1984). A "seed" number controls the sequence of numbers generated, which is 18 in the case of this model (line 60). The simulated output will be entitled "simout" and able to be read into a Microsoft Excel file for later analysis (line 70).

The simulation model then sets the parameter values of the average number of children per family, the marginal propensity to save out of above-average income, and the standard deviation of the ability to earn income which represents such abilities as intelligence or diligence (line 110). Next, the model sets up the initial conditions. The population consists of 100 unmarried people, half of which are assigned some capital and given an arbitrary initial distribution of productive wealth (lines 150-190). To assign capital to half the population, a loop is used. The variable J is called the loop variable.

The next step in the program is to begin the activities of each generation: production, income distribution, marriage, saving, procreation, dying and passing capital to the next generation. In this model, the simulation will be run for 30 different generations (line 230). The simulated output will be identified as “generation” and “persons” for easier interpretation after the program is run (line 240).

Lines 280-340 determine the total amount of capital and labor and its distribution among the population. Differences in initial distributions stem from both individual abilities, and bequests from parents to children (lines 290-340). A subroutine is used to generate randomness in these initial distributions of capital and labor (lines 1180-1210). National income then is created through the use of a Cobb-Douglas production function (line 350). The marginal productivities of both capital and labor are then specified in lines 360-370. The average income of the economy is then defined (line 380), along with PRINT statements for the simulated output.

Individual incomes are computed as a function of the individual’s total amount of labor multiplied by the marginal product of labor, plus the individual’s total amount of capital multiplied by the marginal product of capital (lines 420-440). The people in the model are then ranked according to income (lines 480-550), putting the person with the highest income first in the array. This is done through the use of a loop that identifies the first and last person of the income distribution. This is needed to arrange mating patterns by income and calculate the Gini coefficients of income and capital, which are used to show the trends in the degree of inequality. These Gini coefficients are then computed (lines 590-650), measuring the inequality of the equilibrium size distribution of lifetime income and capital. This model was changed to generate a Gini coefficient for both income and capital since the original program only computed the Gini coefficient for capital (lines 601-622). PRINT statements are used to describe the simulated output (lines 630-640). An input statement is included to see each generation individually, as it is generated (line 650).

In this version of the program, spouses are chosen at random. While Pryor's model analyzes the effects of three rules of marriage, spouses are picked at random in lines 710-750. The RND command accounts for the randomness in selection process of the marriages through the variable ICHOSE. Family income is calculated by combining the incomes of the two spouses (line 760). Those families with above average income are programmed to save, adding the saving to their capital (lines 770-790). If family income is greater than the average income of the economy multiplied by 2, then the family will save. In this version of the program, poorer families do not save any of their income.

The computer arrangements for the subsequent generations are formed in two arrays for capital. One is for the parents and the other is for the children (lines 840-870). A variable FUND is then included to account for all capital not bequeathed (line 850). Children are then born into the different families. The number born is determined by a draw from the Poisson distribution (lines 1250-1300). The number of children born to each family is specified (lines 900-940) and in the case that the number of children is 0, the program will skip to line 1020, with the bequests put in FUND.

Children inherit capital, which is stored in the CAP (ICHIL,I) array. The parent's capital is stored in the CAP (IPAR, K) array. The first generation has IPAR=1 and

ICHIL=2, while the next generation has reversed values (lines 980-1030). The possibility of a population with an odd number of people is prevented to simplify the search for a spouse (lines 1070-1080). After the children are grown and ready to start their own production and procreation, the new cycle starts back on line 210 (lines 1120-1140).

Program Modifications

As previously explained, the distribution of wealth depends on such factors as the propensity to save, fertility rates, marriage patterns, and inheritance patterns. Due to the limits of microsimulation, these variables are chosen as the most significant and feasible to analyze for the purposes of this study. The major goal of this study is to analyze the impact of these parameter modifications on the overall distribution of societal wealth. Based on previous research, in addition to the predictions of Pryor's model, these determinants were chosen as the most significant factors that affect the wealth distribution over many generations. By altering their specifications in Pryor's model, a clearer interpretation of their inter-generational impact will be gained.

In analyzing each of the determinants, a Gini coefficient for both capital and income was programmed in the simulation model. However, when analyzing their outcomes from the parameter adjustments, it was concluded that there is not much difference in their relative impacts. Both followed the same long-run trends and demonstrated the same short-run fluctuations. This is because of the fact that the inequality of capital influences the inequality of income. If there is more capital inequality in society, there will also be more income inequality. Additionally, the model does not allow for changes in the inequality of labor income. The human capital individuals start with is the same level they have for the remainder of their life. Because these two Gini coefficients are heavily correlated with each other, the following analysis will focus specifically on the Gini coefficient for capital and its implications in the overall distribution of wealth.

The long run movement of the Gini coefficients is marked by wide fluctuations for each run of the different simulations. Since there is such randomness in the long-run distribution, it would be inaccurate to conclude any significant implications from their fluctuations. Thus, the following analysis will focus specifically on the associated levels of inequality resulting from the different parameter modifications.

Pryor's original program, reconstructed by Bergman, will be used as a foundation for the following program modifications. Each simulation, unless specified differently, will be assumed to follow the version of the program listed in Table 2. This original program assumes a fertility rate of 2, a savings rate of .2, equal division for inheritance, and random mate selection. These initial parameters will be adjusted in the following sections and changed to allow for a more accurate analysis of the determinants of long-run wealth distribution.

Savings Patterns

The distribution of wealth in society is largely attributable to the particular savings patterns assumed by individuals. Differences in the marginal propensity to save, along with the actual proportion of the population who saves their income should affect the long run distribution of capital accumulation. This model will analyze the effects of different marginal propensities to save within three different savings patterns. First, the model will assume that all people save a fixed percentage of their income. Secondly, the model will assume that only those families with above average income will save. Lastly, the model will assume that only those families who earn above twice the average income will save.

To analyze the effects of different savings rates on the overall distribution of wealth, the program was first modified in line 110:

110 FERTIL = 2: SAVMP = .05: STDEV = .2

To account for changes in the marginal propensity to save, SAVMP was given the values of .05, .1, .2, .25 and .3. A different simulation was run for each of the three savings patterns, along with each of these savings rates, to determine their relative significance on the distribution of wealth in society.

The first pattern tested in this study accounted for a society in which only those families who earned above twice the average income save a percentage of their earnings. This particular pattern is the one accounted for originally in Bergman's reconstruction of Pryor's model and illustrated in lines 770-790:

```
770 IF FAMINC < 2*AVINC THEN GOTO 800
780 SAVING = SAVMP*(FAMINC – 2*AVINC)
790 CAP (IPAR,I) = CAP (IPAR,I) + SAVING
```

Those families whose earnings fall above this income level will then add this saving to their accumulated capital. The results of this savings pattern are illustrated in Figure 3:

As illustrated in Figure 3, there is not a large change in the level of wealth inequality among the different marginal propensities to save within this society. The general trend is that a lower marginal propensity to save results in a lower level of inequality among capital distribution. In other words, the more people save, the more unequally capital will be distributed among different families. When people who earn above twice the average level of income are inclined to save more, they will accumulate greater amounts of capital from these added savings. This positive relationship can be seen in the graph, although it is not a great difference. Because the wealthiest percentage of the population is saving and the poorest percentage is not, a greater level of capital inequality is a reasonable conclusion from this simulation. Thus, the more inclined those families with above twice the average income level are to save, the greater their capital accumulation.

The second savings pattern investigated is a society in which people with above average income save a percentage of their earnings. The program was modified as follows in lines 770-780 to account for this change:

```
770 IF FAMINC < AVINC THEN GOTO 800
780 SAVING = SAVMP*(FAMINC – AVINC)
```

In this scenario, a greater percentage of the population is saving a portion of their income, although the poorest segments are still not. The results of this savings pattern are shown in Figure 4:

Once again, there is not a significant difference in the overall wealth distribution when accounting for differences in the marginal propensities to save among individuals. In fact, there is less of a difference when adjusting the model to allow more people with a lower income to save. The same relationship holds true, as illustrated in the previous scenario: the greater the marginal propensity to save, the greater the level of wealth inequality. However, this level of wealth inequality is not as great when allowing more people to save their income. Previously, there were greater differences between different values of SAVMP. Since those with above average income are now programmed to save part of their income, poorer people are saving more in the economy. Thus, there will not be as much inequality among the wealth distribution.

The final scenario accounts for a society in which everyone saves a fixed percentage of his or her total income. In other words, all people in the society save, regardless of their income level. The program was modified in line 780 to account for this pattern:

```
780 SAVING = SAVMP * FAMINC
```

Line 770 was deleted in the program since all people save, regardless of their family income. The following results were obtained from the simulation run, as illustrated in Figure 5:

An interesting difference between a society in which everyone saves a fixed percentage of their income and one where only those with above or twice the average income save is illustrated through the relationships between the different values of the SAVMP variable. In the previous two simulations, there was a positive relationship between the marginal propensity to save and the level of wealth inequality. However, when everyone saves a fixed percentage of his or her income, this relationship no longer holds true. There is actually an inverse relationship between the marginal propensity to save and the level of wealth inequality.

As people become more inclined to save a fixed percentage of their income, the level of inequality decreases in society. If everybody in society saves more money, then the wealth distribution will become more equal. In other words, the higher percentage everyone saves, the less associated inequality there will be in society. One explanation for this finding is that for poorer people, savings represents a greater percentage of their total wealth. Since changes in the savings rate affect the poorer population on a greater level, a higher propensity to save in society will result in a greater increase in wealth for the poor. With the poor financially better off, there will be an associated decrease in the overall level of inequality. When more poor people are inclined to save, wealth is distributed more equally across society.

This inverse relationship is also partially due to the fact that everybody starts off life with an unequal initial distribution of income. If everybody were to save, this unequal distribution of wealth would become less stratified since poorer people will have greater capital accumulation, and thus have more to pass on to future generations in the form of inheritance. If everybody were less inclined to save, the gap would continue to be large between those with a greater level of initial capital distribution and those with fewer assets. The more capital accumulated by those with less income, the lower the level of inequality in society.

It is also useful to compare the three types of savings patterns within the same marginal propensity to save to gain better insight into their influence on wealth distribution. Figure 6 shows these three savings patterns at a marginal propensity to save equal to .2:

This graph clearly illustrates that a greater level of wealth inequality will result as the percentage of poorer people who save decreases. The first scenario investigated the condition that only people who earn above twice the average income level save a portion of their earnings. This situation is probably the one that most closely mirrors the current economy. People who are at the lower end of the income distribution tend to consume everything they earn and do not accumulate a large amount of savings. The more people earn, the more inclined they will be to save. Thus, the poorer population will probably be more inclined to consume their earnings rather than save, unlike the wealthier people in society.

The second scenario investigated a society where a greater percentage of the population saves their income: those who earn above the average income level. In this case, there was still a considerable amount of inequality, although less than the previous simulation. The graph illustrates that as this percentage increases, wealth will gradually become more equally distributed.

When everyone saves a fixed percentage of his or her income, regardless of his or her income level, less inequality will occur in the economy over several generations. Families will have more capital to pass down to subsequent generations and the overall wealth distribution will become more equal. The poor will be better off as they have a higher propensity to save. This is apparent in all 30 generations, as the Gini coefficient for capital is less than the preceding two simulations.

Fertility Rates

Fertility rates are another determinant of interest when analyzing the distribution of wealth. This analysis will first examine the influence of different fertility rates on the overall distribution of wealth. Then it will account for the effects of differential fertility rates on the overall capital accumulation over many generations. To change the fertility rates, the program was modified in line 110:

110 FERTIL = 2: SAVMP = .2: STDEV = .2

The variable FERTIL assumed seven different values between 1.7 and 2.3 to account for differences in fertility rates. Due to the limitations of the BASIC program, the dimensions to the array were increased to account for this greater population in the case of a high fertility rate. The model was unable to experiment beyond this range, due to limited capacity in the existing arrays. The program was modified in line 50 to increase the storage capacity in the arrays:

50 DIM CAP (2,1000), XLAB (1000), XINC (1000), ISPOU (1000)

After increasing the dimensions to 1,000, the storage capacity was able to hold the greater population that resulted from increased fertility rates. A separate simulation was run for each of these rates to analyze their impact on long-run capital distribution. The results are shown in Figure 7:

As seen in the graph, the simulation was often unable to run for the entire 30 generations due to very high or very low fertility rates. In the case of the high fertility rates of 2.3 and 2.2, the program ran out of space to store the greater population. In the case of the low fertility rates of 1.8 and 1.7, the population died out before the simulation could run for the entire 30 generations. Regardless of these outcomes, the simulation is still useful in analyzing the impact that these different fertility rates have on the overall distribution of capital.

The general relationship between fertility rates and the level of capital inequality can be seen in Figure 7. There is a positive relationship between the fertility rates and the Gini coefficient for capital. In other words, the greater the fertility rate, the more unequal the capital distribution will be over many generations. As the population increases, there is more wealth inequality in society.

As seen in the graph, there is not a significant difference between the fertility rates of 1.9 to 2.3. However, the lower fertility rates of 1.7 and 1.8 demonstrate a clear jump downwards after the fourteenth generation. From that generation until the last one ran in the simulation, the Gini coefficients are much lower than those of the higher fertility rates. This seems to indicate that as the population becomes significantly lower, there is an associated lower level of wealth inequality. On the other hand, it may be that the outcomes simply become more variable and unpredictable with a lower population. Due to this low population, it may be inaccurate to infer any conclusions about the fluctuations in these fertility rates.

There are also huge and significant fluctuations after the fourteenth generation for the fertility rates of 1.7 and 1.8. Once again, these lower fertility rates have a more significant impact on the distribution of wealth than those that are greater. This could be because as the population becomes significantly lower, capital distribution is more sensitive to changes in the fertility rate. With less people in society, capital distribution is more volatile to changes in the population.

Differential fertility rates are experimented with in this analysis to account for correlations between family income and the number of children born to each family. In this analysis, the rich can either be designated to have more or fewer children than the poor or vice versa. To account for a situation in which the rich have a higher fertility rate than the poor, the program is modified in the subroutine that computes the random number IPOIS to determine the number of children born to a family (lines 1250-1300):

1245 IF I < IPOP/2 THEN FERTIL = 1.8 ELSE FERTIL = 2.3

Line 1245 was added to the subroutine to specify that the wealthiest half of the population has a fertility rate of 2.3 and the poorest half of the population has a fertility rate of 1.8. The rate of 2.3 was chosen because it is the highest fertility rate that BASIC's capacity will hold to still account for all 30 generations. The rate of 1.8 was chosen because it is the lowest rate the program will allow before the population becomes extinct after 30 generations. After this simulation was run accounting for a higher fertility rate among the wealthiest half of the population, another simulation was run accounting for a higher fertility rate among the poorest half of the population:

1245 IF I < IPOP/2 THEN FERTIL = 2.3 ELSE FERTIL = 1.8

Once again, line 1245 was added to the subroutine. However, this time it accounted for the poorest half of the population having more children. The results of these two simulation runs are shown in Figure 8:

As illustrated in Figure 8, there is more associated inequality when the poorest half of the population has a higher fertility rate. On the other hand, capital is more equally distributed when wealthier families have a higher fertility rate. An explanation of this outcome can easily be found when examining the distribution of inheritance among future generations.

If the wealthiest percentage of the population has a higher fertility rate, they will have more children to distribute their capital to in the form of bequests. With a greater number of children per wealthy family, these large inheritances will be more evenly distributed since there are more people to share in this wealth. On the other hand, if a wealthy family were to have fewer children, their accumulated capital would be more clustered in the hands of those particular children. Without many siblings to share the wealth, those wealthy families with fewer children will more greatly contribute to the level of wealth inequality in society. Capital will simply be clustered in the hands of a smaller group of individuals.

When the poorest half of the population has a higher fertility rate, the opposite will hold true. The small amount of wealth passed down those poorer families with many children will be more divided with less capital going to each child. This high fertility rate will lead to greater inequality as the wealthiest percentage of the population gain more wealth in the hands of fewer people. A high fertility rate among poor people will only contribute to the inequality of wealth distribution and lead to more economic stratification. If the poorest half of the population has a lower fertility rate, this inequality gap will be narrowed as more wealth is clustered in the hands of lower income individuals. With less children to split the inheritance, the poorer families will have more individual income to pass down to subsequent generations. This greater clustering of wealth among poorer individuals along with the simultaneous dispersion of wealth among the wealthiest families will lead to more equality in long-run wealth distribution.

After examining the relative impact that differential fertility rates have on society, it is evident that a higher fertility rate among the poor coupled with a lower fertility rate among the wealthy carries the greatest impact on the overall capital distribution. This is illustrated in Figure 8 through the large gap between a fixed fertility rate of 2 and the differential fertility rates of the rich with 1.8 and the poor with 2.3. While the inverse also leads to a notable change, it is not quite as significant. The reasoning behind this can also be traced to the effects of bequests on the long run wealth distribution. A higher fertility rate among the poor significantly increases the associated inequality of capital distribution since the income distribution is more heavily weighted at the bottom. A lower fertility rate among the wealthy amplifies this inequality as wealth is further clustered in the hands of fewer people.

Marriage Patterns

A major socioeconomic variable of interest is the arrangement of marriages and their effects on the distribution of wealth over many generations. Three different marriage patterns are analyzed in this model to determine their relative effects on capital accumulation: positive assortative mating, negative assortative mating, and random mating. Positive assortative mating is when individuals marry the person next to them on the income distribution scale. In other words, they marry others from similar economic backgrounds. Negative assortative mating accounts for the inverse situation, in which people marry others from opposite ends of the income distribution. Random mating is when everyone has an equal chance of marrying from any economic background. The BASIC program reconstructed by Bergman is originally programmed to account for random mating. In this version, spouses are picked at random (lines 710-750).

To account for a society in which positive assortative mating occurs, the program was manipulated as follows (lines 700-720):

```
700 FOR I = 1 TO IPOP STEP 2
710 IF ISPOU (I) <>0 THEN GOTO 800
720 ICHOSE = I + 1
```

Lines 700 and 720 were changed to eliminate the randomness in the mate selection and to program the mate selection according to their rank in the income distribution. By setting the variable ICHOSE equal to I + 1, positive assortative mating will occur.

To account for a society in which negative assortative mating occurs, the program was manipulated as follows (lines 700-720):

```
700 FOR I = 1 TO IPOP STEP 2
710 IF ISPOU (I) <>0 THEN GOTO 800
720 ICHOSE = IPOP - I + 1
```

Lines 700 and 720 were once again modified to eliminate the randomness in the mate selection process and to perform the opposite affect as the previous program alteration. By setting the variable ICHOSE equal to IPOP – I + 1, negative assortative mating will occur. A separate simulation was run accounting for all three patterns of mate selection and the results are illustrated in Figure 9:

As illustrated in Figure 9, greater wealth inequality will result with positive assortative mating, and less wealth inequality will result with negative assortative mating. If people from the same background marry each other, wealth will be more unevenly distributed across generations since wealth is more heavily clustered among those with the same economic background. Since individuals always marry people with the same general amount of family wealth, both the husbands and wives have inheritances of equal size from their own parents (Osberg 1984). Thus, these fortunes will not diminish with the existence of marriages from the same backgrounds.

However, if individuals from different backgrounds marry each other, family fortunes are more equally dispersed over generations and wealth will tend to spread more equally over the population. When people from well-off families marry those from lower socioeconomic status, family fortunes are fragmented over generations and wealth will tend to be spread more equally over the population (Osberg 1984). Generally, the more random the marriages, the more equal the distribution of wealth will be over subsequent generations. The concentration of wealth will decrease over time to the extent that marriages are random or negatively assortative.

Inheritance Customs

Another socioeconomic variable of interest in this analysis is inheritance customs. Inheritance customs are particularly interesting to analyze because of their strong correlation with the wealth distributions of future generations. In most cases, the large fortunes of one generation belong to the children of those who possess the large fortunes of the preceding generations (Osberg 1984). Due to these intergenerational transfers of wealth, different inheritance customs play a significant role on the long run wealth distribution.

For the purposes of this study, three different inheritance customs will be analyzed: equal division, primogeniture, and the compromise rule. The inheritance custom most commonly used in today's society is equal division. In this case, children equally share in their parent's estate. Although the norm in the United Sates is equal sharing, it is interesting to analyze the effects of different division patterns among the children (Osberg 1984). If all children share in the division of their parent's estate, the size of each share and the number of children to whom the inheritance is left determines the intergenerational stability of the wealth distribution. Bequests can also take the form of primogeniture, where the eldest son inherits all property. Lastly, the compromise rule will account for the situation in which the eldest child receives half the inheritance and the remainder is divided among the other children.

The model is originally programmed to account for equal division of inheritance among the children, as this is the custom used in present society. In lines 980-1020, children inherit capital according to the equal division rule. The program is modified as follows to account for a society in which primogeniture is the case:

```
850 ICOUNT = 1: FUND = 0
1000 IF KCHIL = 1 THEN CAP (ICHIL, ICOUNT) = CFAM +
FUND
1010 NEXT KCHIL: FUND = 0
1020 NEXT I
```

In line 850, ICOUNT is set equal to 1 to ensure that the first child born to every family receives the entire inheritance. Lines 980-990 are deleted to eliminate the equal division among the children in the families. Line 1000 is modified to prevent the inheritance from being distributed evenly among all the children in the family. It specifies that the first child born to the family will receive the entire inheritance.

To adjust the model according to the compromise rule, the following modifications were made to the original program:

1005 IF KCHIL = 1 THEN CAP (ICHIL, ICOUNT) = (CFAM + FUND)/2 ELSE 1007

1006 GOTO 1010

1007 CAP (ICHIL, ICOUNT) = ((CFAM + FUND)/2) / (NCHIL – 1)

1010 NEXT KCHIL: FUND = 0

1020 NEXT I

Line 1005 instructs the computer to give the first-born child half of the inheritance. In line 1007, the remainder of the inheritance is distributed equally among the rest of the children in the family. A separate simulation was run for each of the three inheritance customs. The results are presented in Figure 10:

As illustrated in Figure 10, primogeniture is associated with the most unequal wealth distribution in society. Primogeniture perpetuates the existence of large fortunes by placing wealth in the hands of fewer people. In this case, the distribution of wealth would become more stratified as the eldest sons' large fortune is passed down to the next eldest son. As in the case of positive assortative mating, there is the same tendency for the perpetuation of wealth inequality due to the continuation of large inherited fortunes.

Wealth is more evenly distribution through both equal division and the compromise rule. Surprisingly, there is not a significant difference between these two inheritance patterns when analyzing wealth inequality, as demonstrated in Figure 10. In fact, the compromise rule actually has less associated wealth inequality than equal division. Although this is somewhat counterintuitive in reasoning, these results suggest that when examining their impact over many generations, the only custom that makes a significant impact on the overall distribution is primogeniture. Equal division and the compromise rule are fairly equivalent throughout most of the generations. This seems to suggest that although the first-born child receives half the inheritance when following the compromise rule, the wealth eventually becomes more evenly distributed after several generations. This custom of inheritance does not create a significantly more unequal distribution of long-run wealth than the equal division rule.

Combined Determinants of Wealth Inequality

It is helpful to analyze the overall impact that the four parameter modifications have when combined together in society. Based on the previous analysis, it was determined which program adjustments caused both the greatest amount of inequality and equality in society. The original program reconstructed by Bergman was once again used as a base line for the program modifications.

To account for a society in which the highest level of inequality occurred, the following adjustments were made to the program. First, only those with earnings above twice the average income level save their income. It was determined in prior analysis that this particular savings pattern causes the highest amount of inequality in society. To account for this particular pattern, no changes were made to the original program since it already followed this savings trend. Additionally, this analysis determined that the savings rate was positively related to the level of inequality under this particular savings pattern. Thus, a savings rate of .3 was used in this simulation to account for a society with the highest level of inequality. It was also determined that when the poorest half of the population has a higher fertility rate, there is more associated inequality in society. Therefore, the program was modified as follows:

```
1245 If I < IPOP/2 THEN FERTIL = 1.8 ELSE FERTIL = 2.1
```

The fertility rate of 2.1 instead of 2.3 was used to ensure that the arrays in the program had enough storage capacity for the population. Also, it was determined in prior analysis that positive assortative mating leads to a higher level of inequality. The program was thus manipulated in the following lines to account for this mating pattern:

```
700 FOR I = 1 TO IPOP STEP 2
710 IF ISPOU (I) <> 0 THEN GOTO 800
720 ICHOSE = I + 1
```

Lastly, it was previously discovered that the inheritance pattern of primogeniture is associated with the most inequality in the wealth distribution. Therefore, the program was changed as follows:

```
850 ICOUNT = 1: FUND = 0
1000 IF KCHIL = 1 THEN CAP (ICHIL, ICOUNT) = CFAM +
FUND
1010 NEXT KCHIL: FUND = 0
1020 NEXT I
```

After these program adjustments were made, a simulation was run to account for a society in which the highest level of inequality occurred.

Along with this simulation, a second simulation was run to account for a society in which the highest level of equality among the wealth distribution occurred. The following program modifications were made. As discovered in previous analysis, the savings pattern associated with the most equality is when everyone saves a fixed percentage of his or her income. Line 780 was modified as follows to account for this pattern:

```
780 SAVING = SAVMP * FAMINC
```

Also, a savings rate of .3 was used since with this savings pattern, a negative relationship results between equality and the savings rate. The next adjustment that created more equality in society is to account for the situation where wealthier families have a lower fertility rate and poorer families have a higher fertility rate:

```
1245 IF I<IPOP/2 THEN FERTIL = 2.1 ELSE FERTIL = 1.8
```

Once again, the fertility rate of 2.1 was used instead of 2.3 to ensure that the arrays would sustain the population. Since it was discovered in previous analysis that negative assortative mating leads to a greater level of equality, the following adjustments were made:

```
700 FOR I = I TO IPOP STEP 2
710 IF ISPOU (I) <> 0 THEN GOTO 800
```

720 ICHOSE = IPOP – I + 1

Lastly, the compromise rule was manipulated in the program since it was associated with the lowest level of inequality:

1005 IF KCHIL = 1 THEN CAP (ICHIL, ICOUNT) = (CFAM + FUND)/2 ELSE 1007
1006 GOTO 1010
1007 CAP (ICHIL, ICOUNT) = ((CFAM + FUND/2) / (NCHIL – 1)
1010 NEXT KCHIL: FUND = 0
1020 NEXT I

After accounting for those modifications that result in the highest level of equality among the wealth distribution, a simulation was run.

One simulation represented a society with the highest level of inequality, while the other represented a society with the most equality in the wealth distribution. The results of the two simulations are presented in Figure 11:

As illustrated in Figure 11, the two simulations were significantly different in their effects on the long-run wealth distribution. In fact, they were almost complete inverses of each other. As expected, the simulation that incorporated those program modifications that produced the greatest level of inequality also lead to a great level of inequality in this simulation run. In fact, the Gini coefficients were so high that they were almost equal to 1, which represents perfect inequality. The second simulation, accounting for those factors that tended to result in a more equal distribution of wealth, also produced the expected effects. It had a significantly lower level of inequality, with Gini coefficients greatly below that of the other simulation. Wealth is clearly more evenly distributed among individuals through these patterns of saving, fertility, marriage, and inheritance.

However, it can be concluded that the factors associated with a higher expected level of inequality have a greater impact on the long-run wealth distribution than those associated with more equality. As illustrated in Figure 11, the simulation that accounts for more inequality results in a greater change in the distribution of wealth. While the other simulation produced the expected results, there was a much stronger trend towards perfect inequality than perfect equality. This is seen through the proximity of the first simulation towards the upper end of the Gini coefficient range.

These findings can be used to help explain the problems associated with wealth inequality in today’s society. It is very difficult to achieve total wealth equality, even in a society where those factors that influence its long-run distribution are modified in favor of a more equal dispersion. There are too many conditions that prevent wealth from being more evenly distributed among individuals. Differences in human capital, family wealth, and economic opportunity cause the gap to widen between the rich and the poor, even with social programs to help combat these differences. Additionally, people start off life with a different set of resources. From the moment a child is born, there is an associated amount of inequality that can be traced to their family background and individual abilities. Since everybody starts off life with an unequal amount of wealth, opportunity, and human capital, it is much more difficult to remedy these differences.

Even when poor people are inclined to save more, as this previous simulation demonstrated, they still are unable to move up the economic ladder as rapidly as those who are wealthy. Although savings represents a greater percentage of wealth for poorer families, the initial wealth inequality is too great to substantially reduce. Despite a lower fertility rate among poorer families, the poor are still at a disadvantage due to the small amount of inheritance left to them from their parents. This correlation between the parent's wealth and the wealth of future generations partially explains the difficulties in narrowing wealth inequality gap. Similarly, inheritance and marriage patterns have less of an impact when remedying this inequality. While negative assortative mating and the compromise rule promote greater equality, they do not significantly change the long-run distribution of wealth.

On the other hand, it is much easier to amplify wealth inequality in a society where children start off life with different resources. This is demonstrated through the results of the previous simulations. Changes in the determinants of wealth distribution have a greater and more significant impact when those factors are modified in favor of a more unequal distribution. As seen in Figure 11, it is not difficult to increase the level of inequality by assuming different social patterns. When fewer poor people save in society, the gap between the rich and the poor is significantly amplified. Also, when poorer people have a higher fertility rate, this inequality is further applied to these families. Positive assortative mating and primogeniture also greatly affect the long-run wealth distribution by concentrating the wealth in the hands of fewer individuals. With these factors combined together, they result in an extremely high level of wealth inequality.

Conclusions

After modifying Pryor's original model to experiment with certain socioeconomic variables of interest, a more accurate depiction of long-run wealth accumulation was gained. Since existing theories of wealth distribution alone did not adequately explain this distribution across many generations, this analysis was helpful by combining those elements needed to formulate an adequate theory into one model. The outcomes of the simulations run on savings patterns, fertility rates, marriage patterns, and inheritance customs can be used to more accurately explain the patterns of wealth inequality.

It was discovered that a positive relationship between the savings rate and wealth inequality exists when the only families who save earn twice or above the average income. Conversely, a negative relationship was discovered between the savings rate and inequality when everyone in society saves a fixed percentage of their income. The greater the amount of poor people who save a fixed percentage of their income, the more equal the wealth distribution will eventually become. When examining the effects of different fertility rates, it was concluded that a positive relationship exists between fertility rates and the overall level of wealth inequality. After analyzing the impact of differential fertility rates, it was discovered that there is more associated inequality when the poorest half of the population have a higher fertility rate and the wealthy have a lower fertility rate. In this case, it was determined that because wealth was concentrated in the hands of a smaller percentage of wealthy people, the overall level of economic stratification increases.

By analyzing different social patterns such as marriage and inheritance customs, this study accounted for the effects of socioeconomic variables on the distribution of wealth over many generations. Many other models of wealth distribution have failed to account for such factors. This analysis discovered that greater wealth inequality results with positive assortative mating and less with negative assortative mating. Positive assortative mating leads to a situation in which wealth is more heavily clustered among those with the same economic background. The more random the marriages, the more equal the intergenerational wealth distribution. When examining inheritance customs, it was found that primogeniture is associated with the most unequal wealth distribution in society. On the other hand, wealth is more evenly distributed through both equal division and the compromise rule. By placing wealth in the hands of fewer people, primogeniture perpetuates the existence of large fortunes.

This analysis also provided insight into the combined effects of those determinants with both the highest level of inequality and highest level of equality on the long-run wealth distribution. It was discovered from these findings that it is much easier to create inequality in an economy than it is to remedy existing inequality. Changes in the determinants of wealth distribution were found to have a greater impact when modified in favor of a more unequal wealth distribution.

The inequality of wealth in America is much greater than the inequality of earnings. Thus, it is important to have an adequate theory that explains its long-run distribution. While the life-cycle model and theories of inheritance partially account for this distribution, they are lacking many of the socioeconomic variables that simulation models incorporate. This analysis incorporated many of the factors that were lacking in these existing theories of wealth distribution and provided new insight into existing simulation models. The findings from this analysis can be applied to the current economy to better analyze the recent distribution of wealth in the United States. With an adequate theory incorporating the many factors that determine intergenerational wealth distribution, society is one step closer to understanding the reasoning behind economic inequality.

Bibliography

Bergman, Barbara. "Micro-to-Macro Simulation: A Primer With a Labor Market Example." *Journal of Economic Perspectives* 4 (Winter 1990): 99-116.

Goldstein, Larry Joel, and Martin Goldstein. *IBM PC: An Introduction to the Operating System BASIC Programming and Applications*. Bowie: Robert J. Brady Co., 1984.

Pryor, Frederick. "Simulation of the Impact of Social and Economic Institutions on the Size Distribution of Income and Wealth." *The American Economic Review* 63 (March 1973): 50-72.

Orcutt, Guy. "Simulation of Economic Systems." *The American Economic Review* L (December 1960): 893-907.

Osberg, Lars. *Economic Inequality in the United States*. New York: M.E. Sharpe, Inc., 1984