The Economics of Poverty Intensity: A Cyclical Analysis in A Generational Framework

A DISSERTATION SUBMITTED TO

THE GRADUATE FACULTY OF
ECONOMICS AND FINANCE DEPARTMENT
MIDDLE TENNESSEE STATE UNIVERSITY
IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR
THE DEGREE OF DOCTORAL OF PHILOSOPHY IN ECONOMICS

BY

SOIBUPPHA SARTMOOL

MURFREESBORO, TENNESSEE
AUGUST 2005

APPROVAL PAGE

THE ECONOMICS OF POVERTY INTENSITY: A CYCLICAL ANALYSIS IN A GENERATIONAL FRAMEWORK

BY

SOIBUPPHA SARTMOOL

A DOCTORAL DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE

DOCTOR OF PHILOSOPHY IN ECONOMICS

AUGUST 2005

APPROVED BY:

Dr. Stuart J. Fowler, Committee Chair

Dr. Joachim Zietz, Committee Member

Dr. Reuben Kyle, Committee Member

Dr. John T. Lee, Department Chair, Economics & Finance

Dr. Abdul S. Rao, Dean, College of Graduate Studies

ACKNOWLEDGEMENTS

I owe a great debt of gratitude to my dissertation committee, Dr. Stuart J. Fowler, Dr. Joachim Zietz, and Dr. Reuben Kyle for their generous support, patience and constructive guidance.

I would like to thank the Economics and Finance Department at Middle Tennessee State University for generous financial support during my time as a graduate student in economics.

I am also indebted to Sittiporn Intuwonges, Ph.D. for his help and encouragement. Thank you for the wonderful journey we have had here at MTSU.

My greatest appreciation is reserved for my beloved mother, Renu Tharanatham, who always believes in me, and my sister, Ruenruedee Sartmool, who continues to assist me in my endeavors. I am deeply grateful for their love.

ABSTRACT

This dissertation addresses the issues on the persistence of poverty. Both policymakers and economists agree that one reason why the phenomenon of stagnating poverty rates is so difficult to understand and to treat lies in the inadequate measurement instruments that are used to identify poverty. To help public and policymakers better understand the incidence of poverty persistence, the study employs the SST poverty intensity index as the poverty measure, and finds that not only the number of poor population has persisted since the mid 1970s, but their economic poverty position has also deteriorated over time, in particular, young and middle-aged households. This deteriorating economic position in poverty of the low-income households is apparently consistent with the findings from Cutler and Katz (1991) and Blank (1993, 2000). There occur the unfavorable changes in labor market towards low-skilled and less-educated workers during the past economic expansions.

Furthermore, the study observes the cyclical change in the economic poverty position between the pre-1984 and the post-1984 periods, especially for middle-aged and old households. The break point in 1984 is where Stock and Watson (2003) suggest that the business cycle has considerably changed, and also it is the period, in which the anti-poverty effect of economic expansion started losing its power (Blank, 1993; Cutler and Katz, 1991).

Since changes in business cycle could reflect through the attitude on uncertainty, that may lead to changes in consumption and saving behaviors, hence, the economic poverty position. This research finds that the moderation in the business cycle has an

impact on the economic poverty position of low-income households, particularly the old households. Additionally, this dissertation finds that the fixed effects or individual's permanent characteristics related to innate ability and education have a profound effect to labor efficiency and the economic poverty position. Thus, this finding is very crucial for policymakers and government to design effective poverty-aid programs and welfare reforms perhaps through education and skill trainings that improve labor productivity of the working poor, which in turn raise their labor earnings. Consequently, this could help the economic poverty position of the low-income households or even move them out of poverty.

TABLE OF CONTENTS

LIST OF TABLES

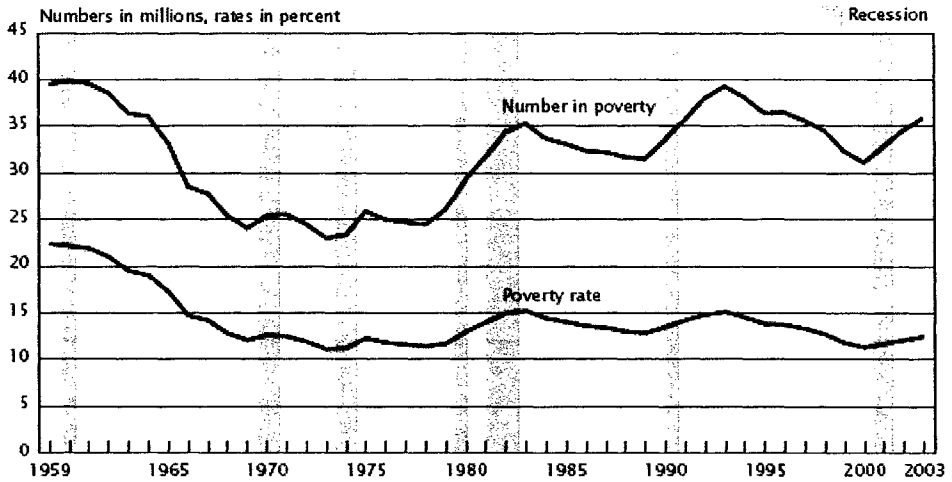
LIST OF FIGURES

Chapter 1

Introduction

1.1 General Introduction

The United States has tried to eliminate poverty for roughly four decades. Despite a surge of economic expansion and a number of antipoverty programs implemented by government and related agencies, the poverty rate remains persistently high. Figure 1 shows that the official poverty rate has fluctuated within a range between 10 and 15 percent since the mid 1960s. According to the 2003 statistic, the population living in poverty was 12.5 percent, a decrease of only 2.2 percentage points from 1966 (U.S. Census Bureau, 2004b). The persistence in the poverty rate raises many questions, especially on the effectiveness of economic growth in eliminating poverty. Numerous well-known studies such as Blank and Blinder (1986), Danziger and Gottschalk (1986), Sawhill (1988), Cutler and Katz (1991), Blank (1993, 2000), Romer and Romer (1999), Haveman and Schwabish (2000), R. Freeman (2001) and D. Freeman (2003), among many others, find that the anti-poverty effect of economic growth still exists; however, the impact on the poverty rate has been weak since the mid 1970s.



Note: The data points are placed at the midpoints of the respective years.
Source: U.S. Census Bureau, Current Population Survey, 1960 to 2004 Annual Social and Economic Supplements.
Available: http://www.census.gov/hhes/www/poverty/poverty03/pov03fig03.pdf

Figure 1-1: Poverty Rate and Number of People in Poverty from 1959 to 2003

Danziger and Gottschalk (1986), Sawhill (1988), Blank (1993, 2000), Cutler and Katz (1991, 1992), and Romer and Romer (1999) also suggest that an increase in income inequality led largely by a widening in wage differentials could potentially be a major factor contributing to the diminishing anti-poverty effect of economic expansion.[1] For example, the wages among high-skilled workers had gone up, but the opposite was true for low-skilled workers. Even though the average income rose during the expansions in the 1980s and the 1990s, the increases in incomes were unevenly distributed across the individuals. The low-skilled workers, particularly those at the bottom 20 percent who rely heavily on wage earnings as their dominant source of income, had enormously felt the impact of the inverse effect of economic upturns.

[1] The literature also discusses other possible reasons including demographic changes and behavioral changes due to generous transfer programs. However, Sawhill (1988), Blank (1993), and Cutler and Katz (1991) show and discuss in detail that these reasons account for a very small part of the poverty persistence.

Many economists have claimed that income inequality due to the adverse labor market outcomes could be the underlying explanation for the persistence in the poverty rate over the past decades; however, they have not yet quantified the counter effect of the income disproportion. It is still a question whether the unevenly distributed income moved the working poor further from or closer to the poverty line and by how much. To begin addressing the clue may lie at the nature of the poverty rate, which is typically used as a poverty measure in the literature. By design, it cannot capture the changes in the income distribution of the poor as a result of the inverse effect of the economic expansions, especially in the 1980s and the 1990s. The poverty rate merely represents the proportion of the population living in poverty. Additionally, the literature suggests that different groups in the population are likely to respond differently to economic conditions (Blank and Card, 1993; Cutler and Katz, 1991; Balke and Slottje, 1993). In particular, Cutler and Katz (1991) find that the low-skilled and less educated working poor were far less responsive to economic expansion in the 1980s.

These lead to my dissertation topic "The Economics of Poverty Intensity: A Cyclical Analysis in A Generational Framework". In this study, I document U.S. poverty by employing the Sen-Shorrocks-Thon poverty intensity index as the poverty measure. This index has been proved to be more comprehensive and more informative relative to the common poverty rate. The SST index measures the degree of poverty or how poor the poor are. It incorporates not only the incidence of poverty but also the distribution of income among the poor. This measure enables the study to better observe how economic conditions and adverse labor market developments affect the poor and their distribution of income, which basically determines their economic position in poverty. Understanding

the poor and their economic position in poverty should provide answers to various important questions regarding to the incidence of poverty persistence. Moreover, by relying on this comprehensive and informative poverty measure, the government and policymakers are able to design more effective anti-poverty programs that can reach their targets with more precision.

In addition, Stock and Watson (2003) suggest that the business cycle changed considerably, specifically in the mid 1980s, when the anti-poverty effect of economic expansion started losing its power (Blank, 1993; Cutler and Katz, 1991). This research also explores the characteristics of the cyclical behaviors of the economic position of the poor across age groups under an overlapping generations framework. Since changes in the business cycle could reflect an attitude of uncertainty that may lead to changes in consumption behavior, saving behavior, and hence economic poverty position. Therefore, this research examines the effect of moderation in the business cycle, more specifically on the economic poverty position of low-income households, and to find the contributing factors for changes in their economic poverty position.

The dissertation proceeds as follows. Chapter 2 provides the empirical facts of poverty intensity and economic poverty position of low-income households. In Chapter 3, the study examines the effects of changes in the business cycle on the economic poverty position. In addition to that, this chapter explores the effects of shifting labor productivity variances that could possibly contribute to the change in the economic poverty position. Chapter 4 concludes the research.

Chapter 2

The Empirical Facts of Poverty Intensity and Economic Poverty Position in the U.S.

2.1 Introduction

The persistence of poverty has led to a rethinking of poverty and the way in which the stagnating rates of poverty can be reduced. The trickle-down effect of economic growth (Anderson, 1964) appears no longer sufficient to reduce poverty. Numerous programs aimed at poverty reduction also have not worked as expected to bringing down poverty rates. Something appears to be amiss.

Both policymakers and economists agree that one reason why the phenomenon of stagnating poverty rates is so difficult to understand and to treat lies in the inadequate measurement instruments used to identify poverty. In particular, although the poverty rate is the measure that is most understandable to the public, it merely captures the proportion of the population that lives in poverty. The poverty rate does not capture information on several aspects of poverty that would be crucial in any attempt to further reduce poverty. For example, one would want to know not only who is poor but also how severe the degree of poverty is and/or where the poor stand in the poverty cycle. These pieces of

information are critical for policymakers in designing and channeling aid to the poor who are in need.

This chapter has two main objectives. First, it documents U.S. poverty with the help of a poverty measure that is both more comprehensive and more informative than the common poverty rate. Second, it identifies how economic conditions, such as those brought about by the business cycle, change the economic position within the income range that is classified as poverty.

In a new branch of the poverty literature, Rodgers and Rodgers (1991 and 2000), Osberg and Xu (1999 and 2000), Myles and Picot (2000), and Osberg (2002), for example, have begun to apply new, more comprehensive and informative measures to assess poverty.[1] This study follows their example and employs the Sen-Shorrocks-Thon (SST) poverty intensity index as proposed by Osberg and Xu (1999 and 2000). The SST poverty intensity index is the product of the poverty rate, the average poverty gap ratio, and the inequality in poverty gaps. The SST index measures the degree of poverty or how poor the poor are. Its components also reveal who the poor are and where the poor are located within the poverty range. Income distribution among the poor plays a crucial role in assessing the well-being of the poor. Both the mean income - how far the poor are from the poverty line, on average - and the variance of income - how poverty is distributed below the poverty line - are important determinants of income distribution among the poor. While the SST measure captures changes in the income distribution of

[1] Rodgers and Rodgers (1991) apply Sen's initial poverty intensity index and several other poverty intensity indices in measuring the welfare of the poor. Osberg and Xu (1999, 2000), Myles and Picot (2000), and Osberg (2002) devote their work to the SST poverty intensity index and its decomposition, proposed by Osberg and Xu, which is the latest improvement of Sen's poverty intensity index. Most works study the poverty incidence in Canada and Europe.

the poor, the common poverty rate measure does not, this is because the latter violates two important properties of a poverty measure: the *Monotonicity Axiom*, which states that a decline in income of a poor household must increase a poverty measure, and the *Transfer Axiom*, which states that a pure transfer of income from a poor household to any other household that is richer must increase a poverty measure (Sen, 1976). Generally, the poverty rate captures neither the effect of the decline in income nor the impact of the transfer of income of poor households. It only provides the number of people in poverty.

For example, it is possible to reduce the poverty rate by taking money from the very poor to lift some of the poor near the poverty line out of poverty. Even though the poverty rate declines, the very poor become poorer as they are being pushed deeper into poverty and their economic position worsens. As another example of the inadequacy of the poverty measure, consider that counting people who live in poverty would give the same poverty rate whether the poor are just below the poverty threshold or very far from the threshold at the bottom of the income scale. Thus, the poverty rate presents a very rudimentary picture of poverty, one that is unable to reflect the economic position or well-being of the poor. Yet having such a measure of economic position is, in fact, an important aspect of understanding and ultimately treating poverty (Deaton, 1997 and 2004). The SST poverty intensity index is far superior to the conventional poverty rate in terms of its ability to display several necessary pieces of information at once since the SST index reflects the impact of changes in the incomes of the poor through its various components. To convey this useful information to the public and to policymakers, this chapter uses a simple graphic method to present the SST index and its various dimensions of poverty (Osberg, 2002).

Although the literature has begun to study poverty incidence and the well-being of the poor with the SST index, to date very little is known about the business cycle behavior of poverty intensity.[2] This chapter appears to be the first attempt to study the business cycle behavior of poverty intensity and economic poverty position using the SST poverty intensity index. Of particular interest will be the question of whether an economic expansion moves the poor up or down the income scale within the poverty range and by how much. For this purpose, the study defines a movement within the poverty range through which the poor become either better or worse off as a change in economic poverty position. This chapter focuses on (i) movements in the economic poverty position as a result of cyclical expansions or contractions and (ii) periods for which the cyclical behavior of poverty has changed, if such behavior exists.

Understanding the poor and their economic position within poverty offers an important perspective on some questions on the incidence of poverty persistence. So far, the government has solely relied on the simple poverty rate in constructing and evaluating policies aimed at poverty reduction. However, this official poverty statistic is an inaccurate yardstick due to its inability to capture significant characteristics of poverty, such as the economic well-being of the poor (Burtless and Smeeding, 1994). Relying on a more comprehensive poverty measure will likely help policymakers and the government to design more appropriate anti-poverty programs that reach their targets more precisely.

[2] Osberg and Xu (2000) mention only briefly the connection between business cycles and the SST poverty intensity measure.

A case in point of precise targeting relates to the poverty experience of households in different age groups. The literature suggests that different groups in the population are likely to respond differently to changes in economic conditions (Blank and Card, 1993; Cutler and Katz, 1991; Balke and Slottje, 1993). In particular, the two bottom quintiles of income distribution appear to be less responsive to economic expansions but more responsive to economic downturns. Moreover, Cutler and Katz (1991) find that, since the mid 1970s, the working poor are far less responsive to economic growth. This applies in particular to young households headed by less-skilled and less-educated workers. These findings are based on measurements that rely on the poverty rate rather than the position of the poor in poverty. The question to be addressed is to what extent a new measurement concept modifies these results.

To document business cycle effects on poverty, the study uses the Panel Study of Income Dynamics (PSID), conducted by the Survey Research Center at the University of Michigan. The PSID is a nationally representative longitudinal survey that emphasizes the dynamic aspects of economic and demographic behavior, especially the dynamics of employment, earnings, and income over the life cycle. The PSID is chosen because the income data are of high quality and consistent over time. Both of these characteristics are important in constructing income-based poverty measures.

The study finds that the SST poverty intensity and the poverty rate often move together in the same direction during the 1968 to 1996 period. However, the two poverty measures respond to changes in economic conditions to a different extent. The poverty intensity measure is far more sensitive to recessions than the poverty rate. There are also noticeable changes in the magnitude of the economic responsiveness of the two indices,

especially during recessions, in which the income of the poor has been considerably altered. This finding is consistent with the fact that the economic position of the poor within poverty mostly deteriorates in recessions.

To evaluate variations in the cyclical behavior of the economic poverty position or the EPP, this chapter performs a simple correlation analysis between the EPP and a business cycle indicator. Since the study covers five recessionary periods, it is possible to check whether the cyclical behavior of the EPP changes over time. The correlation analysis is, therefore, run for three intervals, the pre-1984 years from 1968 to 1983, the post-1984 years from 1984 to 1996, and the overall period from 1968 to 1996, based on Stock and Watson (2003). Strikingly, the cyclical behavior of the EPP appears to change between these periods. The study also examines the cyclical behavior of the change in economic poverty position of the different age groups of poor households.

The main findings of the analysis of the business cycle behavior of poverty can be summarized as follows: (i) the economic poverty position has deteriorated since the mid 1970s in spite of economic expansions over the period; (ii) the economic poverty position seriously worsens in recessions; (iii) different age groups of poor households suffer significantly from different recessions; (iv) poor households experience different degrees of economic deterioration over their life cycle; and (v) there is a statistically significant change in the cyclical behavior of the economic poverty position of the old households from weak procyclicality in the pre-1984 period to moderate countercyclicality in the post-1984 period.

The remainder of the chapter is organized as follows. Section 2.2 lays out the rationale for using the alternative poverty measure and briefly explains the computational

process of the SST poverty intensity index. In Section 2.3, the dataset and variables employed in this chapter are described. Sections 2.4 and 2.5 report in detail the empirical findings related to the cyclical behavior of the SST poverty intensity and poverty rate measures and also present the empirical analysis of the cyclical behavior of the economic poverty position, respectively at the aggregate level and for different age groups. Finally, Section 2.6 draws conclusions.

2.2 Alternative Poverty Measure

2.2.1 Rationale for Alternative Measures

A significant reorientation of the poverty literature began with Sen's pioneering work on poverty measures in 1976. The discussion of the desirable properties of poverty measures has captured considerable attention. Sen's original poverty index has significantly impacted the literature on poverty measurement. New measures have been developed and existing poverty measures modified. Among those measures attracting the most attention are the Sen index (Sen, 1976), the FGT index (Foster, Greer, and Thorbecke, 1984), and the poverty intensity indices by Sen (1976), Thon (1979, 1983), and Shorrocks (1995). Economists and scholars have widely accepted the new indices because of their superior properties compared to the poverty rate. For the public and many policymakers, however, the alternative poverty indices remain difficult to interpret and understand. Consequently, they are not typically used for poverty analysis, especially in the United States. Despite all the deficiencies of the poverty rate and attempts to construct better poverty measures, there is no consensus on a substitute, at least not yet.

Recently, Osberg and Xu (1999 and 2000) have proposed a new version of one of the alternative measures to reduce its complexity and offer ways for the general audience to interpret and understand this poverty measure. The poverty intensity index initially developed by Sen (1976) was modified by Shorrocks (1995) and is identical to Thon's (1979 and 1983). Therefore, it is henceforth, referred, to as the Sen-Shorrocks-Thon (SST) index of poverty intensity.[3] The desirable characteristics of the SST index have allowed Osberg and Xu to decompose the index into the product of three components: the poverty rate, the average poverty gap ratio among the poor, and the Gini index of poverty gap ratios.[4] As a simple extension, the percentage change in the poverty intensity index can be expressed as the sum of the percentage changes in its three components. Since the percentage change in the SST index can be easily decomposed, it can be used to examine the differences in the severity of poverty among subpopulations, for example, states, races, ethnicities, family types, or age groups.[5]

Osberg (2002) develops a simple graphic method called the "poverty box" to demonstrate the results of poverty intensity and its decomposition. This graphic interpretation offers the public and policymakers meaningful information about the poverty index in a simple manner. The poverty box provides a visual illustration of the poverty intensity level, and each dimension of the box indicates a contributing source of poverty intensity. This simple poverty box is fairly convenient for the public and policymakers to understand and thus helps them to interpret the results of the poverty

---

[3] See Shorrocks (1995) and Thon (1979) for a detailed discussion of the limitations of the index and technical modifications.

[4] See Xu (2001) for a detailed discussion regarding how to decompose the SST poverty intensity index.

[5] These papers particularly emphasize the need for studying poverty among subpopulations. Rodgers and Rodgers (1991) use the FGT index to analyze sources of poverty intensity across U.S. states, and Cushing and Zheng (2000) use it to study locational differences in poverty intensity in the U.S.

intensity analysis. For example, it is used in comparing different intensity levels at different time periods (Osberg, 2002). With the new formulation of the index and a graphic illustration to convey the crucial aspects of poverty, one can reasonably assume that the SST poverty intensity index is preferred over the conventional poverty rate for poverty measurement and analysis.

The SST poverty intensity index is not only more suitable for poverty measurement and analysis but also more appropriate for policy implementation and evaluation. As Myles and Picot (1999 and 2000) emphasize, it is often hard for policymakers to evaluate poverty policies that improve the well-being of the poor but do not raise their incomes over the poverty thresholds. Since incremental improvements in the status of the poor cannot be captured by the poverty rate, these changes remain statistically invisible to the public and policymakers. The big improvement of the SST poverty intensity index from a policy perspective is that it picks up changes in the distribution of poverty. It offers policymakers an additional standard by which to measure the effects of poverty reduction programs. This is important because it can prevent policymakers from eliminating poverty reduction programs that have a beneficial effect on the distribution of poverty but no effect on the rate of poverty. [6]

[6] Osberg (2002) argues that the choice of the poverty index matters for both measurement purposes and for economic analysis. He observes the discrepancies between the poverty rate and poverty intensity, particularly for the U.K. Poverty rate and poverty intensity change in the opposition direction over time.

2.2.2 The Poverty Intensity Index and Decomposition

This chapter considers the SST poverty intensity index as modified by Osberg and Xu (1999, 2000). Their poverty intensity index is composed of three elements, the poverty rate, the average poverty gap ratio, and the Gini index of inequality of the poverty gap ratios. More formally, we have

$$SST = (Rate)\ (Gap)\ (1+Gini), \tag{1}$$

for the N-person income vector Y and the poverty thresholds Z.

For computing the number of people living in poverty, this chapter uses the same procedure as the one employed by the U.S. Census Bureau. Thus, the first component, the poverty rate (*Rate*), is defined as

$$Rate = \frac{Q}{N},$$

where Q is the number of the poor, and N is the total population. The number of the poor, Q, includes all those whose income lies below the absolute poverty threshold, Z.

The poverty gap ratios are computed as

$$X_i = \frac{Z - Y_i}{Z}, i = 1,2,...,N,$$

where the X_i are set to zero for the nonpoor population. Thus, the average poverty gap ratio for the poor or *Gap* is defined as

$$Gap = \frac{1}{Q}\sum_{i=1}^{N} X_i .$$

The last component of the poverty intensity index is the Gini coefficient of the poverty gap ratios (*G*ini),[7] which is defined as

$$Gini = 1 - \left(\frac{1}{N}\right)\sum_{i=1}^{N}\left(\frac{\sum_{j=1}^{i} X_j + \sum_{j=1}^{i-1} X_j}{\sum_{j=1}^{N} X_j}\right). \qquad (2)$$

A useful feature of the above version of the SST poverty intensity index is that we are able to track the changes in poverty intensity and the contributing sources of those changes over time by transforming equation (1) into logarithmic form:

$$\ln[SST] = \ln[Rate] + \ln[Gap] + \ln[1 + Gini], \qquad (3)$$

where the term $\ln[1 + Gini]$ can be approximated by the term *Gini* based on a first-order Taylor series expansion. The change in poverty intensity can then be expressed as:

$$\Delta\ln[SST] = \Delta\ln[Rate] + \Delta\ln[Gap] + \Delta\ln[1 + Gini], \qquad (4)$$

where $\Delta\ln[1 + Gini]$ can be approximated by the term $\Delta Gini$. Thus, the overall change in poverty intensity is the sum of the percentage changes in the poverty rate, the average poverty gap ratio among the poor, and the Gini index of inequality in the poverty gap ratios among all people.

[7] Individual poverty gap ratios are ranked from smallest to largest in computing equation (2).

The percentage changes over time in the inequality measure [1 + *Gini*] are relatively small and constant, as shown in the analysis of Osberg and Xu (1999, 2000), Myles and Picot (2000), and Osberg (2002). In practice, the percentage change in poverty intensity can be approximately expressed as the sum of the percentage changes in the poverty rate and the average poverty gap ratio. In addition, when the magnitude of change in equation (4) is small, the percentage change equation can be used as an approximation of the logarithmic identity. Therefore, sometimes the percentage change format is used as a substitute for the logarithmic identity: the percentage change in poverty intensity is approximately equal to the sum of percentage change in *Rate* and in *Gap*.

In examining the cyclical behavior of poverty, the study is particularly interested in both the cyclical movements of poverty incidence and economic poverty position within the poverty range. Poverty incidence is technically represented by the poverty rate (*Rate*). The economic poverty position of the poor depends on the distribution of income among them. Thus, it can be derived from equation (3) by rearranging terms as follows:

$$\ln[SST] - \ln[Rate] = \ln[Gap] + \ln[1 + Gini].$$

Thus, the economic poverty position of the poor is defined as

$$\ln(EPP) = \ln[SST] - \ln[Rate] \tag{5a}$$

or

$$\ln(EPP) = \ln[Gap] + \ln[1 + Gini]. \tag{5b}$$

Poverty intensity and the poverty rate may differ in periods when (i) poor households experience a reduction in income; (ii) there is a pure transfer of income away from poor households; or both (i) and (ii). The economic poverty position changes because the income has been redistributed. This chapter uses equations (5a) or (5b) to document the cyclical trend of the economic poverty position of the poor and to characterize periods in which their economic poverty position has changed.

The location of the poor within poverty depends on the mean income among the poor (*Gap*) and the variance of income among the poor (*Gini*), which is the income distribution of the poor. Changes in the distribution of income are usually employed to determine changes in the well-being of people (Cutler and Katz, 1991). Thus, movements in the economic poverty position of the poor can be used to identify changes in the well-being of the poor. Since "well-being" and "welfare" can be determined by many variables other than income, this study will use the term "economic poverty position" throughout to avoid confusion over terms with the existing works in the welfare literature.

2.3 Data and Definitions

The primary data used to construct the SST poverty intensity index from 1968 to 1996 come from the Panel Study of Income Dynamics (PSID), conducted by the Survey Research Center at the University of Michigan.[8] The PSID, begun in 1968, is a nationally representative longitudinal study of U.S. families and individuals. It emphasizes the broad aspects of economic and demographic behavior such as the dynamics of

[8] For details on the PSID, go to http://psidonline.isr.umich.edu/Guide/Overview.html.

employment, earnings, or income over the life cycle. Because of its high quality and the consistency of its income data (Gouskova and Schoeni, 2002), the PSID has been widely used as the main dataset to study income, poverty, and welfare dynamics (Gottschalk and Ruggles, 1994).

The process of constructing the SST poverty measure is comparable to the official U.S. procedure in terms of the definitions of income and poverty thresholds. A description of the data and variables follows.

Poverty Thresholds.[9] The poverty thresholds represent family income needs at the minimal subsistence level, based on the so-called economy food plan of the U.S. Department of Agriculture. The thresholds were calculated in 1965 as the cost of a nutritionally adequate diet for households of a given size and composition, multiplied by three, reflecting the proportion of food in the total cost of household consumption.[10] These poverty thresholds or standard poverty lines have been adjusted by the Consumer Price Index for All Urban Consumers (CPI-U) every year since then. For instance, by 1980, the poverty threshold was $6,628 for a three-person family (two adults and one child), and by 1995 it was $12,267. The poverty threshold thus works as a yardstick to determine whether a particular family is in poverty or not. If the family is considered

[9] Many have suggested and studied new approaches of improving the poverty threshold. For example, Citro and Michaels (1995) from the National Research Council's Panel on Poverty and Family Assistance have included more of the necessities of daily life in their minimum standard of living; Garners, Short, Shipp, and Paulin (1998) have examined the thresholds recommended by the panel in measuring poverty and confirmed that they appear superior; and Short and Garner (2002) have attempted to take medical expenses into account in their measures. These innovations, however, are beyond the scope of this study. Following the common practice, the official poverty thresholds are adopted as the poverty lines for this analysis.

[10] The multiplier, however, is different for one- and two-person households to reflect the diseconomies of small scale.

poor, all members in that family are taken to be poor since all members of the household are assumed to share the family income equally.

This study employs the official poverty thresholds publicly available from the U.S. Census Bureau.[11] These poverty thresholds vary by size of family and number of children under 18 years of age and are defined in current values. To simplify the calculations, the study uses a series of the weighted average poverty thresholds, differentiated only by family size regardless of the number of children in the family, to compute the poverty rate and the SST poverty intensity index. Each household confronts its own poverty threshold depending on the size of the family. For example, in 1980, the poverty threshold for a household with three members in the family unit was $6,565.[12]

FamilyResources. The total family money income is computed for the years 1968 to 1996. The study follows the official definition of resources used in calculating the official poverty rate by the U.S. Census Bureau, which is the gross (pretax) annual money income from all sources including earnings, unemployment compensation, workers' compensation, social security and supplemental security income, public assistance, veterans' payments, survivor benefits, pension or retirement income, interest, dividends, rents, royalties, income from estates, trusts, educational assistance, alimony, child support, assistance from outside the household, and other miscellaneous sources. This income does not contain noncash benefits such as food stamps and housing subsidies or

[11] For details on poverty thresholds, go to http://www.census.gov/hhes/poverty/threshld.html.
[12] See Appendix 2.7A - Table A1 for the official poverty thresholds applied in this study.

capital gains and losses. The total family income includes all incomes of all family members except for nonrelatives such as housemates.

Corresponding to the above definitions, the total family income is derived from the PSID as the sum of (1) taxable income of household head and wife; (2) transfer income of household head and wife; (3) taxable income of other family unit members (OFUMs); (4) transfer income of OFUMs.[13] All components of income recorded in a given year are expressed in previous year dollars. For instance, total family money income as reported in the 1984 survey refers to 1983 family money income. According to recent adjustments in data collections, starting with 1994, all income components and total family money income are now in the Family Income Plus file.

Family Size. The variable "# IN FU" representing the number of members in the family unit at the time of the interview is obtained from PSID. It is used in order to identify the poverty threshold for a family corresponding to its size.

Age of Head. The variable "AGE OF HEAD" from PSID represents the actual age of the head of the family unit. The study uses this variable to categorize households into three different age groups.

This study classifies working adults into the working young and the working middle-aged groups to observe how the economic position of the working poor has changed throughout their working lives. Thus, the age groups of interest are the working young, the working middle-aged, and the elderly. Households are categorized as young, middle-aged, or old if the age of the family head is, respectively, in the range from 20 to

[13] Appendix 2.7A - Table A2 details the categories of income taken from the PSID.

29 years, 30 to 65 years, or 66 years and above. These age groups are selected because they are most likely of interest to policymakers.

Dataset for Poverty Intensity Index. Households with missing values are removed from the sample. The study also limits the sample to households whose head is aged 20 to 97. The sample excludes households with negative income, which may arise from one-time business or farm losses. For the years 1968 to 1992, households with an income of $1 are also dropped because, prior to 1994, negative and zero incomes were bottom-coded at $1. The sample covers 147,106 households, with approximately 5,000 households for each year. On average, each year's sample comprises 25 percent young households, 60 percent middle-aged households, and 15 percent old households.[14]

Business Cycle. To document the cyclical behavior of poverty intensity and the poverty rate, the study uses real Gross Domestic Product (GDP) per capita. The real value of GDP comes from the Bureau of Economic Analysis, and population data come from the U.S. Census Bureau. Real GDP is in chained 1996 dollars.

[14] Appendix 2.7A – Tables A3 and A4 provide brief descriptive statistics of the dataset.

2.4 Poverty Analysis at the Aggregate level

2.4.1 Behavior of Poverty and the Economic Poverty Position

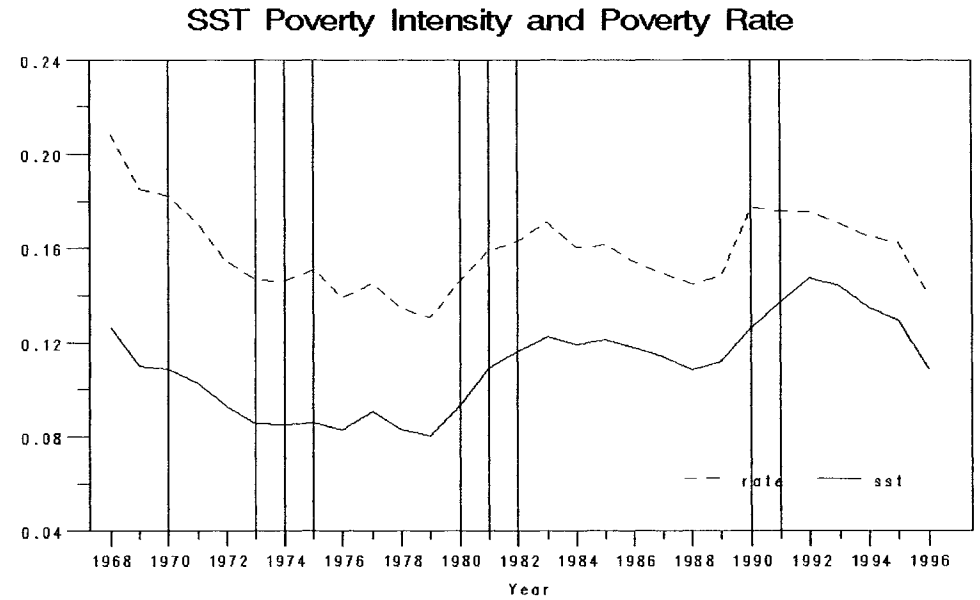


Figure 2-1: Poverty Trends from 1968 to 1996. The poverty rate represents the proportion of the sample households in poverty, while the poverty intensity index records the degree of poverty.

The poverty intensity index and the poverty rate move together for the most part over the 1968–1996 period (Figure 2-1). This is consistent with the findings of Osberg (2002). There are two significant upsurges in the poverty rate and the poverty intensity index. One is in the early 1980s and the other in the 1990s. There also appears to be a change in the magnitude of the economic responsiveness of the indices, especially during recessions (Figure 2-2 and Table 2-1). The two poverty measures differ in how they respond to changes in economic conditions. In particular, poverty intensity is far more sensitive to

recessions. The behavior of the poverty intensity measure suggests that not only does the number of poor people increase in a recession, but the poor also become poorer.

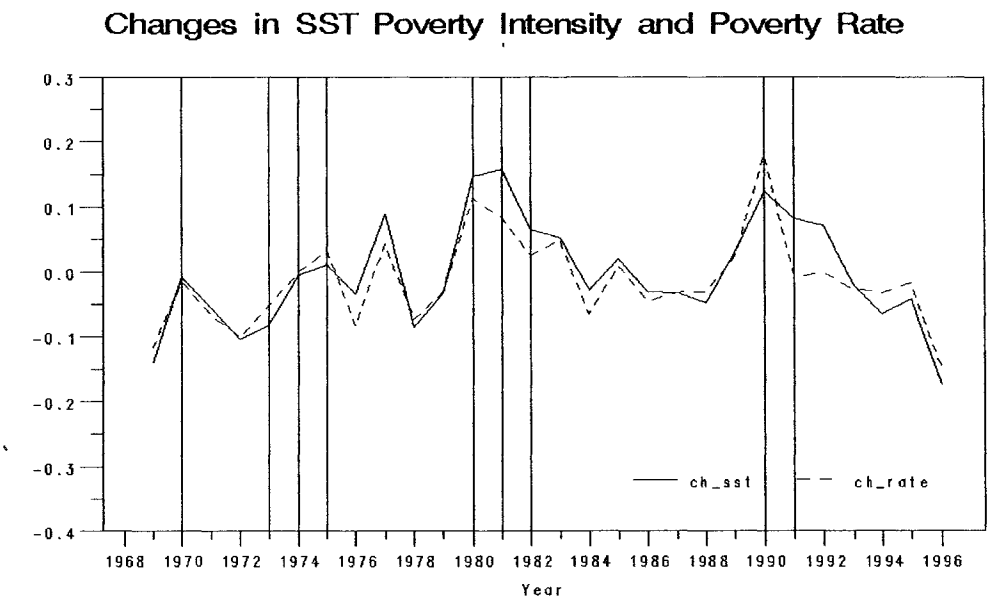


Figure 2-2: The Cyclical Behavior of Changes in the Poverty Intensity Index and the Poverty Rate. The rate of change in SST of poverty intensity is the sum of the percentage changes in the *rate*, the *gap*, and the (1+*Gini*).

From Figure 2-1, the poverty intensity index is always below the poverty rate.[15] The distance between the two lines depends on the other two components of the poverty intensity measure, which are the average in poverty gap ratios (*Gap*) and the inequality among the poor (1+*Gini*). The distance, therefore, reflects the economic poverty position of the poor. It is important to note that, over the past two decades, these two indices have moved closer together. This implies that the poor have moved deeper into poverty. The

[15] In most cases the SST poverty intensity is lower than the poverty rate. There is only an extreme case for which the SST would be the same as the poverty rate: both the *Gap* and the term (1+Gini) would have to equal unity. This would imply that the shortfall in income of all the poor equals, on average, the poverty threshold and there is no income inequality among the poor.

deterioration of the well-being of the poor is due to a widening of the average poverty gap and/or increasing income inequality among the poor.

Table 2-1: The SST Poverty Intensity Index, Decompositions and Changes for All Households

Year	*SST*	Decomposition			*Δln(SST)*	Decomposition of Change		
		Rate	*Gap*	*1+Gini*		*Δln(Rate)*	*Δln(Gap)*	*Δln(1+Gini)*
1968	0.1263	0.2080	0.3249	1.8685				
1969	0.1099	0.1850	0.3148	1.8867	-0.1391	-0.1172	-0.0316	0.0097
1970	0.1089	0.1822	0.3172	1.8854	-0.0085	-0.0152	0.0074	-0.0007
1971	0.1029	0.1705	0.3192	1.8914	-0.0569	-0.0664	0.0064	0.0032
1972	0.0928	0.1542	0.3158	1.9053	-0.1036	-0.1004	-0.0106	0.0073
1973	0.0855	0.1464	0.3059	1.9088	-0.0818	-0.0517	-0.0319	0.0018
1974	0.0850	0.1461	0.3048	1.9093	-0.0058	-0.0022	-0.0038	0.0003
1975	0.0859	0.1509	0.2981	1.9096	0.0103	0.0322	-0.0220	0.0001
1976	0.0829	0.1388	0.3121	1.9139	-0.0351	-0.0833	0.0459	0.0023
1977	0.0906	0.1449	0.3274	1.9106	0.0885	0.0426	0.0477	-0.0018
1978	0.0832	0.1346	0.3223	1.9186	-0.0851	-0.0735	-0.0158	0.0042
1979	0.0805	0.1304	0.3219	1.9184	-0.0329	-0.0315	-0.0013	-0.0001
1980	0.0932	0.1460	0.3344	1.9088	0.1457	0.1127	0.0381	-0.0050
1981	0.1090	0.1587	0.3618	1.8985	0.1569	0.0835	0.0788	-0.0054
1982	0.1162	0.1627	0.3764	1.8971	0.0638	0.0248	0.0397	-0.0007
1983	0.1224	0.1708	0.3785	1.8938	0.0526	0.0490	0.0054	-0.0018
1984	0.1189	0.1600	0.3916	1.8976	-0.0291	-0.0653	0.0342	0.0020
1985	0.1212	0.1613	0.3963	1.8963	0.0193	0.0081	0.0118	-0.0007
1986	0.1175	0.1541	0.4012	1.9011	-0.0310	-0.0459	0.0123	0.0025
1987	0.1137	0.1492	0.4002	1.9044	-0.0330	-0.0323	-0.0024	0.0017
1988	0.1084	0.1446	0.3924	1.9092	-0.0483	-0.0311	-0.0196	0.0025
1989	0.1116	0.1479	0.3957	1.9067	0.0294	0.0224	0.0084	-0.0013
1990	0.1263	0.1769	0.3776	1.8905	0.1237	0.1793	-0.0470	-0.0085
1991	0.1371	0.1755	0.4140	1.8870	0.0821	-0.0083	0.0922	-0.0019
1992	0.1472	0.1752	0.4450	1.8879	0.0709	-0.0017	0.0721	0.0005
1993	0.1439	0.1704	0.4463	1.8916	-0.0225	-0.0276	0.0031	0.0020
1994	0.1347	0.1650	0.4303	1.8975	-0.0659	-0.0324	-0.0366	0.0031
1995	0.1291	0.1621	0.4197	1.8983	-0.0427	-0.0180	-0.0251	0.0004
1996	0.1086	0.1401	0.4047	1.9143	-0.1732	-0.1454	-0.0362	0.0084

Data Source: The Panel Study of Income Dynamics (PSID)

The change in economic poverty position started roughly during the double-dip recession of the early 1980s. The poverty intensity rose from 8.0 percent in 1979 to 11.6 percent in 1982, while the poverty rate increased 3.2 percent (Table 2-1). The rapid increase in the poverty rate, which is typical for a recession, is the dominant source of the 22 percent rise in poverty intensity over this period. The increase in the average poverty gap ratios contributes about 15.7 percent to the surge in poverty intensity. Income inequality among the poor decreased slightly. Hence, the economic poverty position over the 1978-1982 time period deteriorated primarily on account of the widening of the *Gap*.

In the following economic recovery, the poverty intensity and the poverty rate started to fall. However, although the SST poverty intensity fell, the average poverty gap ratios were widening and the inequality among the poor was increasing. Although favorable economic conditions caused the number of poor people to decline, those remaining in poverty tended to be worse off. In other words, the economic position of the poor became worse during the mid-1980s economic expansion.

A similar reaction to an economic contraction occurred in the early 1990s but with smaller movements in poverty. The poverty intensity went up from 11.1 percent in 1989 to 14.7 percent in 1992. This increase of about 28 percent can be decomposed into an increase in the poverty rate of 16.9 percent and a deepening of poverty, which is responsible for the remaining 11.7 percent. The income inequality among the poor also declined over this recession. In the following recovery period, the poverty intensity responded well to the economic expansion and declined sharply to 10.9 percent in 1996. The strong response of the poverty intensity can be attributed to the combination of a

rapid decrease in the poverty rate and a small decline in the *Gap*. Income inequality among the poor increased but only marginally.

It is clear from Figure 2-1 and Table 2-1 that the poverty rate is much lower in 1996 than in 1968. By contrast, the poverty intensity is only slightly lower in 1996 than in 1968. The reason is that the *Gap* and the income inequality of the poor have increased over the three decades.[16] For instance, the *Gap* stands at 40 percent in 1996 compared to only 32.5 percent in 1968. The upward trend of the *Gap* and the term (1 + *Gini*) has deteriorated the economic poverty position. This is the economic meaning of the narrowing distance between the two poverty measures in Figure 2-1.

This result of a deteriorating economic poverty position of the poor contradicts common perceptions about poverty. The latter tend to be driven by the poverty rate as the sole poverty indicator, and it has decreased from 20.8 percent to 14.0 percent over the period studied. Yet the poverty rate covers only one aspect of poverty and ignores the living conditions of the poor below the poverty threshold. Figure 2-3 illustrates the fact that, although the number of poor people has declined over time, the part of the population remaining in poverty has fared worse, regardless of the strong economic growth over the three decades.[17] This result clearly should be of policy concern.

---

[16] The *Gap* declined a little during the economic expansion periods of the 1980s and the 1990s, but the decreases were not sufficient to return to the levels before the recessions.

[17] Since the SST is in the range [0, 1], the economic position of the poor (EPP), which is calculated based on equation (5) and is in logarithm form, always has a negative value. A higher value represents a worsening of the economic position of the poor.

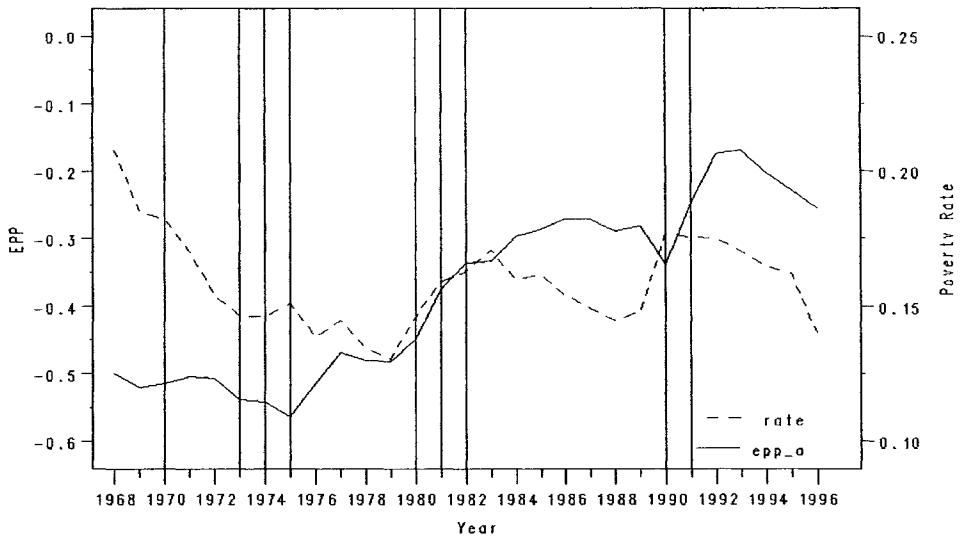


Figure 2-3: The Economic Poverty Position and the Poverty Rate for All Households. The upward trend of the economic poverty position represents the worsening condition of the poor in poverty, regardless of the strong economic expansion over time.

2.4.2 Cyclicality of the Economic Poverty Position

In Figure 2-4, the economic poverty position is plotted against the cyclical component of the log of real GDP.[18] The economic poverty position of the poor has been changing continuously over time. It appears sensitive to cyclical movements in GDP, especially economic downturns. In particular, it tends to respond more negatively to recessions than positively to economic expansions both in the 1980s and the 1990s. Figure 2-4 also shows that the countercyclicality of the economic position of the poor is more apparent in the past two decades. Over the period studied, the cyclical components of the EPP appear

[18] Based on the Dickey-Fuller unit root test, the study cannot reject the null hypothesis of the presence of a stochastic trend in the economic poverty position series. The study makes the series stationary by using first differencing. Thus, the cyclical component of the economic poverty position is used in plotting all figures. The cyclical component of the log of real GDP is generated by the Hodrick-Prescott filter.

to exhibit weak countercyclical behavior with a correlation coefficient of -0.33 with respect to the cyclical component of the log of real GDP.

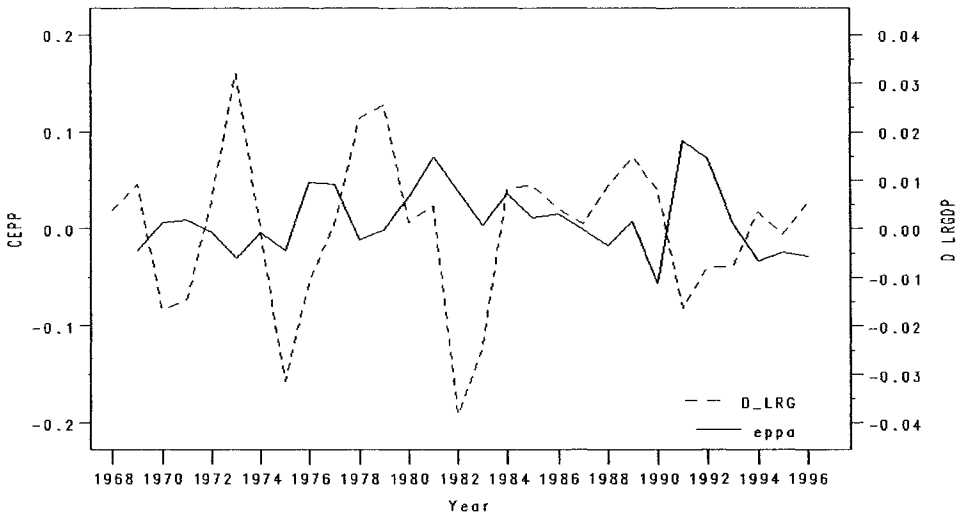


Figure 2-4: The Cyclicality of the Economic Poverty Position for All Households. It is countercyclical with a correlation coefficient of -0.33 over the 1968-1996 period. The economic poverty position of the poor appears to have a noticeably upward surge during the 1990s recession.

Table 2-2 presents a summary of the cyclical behavior of the economic poverty position for all poor households. It includes stability tests of the null hypothesis of stable correlation coefficients against the alternative that the correlation coefficients change between periods.[19] The study then employs *Fisher's z* transformation test[20] to check whether the change in the correlation coefficients is statistically significant.

[19] The tests assume a bivariate normal distribution. The two data series are treated as random samples. Thus, the Wald statistic has a Chi-square distribution with one degree of freedom.

[20] For a detailed description of the test statistic applied here, see Ostle (1963), pp. 225-227.

Table 2-2: The Cyclical Behavior of the Economic Poverty Position

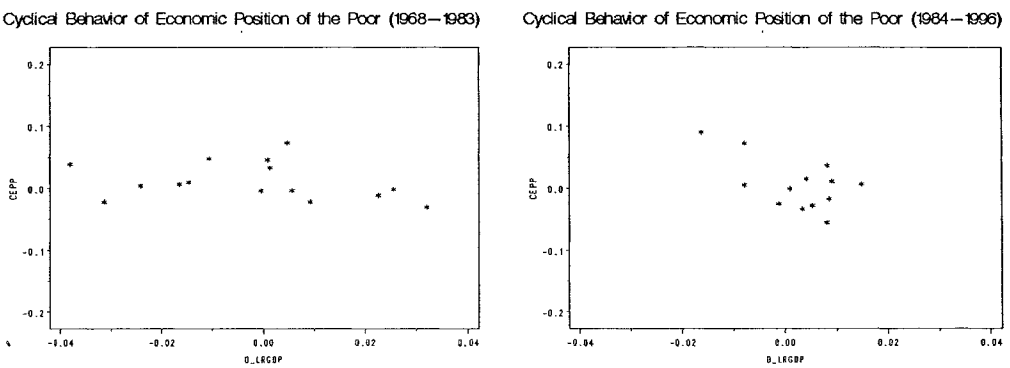
Correlation Coefficients of the EPP with the Log of Real GDP			
	1968-1996	Pre-1984	Post-1984
	-0.330	-0.2688	-0.5925
	(0.086)**	(0.333)	(0.033)*
Stability Test		0.8988	
		(0.343)	

Notes: The EPP is the economic poverty position. Pre-1984 is from 1968 to 1983. Post-1984 is from 1984 to 1996. The stability test is based on a Wald statistic with the null hypothesis that there is no change in the correlation coefficient between periods. Numbers in parentheses are p-values. * indicates five percent significance. ** indicates ten percent significance.

The study breaks down the whole period into pre-1984 and post-1984 periods, based on Stock and Watson (2003). Their analysis of the changes in the business cycle over the past three decades is based on the change in the volatility of GDP growth. They suggest that the sharp decline in the volatility of output growth is perhaps the most dominant change. They identify 1984 as the year in which volatility shifted in U.S. GDP. Figure 2-4 appears to be consistent with their finding since the variable *D_LRG* shows less fluctuation after the mid-1980s.

In both the pre-1984 and the post-1984 periods, the EPP is countercyclical with correlation coefficients with the log of real GDP of -0.269 and -0.593, respectively. The countercyclicality of the EPP in the post-1984 period appears much stronger and is statistically significant at the 5 percent level. Accordingly, these results confirm the rapid increase in the EPP during the recession in the early 1990s (Figure 2-4). Nevertheless, this short recession seems to have had more severe effects on the poor than the previous downturns. Figure 2-5 shows that the countercyclicality of the EPP has changed

noticeably between the pre-1984 and post-1984 periods, even though the stability test shows that the cross-correlation structure is not statistically different between those periods.



Panel (a) Panel (b)

Figure 2-5: The Cyclical Behavior of the Economic Poverty Position for the Pre-1984 and Post-1984 Periods. The cyclical behavior of the EPP appears to show a weak countercyclical relationship in the pre-1984 period (Panel a), and the countercyclicality has clearly become stronger in the post-1984 period as shown in Panel (b).

2.5 Poverty Analysis for Different Age Groups

2.5.1 A Life-Cycle Behavior of Poverty and the Economic Poverty Position

Figure 2-6 displays the SST poverty intensity trends among different age groups of households. Since the 1980s, young households have experienced poverty to a greater extent than other groups of households. The intensity trend of young households began moving upward in 1973 due to a severe recession. Despite the economic expansion in the

late 1970s, the upward trend in poverty intensity continued. In fact, poverty intensity moved up drastically again during the 1980s recession. Unlike the young households, the middle-aged and older households experienced a fairly steady degree of poverty until the recession of the early 1990s. These groups of households also have similar poverty intensity trends and respond similarly to changes in economic conditions over the decades.

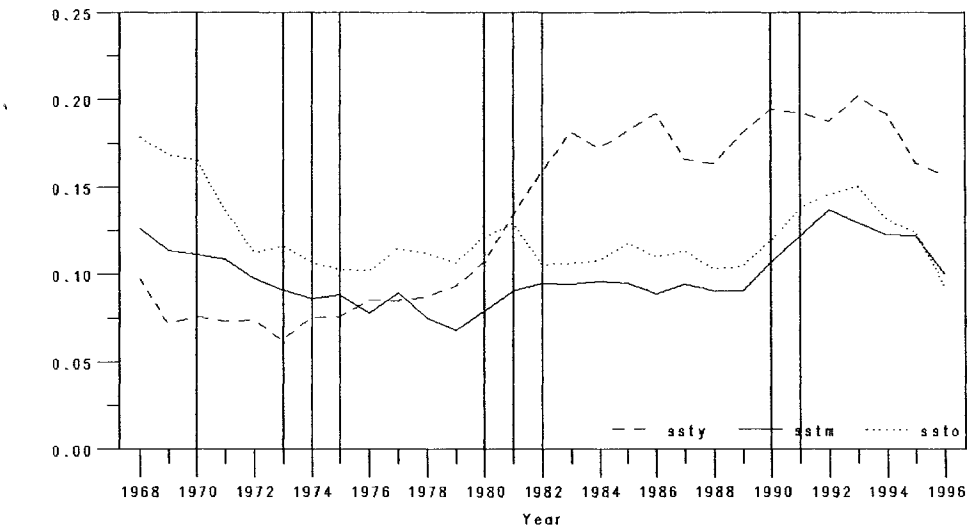


Figure 2-6: Poverty Intensity from 1968 to 1996 among Age Groups of Households. It shows fairly dissimilar trends over three decades.

The SST poverty intensity index appears to be more responsive to economic downturns for all groups of poor households. Regardless of the expansions in both the 1970s and the 1980s, poverty intensity levels stayed rather stable. The pattern of responsiveness to economic conditions is consistent with Blank and Card (1993), Cutler and Katz (1991), and Balke and Slottje (1993). Poverty intensity decreased during the

economic boom of the 1990s by roughly five and six percentage points for the young and old households, respectively (Table 2-3). It is also interesting to note that the response of the poverty intensity to economic contractions has changed over time. For instance, the recession of the early 1980s increased the poverty intensity of young households by about five percentage points while the recession of the early 1990s appeared to have no effect (Table 2-3).

Figure 2-7 displays the historical development of the SST index among age groups. Poor households that are young have fared worst over the past few decades. They have experienced not only an increase in the poverty rate but also a substantial deterioration of their economic position in poverty, which is evidenced by the upward trend of the SST poverty intensity index. The middle-aged and older households experienced a relatively steady increase in poverty intensity up to the early 1990s. They share a similar pattern of poverty intensity, although with different underlying causes. For the middle-aged households, the declining poverty intensity level depended on a substantial decrease in the poverty rate until the early 1980s. Since then the economic poverty position has become the dominant driving force behind the poverty intensity index. Their economic position in poverty has become much worse, even though the expansion continued to reduce the number of poor middle-aged households. This evidence suggests that it may be misleading to look only at the poverty rate as a poverty indicator. In contrast, the poverty intensity of old households is driven by both the poverty rate and the economic position in poverty, which have moved together over time.

Table 2-3: The SST Poverty Intensity Index and Decompositions by Age Groups

Year	*SST*	Decomposition			*SST*	Decomposition			*SST*	Decomposition		
		Rate	*Gap*	1+*Gini*		*Rate*	*Gap*	1+*Gini*		*Rate*	*Gap*	1+*Gini*
	Young-Headed Households				Middle-Aged-Headed Households				Old-Headed Households			
1968	0.0975	0.1766	0.2925	1.8878	0.1260	0.2028	0.3321	1.8710	0.1788	0.3035	0.3252	1.8115
1969	0.0720	0.1254	0.2980	1.9254	0.1132	0.1875	0.3203	1.8850	0.1687	0.3040	0.3069	1.8083
1970	0.0754	0.1364	0.2882	1.9179	0.1112	0.1802	0.3274	1.8849	0.1650	0.2971	0.3060	1.8151
1971	0.0730	0.1175	0.3227	1.9259	0.1083	0.1783	0.3220	1.8858	0.1366	0.2453	0.3019	1.8454
1972	0.0736	0.1118	0.3409	1.9325	0.0974	0.1609	0.3185	1.9004	0.1124	0.2212	0.2728	1.8634
1973	0.0623	0.1001	0.3215	1.9362	0.0909	0.1560	0.3062	1.9042	0.1160	0.2191	0.2851	1.8582
1974	0.0752	0.1162	0.3359	1.9275	0.0858	0.1476	0.3049	1.9076	0.1069	0.2220	0.2585	1.8633
1975	0.0756	0.1237	0.3177	1.9228	0.0881	0.1515	0.3043	1.9102	0.1033	0.2243	0.2470	1.8640
1976	0.0851	0.1209	0.3658	1.9240	0.0776	0.1338	0.3025	1.9163	0.1020	0.2180	0.2515	1.8614
1977	0.0849	0.1160	0.3794	1.9283	0.0890	0.1457	0.3198	1.9103	0.1146	0.2293	0.2708	1.8458
1978	0.0867	0.1228	0.3662	1.9271	0.0749	0.1191	0.3266	1.9259	0.1122	0.2459	0.2474	1.8453
1979	0.0930	0.1231	0.3931	1.9206	0.0674	0.1151	0.3038	1.9285	0.1068	0.2251	0.2567	1.8486
1980	0.1068	0.1380	0.4052	1.9107	0.0786	0.1250	0.3275	1.9213	0.1216	0.2711	0.2462	1.8216
1981	0.1339	0.1685	0.4201	1.8908	0.0903	0.1320	0.3573	1.9149	0.1290	0.2617	0.2707	1.8207
1982	0.1585	0.1877	0.4512	1.8720	0.0945	0.1329	0.3712	1.9166	0.1057	0.2418	0.2370	1.8451
1983	0.1811	0.2086	0.4671	1.8583	0.0941	0.1348	0.3644	1.9164	0.1064	0.2500	0.2311	1.8421
1984	0.1720	0.1882	0.4889	1.8685	0.0956	0.1284	0.3884	1.9169	0.1080	0.2519	0.2336	1.8355
1985	0.1819	0.2082	0.4706	1.8568	0.0949	0.1232	0.4011	1.9196	0.1178	0.2553	0.2509	1.8384
1986	0.1916	0.2104	0.4914	1.8536	0.0884	0.1189	0.3863	1.9246	0.1099	0.2208	0.2687	1.8530
1987	0.1653	0.1917	0.4608	1.8707	0.0939	0.1178	0.4141	1.9236	0.1134	0.2310	0.2656	1.8478
1988	0.1629	0.1905	0.4564	1.8737	0.0903	0.1149	0.4077	1.9273	0.1030	0.2157	0.2574	1.8551
1989	0.1806	0.2082	0.4666	1.8592	0.0902	0.1130	0.4144	1.9275	0.1052	0.2288	0.2478	1.8552
1990	0.1943	0.2193	0.4788	1.8505	0.1066	0.1429	0.3905	1.9099	0.1198	0.2761	0.2372	1.8285
1991	0.1919	0.2125	0.4876	1.8526	0.1212	0.1446	0.4400	1.9054	0.1383	0.2750	0.2765	1.8191
1992	0.1872	0.2012	0.4992	1.8633	0.1368	0.1508	0.4771	1.9008	0.1460	0.2598	0.3055	1.8395
1993	0.2018	0.2053	0.5292	1.8578	0.1288	0.1380	0.4892	1.9075	0.1505	0.2851	0.2881	1.8319
1994	0.1916	0.1944	0.5275	1.8685	0.1223	0.1411	0.4537	1.9103	0.1315	0.2597	0.2752	1.8402
1995	0.1631	0.1881	0.4627	1.8742	0.1220	0.1417	0.4508	1.9094	0.1237	0.2433	0.2753	1.8466
1996	0.1565	0.1846	0.4507	1.8810	0.1003	0.1217	0.4283	1.9244	0.0928	0.1792	0.2738	1.8910

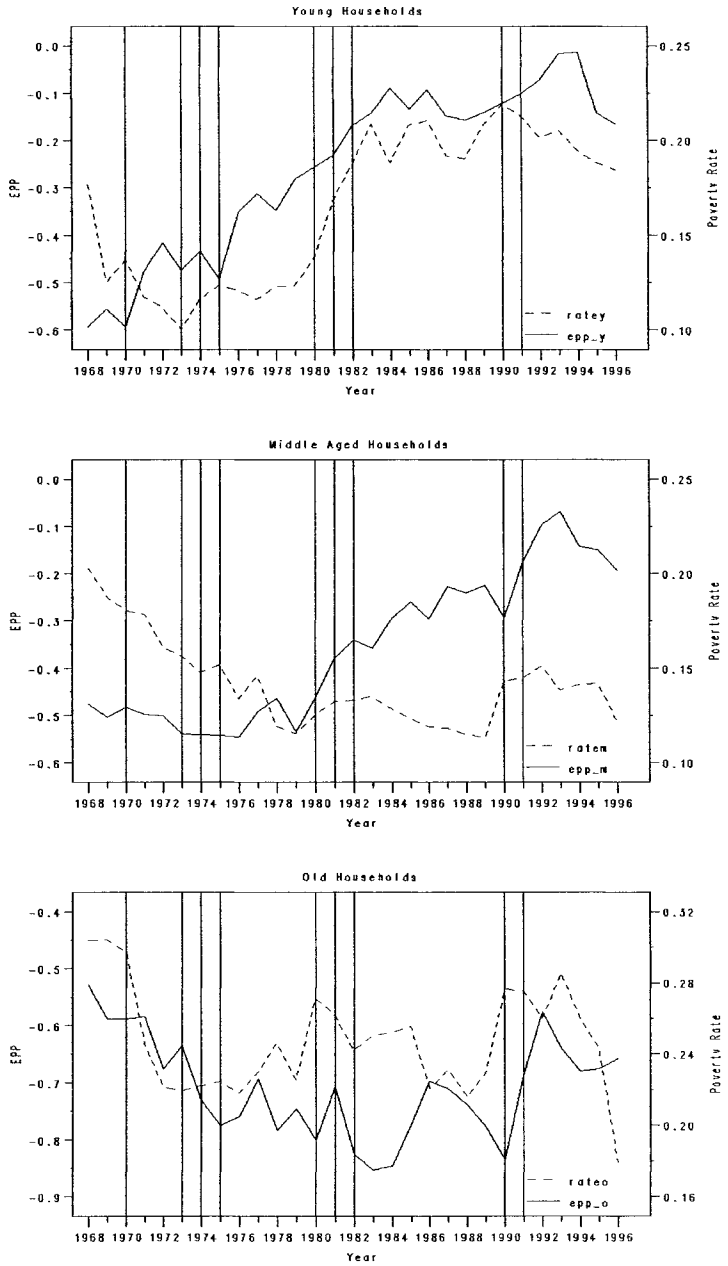


Figure 2-7: Poverty Rate and Economic Poverty Position among Age Groups. Young and middle-aged households experience an upward trend in economic poverty position. Their poverty situation steadily worsens. Old households enjoyed an improvement in their poverty position until the early 1990s, when it also started to deteriorate.

It is apparent from Figure 2-7 that young households have fared the worst since the mid-1970s. They experienced a high rate of poverty incidence as well as an extensive deterioration in their economic poverty position. Cutler and Katz (1991) have suggested young households were negatively affected during the 1983 to 1989 expansion by changes in the labor market, particularly in the manufacturing sector. These changes also led to an increase in wage inequality, which affected the distribution of income unfavorably and worsened the economic poverty position of the young households.

Figure 2-7 reveals that the 1990s recession also affected poor households differently when they are classified by age group. Young households, whose poverty position deteriorated significantly during the 1980s recession, were hit much less severely by the 1990s recession. On the contrary, older households fared worst during the 1990s recession. Their economic poverty position worsened considerably. The different degrees by which the economic poverty positions of the three groups of households deteriorated may reflect different patterns in their income redistribution.

2.5.2 Cyclicality of the Economic Poverty Position across Age Groups

Figure 2-8 shows the economic poverty position[21] by age group along with the cyclical component of the log of real GDP, which is taken to represent economic conditions. For all groups, the economic poverty position shows no clear relationship to economic conditions up to the 1990s, when an inverse relationship appears to develop.

[21] The cyclical component of the economic poverty position from the first-difference method is used.

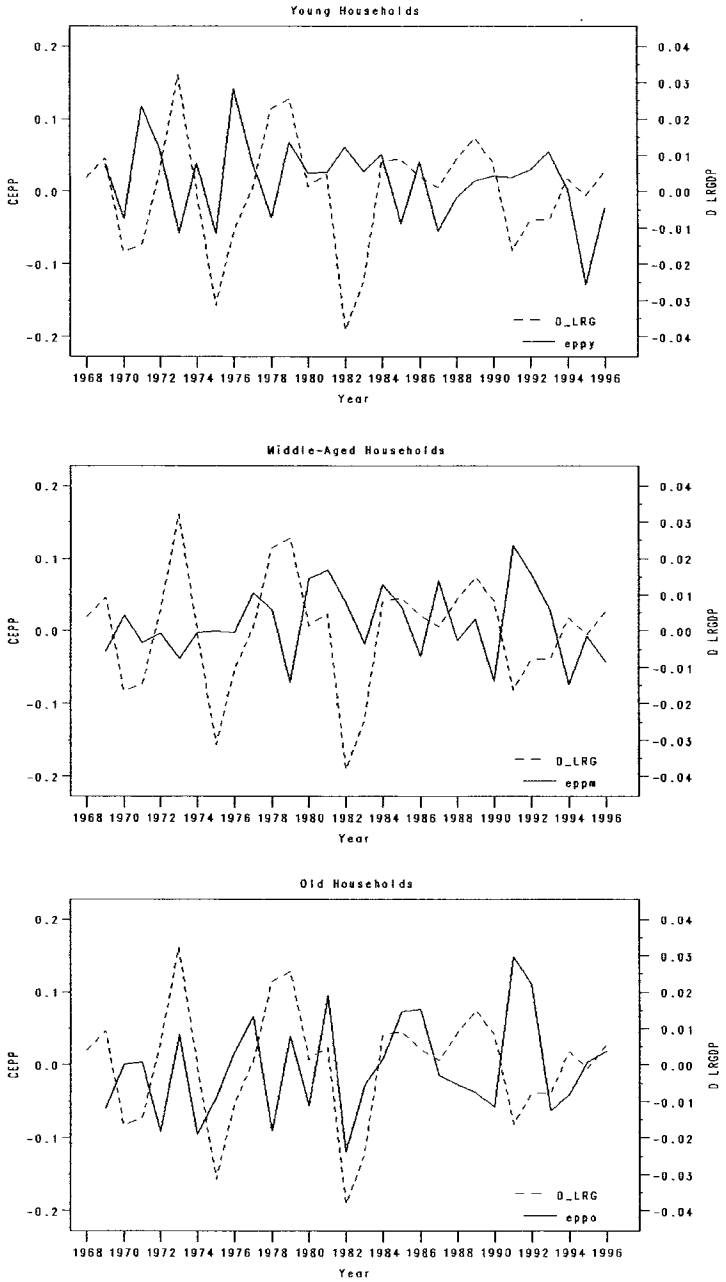


Figure 2-8: The Cyclicality of the Economic Poverty Position among Age Groups. There is no clear cyclical relationship for any group up to the post-1984 period, but it appears to be countercyclical afterward for all age groups.

However, during the 1970s and the 1980s, the economic poverty position of the young and middle-aged households responded merely to the previous economic contractions. To observe clearer cyclicality, the study differentiates between the pre-1984 and post-1984 periods. Figure 2-9 shows the cyclical behavior of the economic poverty position of the poor among age groups for both periods. Evidently, the cyclical behavior of the EPP for all groups changed between these two periods. A stronger countercyclical relationship evolves in the post-1984 period as shown in Panel (b).

To statistically confirm the cyclical relationship, the study tests for correlations between EPP and the cyclical component of the log of real GDP for each type of poor household. Table 2-4 presents the results. They reinforce the graphs of Figure 2-9, which show the countercyclicality of the economic poverty position for each age group of poor households for the post-1984 period. In particular, the countercyclicality is relatively strong and statistically significant for middle-aged and old households with correlation coefficients of -0.535 and -0.507, respectively. For the pre-1984 period, the older households appear to experience procyclicality of their economic position in poverty. The downward trend during that time is accompanied by a large cyclical volatility of the log of real GDP, especially during the recessions of the 1970s and the 1980s.

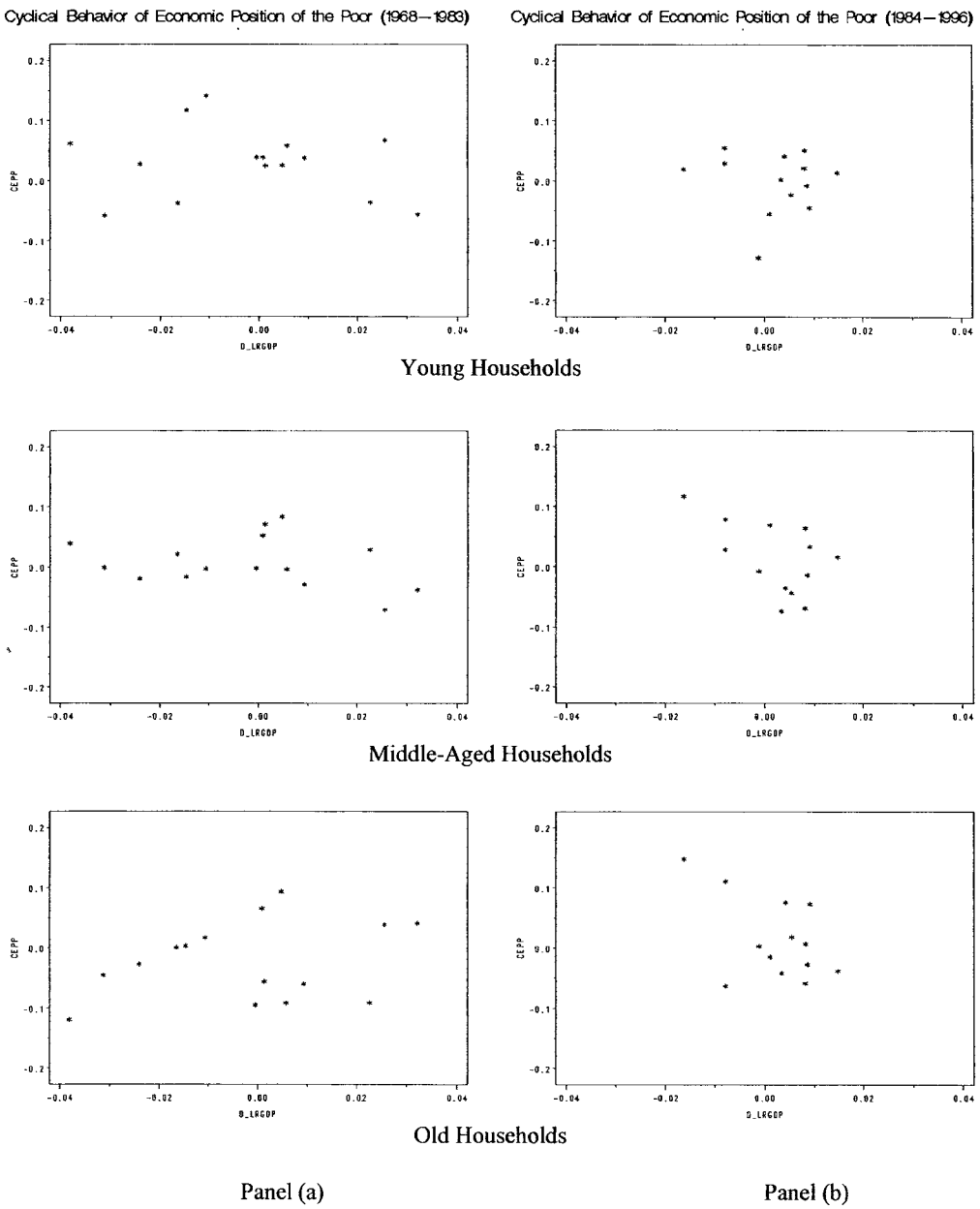


Figure 2-9: The Cyclical Behavior of the Economic Poverty Position among Age Groups for the Pre-1984 and Post-1984 periods. The cyclical behavior of EPP for all groups has changed between these two periods. Evidently, for all groups, there is a stronger countercyclical relationship in the post-1984 period as shown in Panel (b).

Table 2-4: The Cyclical Behavior of the Economic Poverty Position by Age Groups

Variables	1968-1996	Pre-1984	Post-1984	Wald Statistic
	Correlation Coefficients with *LRGDP*			
EPP_y	-0.1752	-0.1675	-0.0865	0.0370
	(0.373)	(0.551)	(0.779)	(0.847)
EPP_m	-0.2823	-0.2450	-0.5351	0.6573
	(0.146)	(0.379)	(0.059)**	(0.418)
EPP_o	0.1006	0.2846	-0.5072	3.9558
	(0.611)	(0.304)	(0.077)**	(0.047)*
	Correlation Coefficients with *EPP_a*			
EPP_y	0.4097	0.4784	0.3577	0.1172
	(0.030)*	(0.071)**	(0.230)	(0.732)
EPP_m	0.7980	0.7039	0.8659	1.0631
	(0.000)+	(0.003)+	(0.000)+	(0.303)
EPP_o	0.5537	0.3797	0.7894	2.4499
	(0.002)+	(0.163)	(0.001)+	(0.118)

Notes: *EPP_a* is the economic poverty position for all households. The lower-case letters *y*, *m*, and *o* denote young, middle-aged, and old households. The Wald Statistics test for the null of the stability in the correlation coefficients. Numbers shown in parentheses are p-values. + identifies significance at the 1 percent level, * significance at the 5 percent level, and ** significance at the 10 percent level.

It is also clear from Figure 2-8 that the cyclical component of the log of real GDP has become less volatile after 1983, which supports the breakpoint suggested by Stock and Watson (2003). At this breakpoint, there is a change in the cyclicality of the economic poverty position of the poor, in particular for older households. The cyclicality changes considerably from weak procyclicality for the pre-1984 period to strong countercyclicality for the post-1984 period. As confirmed by the Wald statistic, this change in cyclicality is statistically significant at the five percent level. While there is no statistically significant change in the cyclical behavior of the poverty position for middle-aged households between the pre- and post-1984 periods, their countercyclicality has become much stronger.

In the lower panel of Table 2-4, correlations of the cyclical behavior of the EPP between all households and each individual age group of households are reported. It is apparent that all types of households play an important role in determining the aggregate economic poverty position for the whole study period 1968-1996. However, for the pre-1984 period, the procyclicality of the EPP for old households counteracts the countercyclicality of the EPP for their younger counterparts. As a result, there is a slight movement in the cyclicality of the aggregate EPP in the early 1970s and only a moderate increase in the countercyclicality of the aggregate EPP in the early 1980s (Figure 2-4). Nonetheless, after 1983 the countercyclicality of the EPP from all groups of households accounts for the aggregate cyclical movement. While the cyclical behavior of young households currently plays a minor role in the aggregate trend, the cyclicality of the EPP of old households has become increasingly important for the aggregate.

2.6 Conclusion

As an alternative poverty measure, the SST poverty intensity index outperforms the conventional poverty rate in terms of its ability to cope with all effects of changes in the income of the poor. Compared to the poverty rate, the poverty intensity is more sensitive to economic conditions. Its components, the *Gap* and the *Gini*, provide important additional information to assess how poverty evolves over time relative to the received poverty rate. This study documents the cyclical behavior of both measures as well as the economic position of the poor. The study finds that the economic poverty position of the poor and the poverty rate deviate in their behavior from each other, especially during

economic expansions. The EPP has had an upward trend since the mid-1970s while the poverty rate has been persistent over the period.

The study observes differences in the EPP for different age groups of poor households. The young and middle-aged households experience an upward trend in the economic poverty position, which represents a worsening of poverty. Old households enjoy an improvement in their poverty position until the early 1990s.

For the post-1984 period, the EPP is countercyclical for all poor households. Even though the countercyclicality of the EPP has become stronger and statistically significant for middle-aged and old households, it is weaker and insignificant for young households. There is also a significant shift in the cyclical relationship of the economic poverty position for old households from procyclicality to strong countercyclicality. The stability test statistically confirms the difference in the cross-correlation structure for the old households between those periods. There is a sudden change in the magnitude of the cyclicality for old households during the 1990s recession. They have become much worse off compared to young households based on their economic poverty position.

2.7 Appendix

2.7A Data and Definitions

Table A1: The Official Poverty Thresholds

Year	Family Size								
	1	2	3	4	5	6	7_a	8	9
1968	$1,748	2,262	2,774	3,553	4,188	4,706	5,789		
1969	1,840	2,383	2,924	3,743	4,415	4,958	6,101		
1970	1,954	2,525	3,099	3,968	4,680	5,260	6,468		
1971	2,040	2,633	3,229	4,137	4,880	5,489	6,751		
1972	2,109	2,724	3,339	4,275	5,044	5,673	6,983		
1973	2,247	2,895	3,548	4,540	5,358	6,028	7,435		
1974	2,495	3,211	3,936	5,038	5,950	6,699	8,253		
1975	2,724	3,506	4,293	5,500	6,499	7,316	9,022		
1976	2,884	3,711	4,540	5,815	6,876	7,760	9,588		
1977	3,075	3,951	4,833	6,191	7,320	8,261	10,216		
1978	3,311	4,249	5,201	6,662	7,880	8,891	11,002		
1979	3,689	4,725	5,784	7,412	8,775	9,914	12,280		
1980	4,190	5,363	6,565	8,414	9,966	11,269	12,761	14,199	16,896
1981	4,620	5,917	7,250	9,287	11,007	12,449	14,110	15,655	18,572
1982	4,901	6,281	7,693	9,862	11,684	13,207	15,036	16,719	19,698
1983	5,061	6,483	7,938	10,178	12,049	13,630	15,500	17,170	20,310
1984	5,278	6,762	8,277	10,609	12,566	14,207	16,096	17,961	21,247
1985	5,469	6,998	8,573	10,989	13,007	14,696	16,656	18,512	22,083
1986	5,572	7,138	8,737	11,203	13,259	14,986	17,049	18,791	22,497
1987	5,778	7,397	9,056	11,611	13,737	15,509	17,649	19,515	23,105
1988	6,022	7,704	9,435	12,092	14,304	16,146	18,232	20,253	24,129
1989	6,310	8,076	9,885	12,674	14,990	16,921	19,162	21,328	25,480
1990	6,652	8,509	10,419	13,359	15,792	17,839	20,241	22,582	26,848
1991	6,932	8,865	10,860	13,924	16,456	18,587	21,058	23,605	27,942
1992	7,143	9,137	11,186	14,335	16,952	19,137	21,594	24,053	28,745
1993	7,363	9,414	11,522	14,763	17,449	19,718	22,383	24,838	29,529
1994	7,547	9,661	11,821	15,141	17,900	20,235	22,923	25,427	30,300
1995	7,763	9,933	12,158	15,569	18,408	20,804	23,552	26,237	31,280
1996	7,995	10,233	12,516	16,036	18,952	21,389	24,268	27,091	31,971

Source: U.S. Census Bureau

Notes: Family size represents the number of members in the family unit or the household. The table shows the weighted average poverty thresholds regardless of the number of children. From 1968 to 1979, 7_a represents the poverty thresholds for family size of seven and more.

Table A2: Total Family Income from 1968 to 1996

Total Family Money Income			
Head and Wife	OFUM	Head and Wife	OFUM
Taxable Income		Transfer Income	
Labor income from farming/gardening		ADC/AFDC income	
Labor income from business		Supplemental security income	
Wages, salaries, other labor income		Other welfare payments	
Bonuses, overtime, and/or commission		Social security income	
Income from trade		Veterans administration pension income	
Labor income from roomers and boarders		Other retirement, pensions, and annuities	
Asset income from farming/gardening		Unemployment payments	
Asset income from business		Worker's compensation	
Asset income from roomers and boarders		Child support	
Rent income		Help received from relatives	
Income from dividends, interest, trust funds, and royalties		Other transfer income	
Alimony			

Note: OFUM stands for other family unit member.

Table A3: Income Dataset and Descriptive Statistics – All Households

Year	Number of Households	Total Family Income ($)		
		Mean	Minimum	Maximum
1968	3712	7,863.02	132.0	85,936.0
1969	2568	8,807.24	45.0	91,660.0
1970	3332	9,276.30	60.0	99,999.0
1971	3643	9,796.84	60.0	99,999.0
1972	3872	10,543.91	40.0	99,999.0
1973	4057	11,408.48	13.0	99,999.0
1974	4155	12,302.01	12.0	99,999.0
1975	4189	13,092.92	20.0	99,999.0
1976	4207	14,662.16	100.0	99,999.0
1977	4439	15,783.14	45.0	99,999.0
1978	4837	17,312.51	100.0	99,999.0
1979	4961	19,352.44	61.0	534,680.0
1980	4960	21,244.66	100.0	1,200,000.0
1981	5136	22,811.43	45.0	772,480.0
1982	5170	23,931.82	25.0	1,279,470.0
1983	5403	25,210.00	60.0	537,400.0
1984	5449	27,465.34	40.0	900,000.0
1985	5504	28,791.37	15.0	700,000.0
1986	5652	30,062.90	40.0	722,000.0
1987	5804	31,763.35	13.0	1,352,000.0
1988	5953	33,843.09	30.0	1,412,200.0
1989	5916	35,730.15	15.0	1,014,250.0
1990	7070	34,895.53	17.0	602,360.0
1991	6952	36,080.54	72.0	975,000.0
1992	6564	38,432.37	10.0	847,500.0
1993	6143	42,250.79	7.0	1,088,862.0
1994	5703	42,973.45	15.0	1,034,930.0
1995	6467	44,444.02	2.0	1,449,566.0
1996	5288	48,656.50	3.0	811,324.0

Source: Panel Study of Income Dynamics (PSID)

Table A4: Income Dataset and Descriptive Statistics Categorized by Age Groups

Year	Young Households		Middle-Aged Households		Old Households	
	# of HHs	Average Total Family Income ($)	# of HHs	Average Total Family Income ($)	# of HHs	Average Total Family Income ($)
1968	685	6,965.91	2626	8,576.17	401	4,725.33
1969	574	7,988.47	1726	9,650.95	268	5,127.18
1970	755	8,385.46	2210	10,273.38	367	5,104.70
1971	877	8,836.57	2358	10,873.54	408	5,638.23
1972	1038	9,640.11	2386	11,760.05	448	6,160.93
1973	1169	10,249.66	2414	12,915.73	474	6,590.27
1974	1274	10,855.59	2377	14,149.58	504	7,244.65
1975	1342	11,455.11	2321	15,209.36	526	7,932.64
1976	1414	12,668.47	2277	17,234.21	516	8,775.55
1977	1491	13,541.72	2406	18,685.99	542	9,063.06
1978	1604	14,723.18	2628	20,686.97	605	9,519.52
1979	1616	16,150.19	2721	22,995.35	624	11,760.29
1980	1631	17,005.01	2712	25,515.92	617	13,677.76
1981	1626	18,361.86	2858	27,104.11	652	15,091.33
1982	1604	18,598.08	2899	28,543.70	667	16,713.65
1983	1620	19,273.66	3071	30,487.07	712	15,955.78
1984	1514	21,098.81	3225	32,666.10	710	17,418.15
1985	1446	21,486.41	3352	34,341.41	706	17,402.15
1986	1402	21,458.48	3499	36,101.08	751	17,993.44
1987	1377	23,492.93	3650	37,689.31	777	18,582.68
1988	1302	24,718.16	3817	40,012.51	834	19,852.69
1989	1225	25,024.51	3845	42,386.40	846	20,979.70
1990	1382	25,877.38	4596	41,231.47	1092	19,641.95
1991	1266	26,742.10	4632	42,070.04	1054	20,975.33
1992	1138	28,795.70	4402	44,758.94	1024	21,945.05
1993	950	30,339.88	4202	48,671.50	991	26,444.08
1994	890	29,502.70	4003	48,655.65	810	29,693.31
1995	1042	31,081.20	4546	50,719.17	879	27,831.06
1996	856	33,076.92	3626	55,767.05	806	33,213.89

Notes: Households are categorized by the age of the household head; if between 20 and 29 years, the household is considered young; 30 to 65 years, the household is considered middle-aged; 65 years and above, the household is considered old. # of HHs = number of households.

2.7B Poverty Analysis

Table B1: The SST Poverty Intensity Index, Decompositions, and Changes by Age Groups

Year	*SST*	Decomposition			*Δln(SST)*	Decomposition of Change		
		Rate	*Gap*	*1+Gini*		*Δln(Rate)*	*Δln(Gap)*	*Δln(1+Gini)*
Young Households								
1968	0.0975	0.1766	0.2925	1.8878				
1969	0.0720	0.1254	0.2980	1.9254	-0.3040	-0.3423	0.0187	0.0197
1970	0.0754	0.1364	0.2882	1.9179	0.0465	0.0840	-0.0336	-0.0039
1971	0.0730	0.1175	0.3227	1.9259	-0.0324	-0.1498	0.1132	0.0042
1972	0.0736	0.1118	0.3409	1.9325	0.0086	-0.0497	0.0549	0.0034
1973	0.0623	0.1001	0.3215	1.9362	-0.1669	-0.1103	-0.0586	0.0019
1974	0.0752	0.1162	0.3359	1.9275	0.1883	0.1490	0.0438	-0.0045
1975	0.0756	0.1237	0.3177	1.9228	0.0046	0.0628	-0.0557	-0.0025
1976	0.0851	0.1209	0.3658	1.9240	0.1189	-0.0226	0.1408	0.0006
1977	0.0849	0.1160	0.3794	1.9283	-0.0026	-0.0414	0.0366	0.0022
1978	0.0867	0.1228	0.3662	1.9271	0.0208	0.0569	-0.0354	-0.0006
1979	0.0930	0.1231	0.3931	1.9206	0.0703	0.0027	0.0710	-0.0034
1980	0.1068	0.1380	0.4052	1.9107	0.1386	0.1136	0.0302	-0.0052
1981	0.1339	0.1685	0.4201	1.8908	0.2259	0.2001	0.0363	-0.0105
1982	0.1585	0.1877	0.4512	1.8720	0.1689	0.1076	0.0713	-0.0100
1983	0.1811	0.2086	0.4671	1.8583	0.1333	0.1060	0.0346	-0.0073
1984	0.1720	0.1882	0.4889	1.8685	-0.0518	-0.1029	0.0456	0.0055
1985	0.1819	0.2082	0.4706	1.8568	0.0562	0.1006	-0.0381	-0.0063
1986	0.1916	0.2104	0.4914	1.8536	0.0522	0.0108	0.0431	-0.0017
1987	0.1653	0.1917	0.4608	1.8707	-0.1480	-0.0930	-0.0642	0.0092
1988	0.1629	0.1905	0.4564	1.8737	-0.0145	-0.0065	-0.0096	0.0016
1989	0.1806	0.2082	0.4666	1.8592	0.1030	0.0888	0.0220	-0.0078
1990	0.1943	0.2193	0.4788	1.8505	0.0731	0.0519	0.0259	-0.0047
1991	0.1919	0.2125	0.4876	1.8526	-0.0121	-0.0314	0.0181	0.0012
1992	0.1872	0.2012	0.4992	1.8633	-0.0250	-0.0544	0.0236	0.0057
1993	0.2018	0.2053	0.5292	1.8578	0.0752	0.0198	0.0583	-0.0029
1994	0.1916	0.1944	0.5275	1.8685	-0.0519	-0.0545	-0.0031	0.0057
1995	0.1631	0.1881	0.4627	1.8742	-0.1609	-0.0329	-0.1311	0.0031
1996	0.1565	0.1846	0.4507	1.8810	-0.0416	-0.0189	-0.0264	0.0036

Table B1: The SST Poverty Intensity Index, Decompositions, and Changes by Age Groups (Continued)

Year	*SST*	Decomposition			*Δln(SST)*	Decomposition of Change		
		Rate	*Gap*	*1+Gini*		*Δln(Rate)*	*Δln(Gap)*	*Δln(1+Gini)*
Middle-Aged Households								
1968	0.1260	0.2028	0.3321	1.8710				
1969	0.1132	0.1875	0.3203	1.8850	-0.1070	-0.0784	-0.0361	0.0075
1970	0.1112	0.1802	0.3274	1.8849	-0.0183	-0.0400	0.0217	-0.0001
1971	0.1083	0.1783	0.3220	1.8858	-0.0264	-0.0104	-0.0164	0.0005
1972	0.0974	0.1609	0.3185	1.9004	-0.1060	-0.1028	-0.0109	0.0077
1973	0.0909	0.1560	0.3062	1.9042	-0.0685	-0.0308	-0.0397	0.0020
1974	0.0858	0.1476	0.3049	1.9076	-0.0577	-0.0556	-0.0040	0.0018
1975	0.0881	0.1515	0.3043	1.9102	0.0254	0.0261	-0.0021	0.0013
1976	0.0776	0.1338	0.3025	1.9163	-0.1270	-0.1244	-0.0058	0.0032
1977	0.0890	0.1457	0.3198	1.9103	0.1379	0.0855	0.0556	-0.0031
1978	0.0749	0.1191	0.3266	1.9259	-0.1729	-0.2020	0.0210	0.0081
1979	0.0674	0.1151	0.3038	1.9285	-0.1051	-0.0339	-0.0726	0.0014
1980	0.0786	0.1250	0.3275	1.9213	0.1538	0.0823	0.0752	-0.0037
1981	0.0903	0.1320	0.3573	1.9149	0.1384	0.0545	0.0872	-0.0034
1982	0.0945	0.1329	0.3712	1.9166	0.0459	0.0068	0.0382	0.0009
1983	0.0941	0.1348	0.3644	1.9164	0.0044	0.0144	-0.0187	-0.0001
1984	0.0956	0.1284	0.3884	1.9169	0.0154	-0.0488	0.0639	0.0003
1985	0.0949	0.1232	0.4011	1.9196	0.0071	-0.0408	0.0322	-0.0014
1986	0.0884	0.1189	0.3863	1.9246	0.0709	-0.0356	-0.0378	-0.0026
1987	0.0939	0.1178	0.4141	1.9236	0.0600	-0.0092	0.0696	-0.0005
1988	0.0903	0.1149	0.4077	1.9273	0.0386	-0.0250	-0.0155	-0.0019
1989	0.0902	0.1130	0.4144	1.9275	0.0009	-0.0173	0.0163	-0.0001
1990	0.1066	0.1429	0.3905	1.9099	0.1665	0.2353	-0.0596	-0.0092
1991	0.1212	0.1446	0.4400	1.9054	0.1284	0.0114	0.1194	-0.0023
1992	0.1368	0.1508	0.4771	1.9008	0.1209	0.0422	0.0811	-0.0025
1993	0.1288	0.1380	0.4892	1.9075	0.0598	-0.0883	0.0250	-0.0036
1994	0.1223	0.1411	0.4537	1.9103	0.0522	0.0216	-0.0753	-0.0015
1995	0.1220	0.1417	0.4508	1.9094	0.0023	0.0048	-0.0066	-0.0005
1996	0.1003	0.1217	0.4283	1.9244	0.1956	-0.1525	-0.0510	-0.0078

Table B1: The SST Poverty Intensity Index, Decompositions, and Changes by Age Groups (Continued)

Year	*SST*	Decomposition			*Δln(SST)*	Decomposition of Change		
		Rate	*Gap*	*1+Gini*		*Δln(Rate)*	*Δln(Gap)*	*Δln(1+Gini)*
Old Households								
1968	0.1788	0.3035	0.3252	1.8115				
1969	0.1687	0.3040	0.3069	1.8083	-0.0582	0.0016	-0.0579	-0.0018
1970	0.1650	0.2971	0.3060	1.8151	-0.0225	-0.0231	-0.0032	0.0038
1971	0.1366	0.2453	0.3019	1.8454	-0.1884	-0.1915	-0.0134	0.0166
1972	0.1124	0.2212	0.2728	1.8634	-0.1952	-0.1036	-0.1013	0.0097
1973	0.1160	0.2191	0.2851	1.8582	0.0317	-0.0096	0.0440	-0.0028
1974	0.1069	0.2220	0.2585	1.8633	-0.0819	0.0133	-0.0980	0.0027
1975	0.1033	0.2243	0.2470	1.8640	-0.0346	0.0105	-0.0455	0.0004
1976	0.1020	0.2180	0.2515	1.8614	-0.0120	-0.0288	0.0182	-0.0014
1977	0.1146	0.2293	0.2708	1.8458	0.1165	0.0509	0.0740	-0.0084
1978	0.1122	0.2459	0.2474	1.8453	-0.0212	0.0696	-0.0906	-0.0003
1979	0.1068	0.2251	0.2567	1.8486	-0.0493	-0.0881	0.0370	0.0018
1980	0.1216	0.2711	0.2462	1.8216	0.1296	0.1859	-0.0416	-0.0147
1981	0.1290	0.2617	0.2707	1.8207	0.0586	-0.0355	0.0946	-0.0005
1982	0.1057	0.2418	0.2370	1.8451	-0.1984	-0.0791	-0.1326	0.0133
1983	0.1064	0.2500	0.2311	1.8421	0.0065	0.0335	-0.0253	-0.0016
1984	0.1080	0.2519	0.2336	1.8355	0.0147	0.0075	0.0108	-0.0036
1985	0.1178	0.2553	0.2509	1.8384	0.0867	0.0135	0.0715	0.0016
1986	0.1099	0.2208	0.2687	1.8530	-0.0692	-0.1454	0.0682	0.0079
1987	0.1134	0.2310	0.2656	1.8478	0.0309	0.0452	-0.0114	-0.0028
1988	0.1030	0.2157	0.2574	1.8551	-0.0959	-0.0687	-0.0312	0.0040
1989	0.1052	0.2288	0.2478	1.8552	0.0211	0.0591	-0.0380	0.0001
1990	0.1198	0.2761	0.2372	1.8285	0.1297	0.1881	-0.0439	-0.0145
1991	0.1383	0.2750	0.2765	1.8191	0.1442	-0.0040	0.1534	-0.0052
1992	0.1460	0.2598	0.3055	1.8395	0.0539	-0.0569	0.0997	0.0111
1993	0.1505	0.2851	0.2881	1.8319	0.0301	0.0929	-0.0586	-0.0041
1994	0.1315	0.2597	0.2752	1.8402	-0.1347	-0.0935	-0.0457	0.0045
1995	0.1237	0.2433	0.2753	1.8466	-0.0616	-0.0652	0.0001	0.0035
1996	0.0928	0.1792	0.2738	1.8910	-0.2872	-0.3058	-0.0052	0.0238

Notes: Calculations based on total family income from the Panel Study of Income Dynamics (PSID). Households are divided by age of household head: if between 20 and 29 years, the household is considered young; 30 to 65 years, the household is considered middle-aged; 65 years and above, the household is considered old.

Chapter 3

A Life-Cycle Theoretical Analysis of Poverty: The Effects of Shifting Labor Productivity Variances

3.1 Introduction

According to Stock and Watson (2003), the U.S. business cycle has become less volatile, particularly after 1984. They find that the standard deviation of the annual growth of real GDP per capita during 1984-2002 fell considerably, almost 40 percent from the earlier period, 1960-1983. This decline in output volatility in turn produces some changes in the duration of the business cycle. Based on the NBER chronology, great moderation accompanies longer expansions and shorter recessions. The recession after 1984 was short - only eight months, while the 92-month expansion in the 1980s and the 120-month expansion in the 1990s are considered the third longest and the longest, respectively, in U.S. history. The prolonged expansions have created strong economic prosperity. At the same time, the economy has experienced unanticipated economic outcomes relating to poverty and inequality over the past two decades.

A key purpose of this chapter is to examine the effect of great moderation of the business cycle, more specifically on the economic poverty position of low-income

households, and to find the contributing factors for the change in their economic poverty position. In particular, this chapter addresses two questions:

1. Can the decline in volatility of economic activities through the effects of saving behaviors possibly explain the cyclical changes in the economic poverty position documented in Chapter 2?

2. Which shocks are responsible for the changes in households' saving behaviors, thus influencing their economic position?

To answer these questions, I investigate the notion that the moderation of the business cycle may distort the attitude toward uncertainty and, as a result, be reflected through consumption and saving behaviors. In general, households save in part owing to a precautionary saving motive. In light of greater certainty in the economy, they may change their consumption and saving behaviors; thus, by saving less, households should experience larger fluctuation in their wealth and well-being during a sudden contraction of economic activities. Therefore, the change in saving behavior is a likely key to recognize the probability that a household will become poor or even poorer in during a recession. In addition, a reduction in aggregate uncertainty should also affect several aspects of households' saving behavior over the life cycle as in the following.

(i) Households at different ages have different motives for wealth accumulation to ensure their future consumption and welfare (Gourinchas, 2000; Gourinchas and Parker, 2002). Young households face excessive labor-income uncertainty in their early working life, so they will save up to a certain amount as a buffer

stock to deal with their income risks. While middle-aged households will save primarily for their retirement.

(ii) Precautionary saving is also found to be very important for low-income households (Gourinchas and Parker, 2001). The estimated marginal propensity to consume for households with low income and little wealth is relatively high, around 40 percent. As a result, precautionary saving has a large effect on the consumption growth and future well-being of these households.

(iii) When households alter their attitudes toward idiosyncratic labor-income risks and the Total Factor Productivity shock, that change will be reflected in their saving behaviors. For instance, if households relax their concerns about future risk in response to the reduction in business cycle fluctuations, they will save smaller buffer savings against labor-income risk and accumulate less life-cycle wealth for their retirement. Thereby, these changes in saving behaviors can potentially make these households more vulnerable to unexpected shock.

(iv) Thus, the long expansion accompanied with low fluctuation in economic activities in the 1980s could potentially explain the cyclical changes in economic poverty position (EPP). As households' attitudes toward uncertainty change, so do their saving behaviors. Because both young and middle-aged households accumulated fewer savings during the 1980s, they were at increased risk for the economic downturn in the early 1990s. More specifically, middle-aged households with a smaller savings buffer from the earlier period (young age) and old households with fewer retirement savings accumulated during the

prior period (middle-aged) became much more sensitive to the recession in the 1990s.

To verify the theory mentioned above, the chapter develops a stochastic overlapping generations (OLG) model with an incomplete market economy, which is closely in line with the models from Storesletten, Telmer, and Yaron (2004a), and Heathcote, Storesletten, and Violante (2004). The presence of uncertainty in the model economy, in terms of productivity shocks, induces households to engage in precautionary saving behavior to ensure their future consumption and welfare. In accordance with the theory of precautionary saving, the stochastic OLG feature is particularly important for the study since it makes it possible to differentiate individuals' income process and to capture various effects of productivity shocks across age groups (Gourinchas and Parker, 2001; Carroll and Samwick, 1998; Lusardi, 1998). For such a purpose, it is important for the study to use the perturbation algorithm as the solution method because the effects of uncertainty usually appear on the second-order solutions.

In addition, an incomplete markets framework is necessary to introduce the dynamics of aggregate variables in the presence of idiosyncratic labor-market uncertainty (Storesletten, Telmer, and Yaron, 2001). The model assumes that agents are unable to fully share risk through a set of financial and insurance securities; thus, to insure risk they are forced to save or hold capital. If the variance of idiosyncratic risk increases during economic downturns, for example, agents would hold additional capital for precautionary motive, which leads to an increase in aggregate capital stock or aggregate precautionary savings. On the contrary, the increase in aggregate savings may contribute to a decline in

aggregate consumption and probably in aggregate output. Therefore, the setting of the incomplete markets economy allows the study to explore an important role of idiosyncratic shocks in the distribution of poverty and economic poverty position.

To characterize the impacts of the moderation of the business cycle on poverty and economic poverty position (EPP) over the life cycle, the study takes the following approaches. (1) Model and solve for the benchmark model economy's competitive equilibrium, and then simulate consumption, income, and saving patterns under the assumption of equally weighted productivity shocks. (2) Define the poverty threshold as half of the median income from the benchmark. The poverty threshold is used for all alternative model economies. (3) Compute the SST index and the EPP measure and then present the distributions with respect to the model GDP. (4) Solve the model and re-simulate all behaviors under the various combinations of productivity shocks. (5) Re-compute the SST and the EPP measures using the benchmark poverty threshold, and then compare the distribution results with the benchmark model. The effect of the decline in the volatility of GDP is measured in terms of how the cyclicality of the SST and the EPP measures changes and which productivity shocks are responsible for the change.

The main conclusions of the analysis are the following. First, the change in the output volatility through the effects of saving behaviors can potentially explain the fluctuation in the SST and the EPP measures. Second, idiosyncratic labor efficiency plays a significant role in saving behaviors and the fluctuation of the two poverty measures. Third, the shift in productivity shocks is the underlying cause for the variation in poverty intensity and economic poverty position for young and old households.

The rest of this chapter is organized as follows. Section 3.2 presents the theoretical model. Section 3.3 then describes the calibration assumptions and solution method. Section 3.4 is devoted to discussing the model's results concerning poverty issues. Finally, Section 3.5 concludes by summarizing the main findings.

3.2 The Economic Model

The model economy in this study is an overlapping generations general equilibrium model and closely in line with the models from Storesletten, Telmer, and Yaron (2004a, 2004b) and Heathcote, Storesletten, and Violante (2004). The key features of the model economy applied in this study are that (i) there are two economic decision makers: households and firms; (ii) the model consists of a large number of heterogeneous households; (iii) the households face both uninsurable earning shocks and aggregate economy shock over their lifetimes; (iv) the households accumulate capital as precautionary savings against uncertainties or sudden changes in the economic environment and also as investments with an expected rate of return to ensure their higher future income.

3.2.1 The Households

The model economy is populated by overlapping generations of economic agents. In each period a large number of a new generation is born with identical preferences and identical initial capital stocks. However, agents differ in their labor productivity. Each individual

from generation t lives for a maximum of N periods and is subject to mandatory retirement at age N-I then each agent dies at age N. At any time t, a set of agents is indexed by $h \in H = \{0, 1, 2, \ldots, N\text{-}1\}$. A typical agent born in period t solves the problem as given by

$$\max E_t \left\{ \sum_{h=0}^{N-1} \beta^h \Psi_h u[(c^t_{t+h}),(l^t_{t+h})] \right\}, \tag{1}$$

where c is consumption and l are leisure hours. In addition, the lifetime for each agent is not certain. The model uses φ_h to denote the conditional probability of surviving from age h-1 to h. The unconditional probability of surviving up to age h is therefore $\Psi_h = \Pi_{j=0}^{h} \varphi_j$. The period utility function is from the family of constant relative risk aversion (CRRA) and invariant to time and generation:

$$u(c,l) = \frac{[(c).(l^{\varpi})]^{1-\rho}}{1-\rho},$$

where ρ is the Arrow-Pratt coefficient of relative risk aversion and ϖ is the weight parameter on leisure.

The model also assumes an incomplete market framework in which agents are unable to fully share risks through financial and insurance securities. To ensure their future income against those risks, they hold capital as precautionary savings over the life cycle. In addition, agents are not altruistic. They consume all of their available income in the last period N; thus, there are no bequests in equilibrium.

The budget constraints for each agent born at time t of any time $t+h$ where $h \in H = \{0, 1, 2, \ldots, N\text{-}1\}$ are

for N-I periods: $$c^t_{t+h} + k^t_{t+h+1} \leq (1 + r_{t+h} - \delta)k^t_{t+h} + w_{t+h} A^t_{t+h} n^t_{t+h}, \quad (2)$$

for I periods: $$c^t_{t+h} + k^t_{t+h+1} \leq (1 + r_{t+h} - \delta)k^t_{t+h}, \quad (3)$$

where k is capital holding. The initial capital holding k_t is set to zero, and the capital holding at the end of the last period, k_{t+N}, is also equal to zero. The real rate of return r is the pre-tax return to capital or savings, w is the real labor wage rate, and δ is the depreciation rate of capital. The individual's working hours, n, is exogenously fixed in this model. Accordingly, working agents have both labor income and capital income, while retirees have only one source of income from the capital investment.

In addition to age heterogeneity, agents also differ by their labor efficiency endowments, A^t_{t+h}. This idiosyncratic labor productivity is a combination of three different types of labor market shocks. The study follows Heathcote, Storesletten, and Violante (2004) and Storesletten, Telmer, and Yaron (2004a, 2004b) to calibrate the agent's labor efficiency.

Log of labor efficiency endowment for a working individual is defined as:

$$\ln(A^t_{t+h}) = \kappa_h + \chi + \eta^t_{t+h} + \upsilon_{t+h}, \quad (4)$$

where κ_h is the deterministic hump-shaped profile of labor productivity over the life cycle. Additionally, the labor efficiency endowment of each working agent is fundamentally driven by three stochastic components: fixed effect, persistent and transitory components.

The fixed effect, $\chi \sim Niid(0,\sigma_\chi^2)$, represents the individual's permanent skills such as innate ability received at birth that remains throughout the lifetime. At the time of labor market entrance, each individual possesses abilities or characteristics that partially determine his/her own labor productivity. Hence, the fixed effect is invariant with age and time.

The persistent component, η^t_{t+h}, varies across individuals in any period $t+h$. It also follows a first order auto-regression (AR [1])[22]:

$$\eta^t_{t+h} = \psi \eta^t_{t+h-1} + \omega_{t+h},$$

where $\omega_{t+h} \sim Niid(0,\sigma_\omega^2)$, and $\eta_0 = 0$. The last component in equation (4) is the transitory component, $\upsilon_{t+h} \sim Niid(0,\sigma_\upsilon^2)$, which agents receive each period, and this also helps to minimize measurement error in wages.

All three types of idiosyncratic shocks are included to produce labor income that closely replicates actual income data from the PSID. Since each agent at any time $t+h$ responds differently to shocks, by incorporating the shocks into the model, the study can

[22] A first-order autoregression (AR[1]) process is common practice in studying the persistent component in labor wages process, as for example in Heathcote, Storesletten, and Violante (2004) and Storesletten, Telmer, and Yaron (2004a, 2004b). Specifically, Heathcote, Storesletten, and Violante (2004) observe the decline in the autocorrelation function of wages at an approximately geometric rate over time. They also find strong life-cycle patterns in the unconditional variance of wages.

generate the differences in the labor-income process. It is of particular importance to the study because labor income is the major source of income for the working agents and the working poor (Sawhill, 1988).

3.2.2 The Firms

Firms produce goods by combining aggregate capital and labor inputs based on a constant return to scale production function. The production function is concave and increasing with respect to both labor and capital. The aggregate output is subject to variation from one period to another due to an aggregate productivity shock, which fluctuates stochastically and exogenously over time. The aggregate output is produced based on a Cobb-Douglas production technology:

$$Y_t = Z_t F[K_t, A_t N_t],$$

$$Y_t = Z_t (K_t)^{\alpha} (A_t N_t)^{1-\alpha},$$

where Y_t is the aggregate output at time $t, K_t = \Sigma_{h=0}^{N-1} k_t^{t-h}$ is the aggregate capital stock at time t, and $A_t N_t = \Sigma_{h=0}^{N-1} A_t^{t-h} n_t^{t-h}$ represents total effective labor input at each time t. The parameter α denotes capital's share in output satisfied $0 < \alpha < 1$. Additionally, the model assumes that an exogenous level of total factor productivity, $z_t = \log(Z_t)$ follows a first-order autoregressive (AR[1]) process:

$$z_t = \phi z_{t-1} + \sigma_z \varepsilon_t,$$

where σ_z is the variance of total factor productivity (TFP) shock and greater than zero. The term ε_t is distributed normally with mean zero and unit variance.

Under competitive market conditions, all productive factors are paid their marginal product values. The marginal productivity of an effective labor hour (MPL) is, thus, the real wage rate of each worker.

$$w_t = (1-\alpha)Z_t(K_t)^{\alpha}(A_tN_t)^{-\alpha}.$$

The marginal productivity of a unit of capital (MPK) equals the real rate of return to capital.

$$r_t = \alpha Z_t(K_t)^{\alpha-1}(A_tN_t)^{1-\alpha}.$$

3.2.3 Characterization of Equilibrium

A typical agent who lives for *N* periods, make choices of consumption, savings, and leisure over his or her life. Agents make economic decisions to maximize the objective function (1) subject to budget constraints (2) and, (3) given the stochastic process for labor productivity as well as the real prices of their labor, *w*, and capital, *r*. The dynamic programming problem of a household born at time *t* at time *t+h* is:

$$v_h(s^t_{t+h}, S_{t+h}) = \max\left\{u(c^t_{t+h}, l^t_{t+h}) + \beta\frac{\Psi_{h+1}}{\Psi_h}E_{t+h}[v_{h+1}(s^t_{t+h+1}, S_{t+h+1})]\right\},$$

where $s^t_{t+h} = \{k^t_{t+h}, \eta^t_{t+h}, \chi^t\}$ and $S_{t+h} = \{\upsilon_{t+h}, z_{t+h}\}$ subject to:

$$c^t_{t+h} + k^t_{t+h+1} \leq (1 + r_{t+h} - \delta)k^t_{t+h} + w_{t+h} A^t_{t+h} n^t_{t+h},$$

$$\ln(A^t_{t+h}) = \kappa_h + \chi + \eta^t_{t+h} + \upsilon_{t+h}.$$

When time $t+h > I$, households will retire and exit from the labor market. As a result, the retired households have only one source of income from their capital savings. The study sets the model as a closed economy and defines its equilibrium as follows.

Definition of Competitive Equilibrium

A recursive competitive equilibrium is a set of (i) household consumptions $\left\{\left\{c_t^{t-h}\right\}_{h=0}^{N-1}\right\}_{t=0}^{\infty}$ *and capital allocations* $\left\{\left\{k_t^{t-h}\right\}_{h=0}^{N-1}\right\}_{t=0}^{\infty}$, *(ii) pricing functions* $\left\{w_t, r_t\right\}_{t=0}^{\infty}$, *(iii) aggregate production plans for firms* $\left\{K_t, A_t N_t\right\}_{t=0}^{\infty}$, *and (iv) value functions* $\left\{\left\{v_h(t)\right\}_{h=0}^{N-1}\right\}_{t=0}^{\infty}$ *given the stochastic process for A and Z, initial capital stocks, as well as labor allocations* $\left\{\left\{\eta_t^{t-h}\right\}_{h=0}^{N-1}\right\}_{t=0}^{\infty}$, *such that, given period 0 capital stocks, the following conditions are satisfied for all t:*

1. *The individual and the aggregate exhibit consistent decision-making behaviors. Thus, the supply of productive factors is equal to the firms' demand:*

$$K_t = \Sigma_{h=1}^{N-1} k_t^{t-h}, \text{ and } A_t N_t = \Sigma_{h=0}^{N-1} A_t^{t-h} n_t^{t-h}.$$

2. *The allocations are feasible:*

$$C_t + K_{t+1} - (1-\delta)K_t = Z_t(K_t)^{\alpha}(A_t N_t)^{1-\alpha},$$

where $C_t = \Sigma_{h=0}^{N-1} c_t^{t-h}$.

3. *Firms maximize their profits or stock market value at each period:*

$$\pi_t = \max\left\{Z_t(K_t)^{\alpha}(A_t N_t)^{1-\alpha} - r_t K_t - w_t A_t N_t\right\}$$

and also pay competitive factor prices, which are equal to the factors' marginal productivities.

4. *Given the law of motion for the capital stocks, the price function, initial conditions, and the transitions for the stochastic states, v is the solution of the following problem:*

$$v_h(t+h) = \max\left\{u(c_{t+h}^t, l_{t+h}^t) + \beta \frac{\Psi_{h+1}}{\Psi_h} E_{t+h}[v_{h+1}(t+h+1)]\right\},$$

subject to:

(i) *the terminal condition* $v_N(t) = 0$ *for all t;*

(ii) *non-negativity conditions* $c_t^t, c_{t+h}^t, k_{t+h}^t \geq 0$ *for all t and h;*

(iii) *the initial capital stock,* $k_t^t = 0$, *and the terminal capital stocks,* $k_{t+N}^t = 0$ *for all t; and*

(iv) *the budget constraints.*

Based on the definition of the competitive equilibrium and specifications for preferences and technology, the optimal behavior of the household ensures the following inter-temporal Euler Equations and budget constraints at each time $t+h$ for each agent t:

$$u'(c^t_{t+h}) = \beta \frac{\Psi_{h+1}}{\Psi_h} E_{t+h}\{u(c^t_{t+h+1})(1 + r_{t+h+1} - \delta),$$

$$(c^t_{t+h})^{-\rho}(l^t_{t+h})^{\varpi(1-\rho)} = \beta \frac{\Psi_{h+1}}{\Psi_h} E_{t+h}\{(c^t_{t+h+1})^{-\rho}(l^t_{t+h+1})^{\varpi(1-\rho)}(1 + r_{t+h+1} - \delta)\},$$

$$1 = \beta \frac{\Psi_{h+1}}{\Psi_h} E_{t+h}\left[\frac{(c^t_{t+h+1})^{-\rho}(l^t_{t+h+1})^{\varpi(1-\rho)}}{(c^t_{t+h})^{-\rho}(l^t_{t+h})^{\varpi(1-\rho)}}\right](1 + r_{t+h+1} - \delta), \quad (6.1)$$

where a lifetime budget constraint of working households for N-I periods is,

$$c^t_{t+h} = (1 + r_{t+h} - \delta)k^t_{t+h} + w_t A^t_{t+h} n^t_{t+h} - k^t_{t+h+1}, \quad (6.2)$$

and lifetime budget constraint of retired households for I periods is,

$$c^t_{t+h} = (1 + r_{t+h} - \delta)k^t_{t+h}. \quad (6.3)$$

Equations (6.1) – (6.3) must hold at any time t for each agent born at time t-h, where $h \in H$.

3.3 Calibration and Solution Method

3.3.1 Calibration

The calibration strategy is to build a model economy that can replicate certain properties of the U.S. economy in the sample periods of 1968-1996, on average. This section also discusses the parameters, the functional forms, and the calibration targets chosen for the model economy.

Demographics

In the model, the life cycle of households, N, is set to 30 periods. Each period represents two calendar years. Households start making economic decisions at age 20 and work for 23 periods or until 65 years of age. Then they enjoy their retirement time, I, for seven periods beginning at age 66. The terminal age is, thus, at 80. The retirement age is set to match the age range in classifying old households in the PSID.

Households face the probabilities of survival presented in Table 3-1. These values are converted from the annual mortality probabilities taken from the U.S. Life Table of the National Center for Health Statistics (1992) to fit the biannual model of N, 30 periods.

Preferences

The study borrows the discount factor β of 0.962 from Heathcote, Storesletten, and Violante (2004) and Storesletten, Telmer, and Yaron (2004a).[23] Based on the model setting, households can only use capital holdings or wealth to self-insure against

[23] These two studies calibrate the model's wealth distribution to match the U.S. aggregate wealth/income ratio for the bottom 99 percent wealth quantile based on the ratios from Table 6 in Díaz-Giménez, Quadrini, and Ríos-Rull (1997) and Table 3 in Wolff (2000).

uncertainties; thus, it is necessary to choose the discount factor value that best reflects significant features of the wealth distribution. As shown in their studies, with this value of the discount factor, their model's aggregate wealth/income ratio matches that of the poorest 99 percent of households in the U.S. economy. The reason for leaving out the richest 1 percent of U.S. households is to be consistent with the available income data from the PSID, which usually contains undersamples of this top 1 percent.[24]

The Arrow-Pratt coefficient of relative risk aversion, ρ, is equal to 1.44. For the weight parameter on leisure, ϖ, the study follows Hendricks (2004) and sets it equal to 0.5 so that the average fraction of time endowment devoted to the aggregate labor market is two-thirds. Assuming eight hours per day for sleep, the households spend the rest of the day on both market and personal activities.

Production Technology

The study follows the literature in choosing production functional form and parameters. A Cobb-Douglas aggregate production function; $Y_t = Z_t(K_t)^{\alpha}(A_t N_t)^{1-\alpha}$, is used in the model. This is consistent with the notion that, in the U.S., there is no trend in the productive factor shares after World War II. The capital share in aggregate output parameter, α, is set to 0.33, and the annual depreciation parameter, δ, is equal to 6 percent. Thus, the model's depreciation rate is 11.64 percent or $[1 - (1 - 0.06)^2]$.

Following most studies, particularly Fowler and Young (2004), the parameters of the stochastic process of aggregate technology are selected based on an autocorrelation of

[24] This notion is supported by the study from Juster, Smith, and Stafford (1999). They confirm that the PSID dataset can precisely characterize the wealth distribution of households in the bottom 99 percent quantile in the U.S.; however the dataset does not contain sufficient samples for the wealthiest 1 percent of the U.S. households.

50 percent of output. This implies that the total factor productivity shock, σ_z, equals 0.01. The model's autocorrelation coefficient for the output, ϕ, is equivalent to 0.25 or $[0.5^2]$.

Table 3-1: Calibrations for Survival Probabilities

Probability Value			Probability Value			Probability Value		
φ_0	=	1.00000						
φ_1	=	0.99831	φ_{11}	=	0.99598	φ_{21}	=	0.96702
φ_2	=	0.99807	φ_{12}	=	0.99486	φ_{22}	=	0.95906
φ_3	=	0.99785	φ_{13}	=	0.99349	φ_{23}	=	0.94926
φ_4	=	0.99783	φ_{14}	=	0.99166	φ_{24}	=	0.93920
φ_5	=	0.99809	φ_{15}	=	0.98920	φ_{25}	=	0.92939
φ_6	=	0.99832	φ_{16}	=	0.98640	φ_{26}	=	0.91814
φ_7	=	0.99825	φ_{17}	=	0.98390	φ_{27}	=	0.90497
φ_8	=	0.99795	φ_{18}	=	0.98120	φ_{28}	=	0.88941
φ_9	=	0.99750	φ_{19}	=	0.97757	φ_{29}	=	0.87208
φ_{10}	=	0.99686	φ_{20}	=	0.97286	φ_{30}	=	0.85319

Note: φ_h denotes the conditional probability of surviving from age h-1 to h, where $h = 1,\ldots, 30$.

Individual Productivity Process

The deterministic age profile of labor productivity, κ_h is calibrated so that the model's consumption profile matches the hump-shaped consumption profile over the life cycle (Fernández-Villaverde and Krueger, 2002; Stroresletten, Telmer, and Yaron, 2004a). At the final steady state of the model economy, this deterministic hump shape of labor efficiency thus entirely determines the individuals' wage processes. In other words, under an environment of certainty, the individuals' wage profiles over their life cycle

strictly follow the age profile of labor efficiency. Therefore, the study sets the model's labor efficiency peaks at age 50-51 and expects that the model's generated income profile would peak around these ages. This estimated profile is anticipated to be consistent with the hump-shaped income profile from Gourinchas and Parker (2002).

The parameters for the stochastic part of individual productivity process are selected and calibrated following Heathcote, Storesletten, and Violante (2004) and Storesletten, Telmer, and Yaron (2004b). The study borrows a persistent autocorrelation of $\psi = 0.94$ and specifically calibrates an equally weighted shock to persistent, fixed-effect, and transitory components $(\sigma_\omega, \sigma_\chi, \sigma_\upsilon = 0.0114)$. The purpose for the study in assigning an equal value to these shocks is to use them as a benchmark in comparing the effects of individuals' income processes and cyclical poverty when shock parameters are varied. It also allows us to observe changes in income processes of the poor and cyclical changes in their economic position in poverty. Table 3-2 presents a summary of the benchmark model's parameters.

Table 3-2: Calibration for Benchmark Model Economy

Preferences		Production Technology		Individual Labor Productivity	
β	$=0.962$	α	$=0.33$	ψ	$=0.94$
ρ	$=1.44$	δ	$=0.1164$	σ_χ	$=0.0114$
ϖ	$=0.5$	ϕ	$=0.25$	σ_ω	$=0.0114$
n	$=2/3$	σ_z	$=0.0114$	σ_υ	$=0.0114$

3.3.2 Solution Method: Perturbation Algorithm

The study employs the perturbation method of Gasper and Judd (1997) and Schmitt-Grohé and Uribe (2004) to solve the model economies for two reasons. First, the perturbation method has been shown to be the most effective for approximating the solution to a nonlinear general equilibrium model. Thus, this method fits the high nonlinearity setting of the model well, since the study focuses particularly on the effects of the stochastic processes from both labor-market and economy-wide environments through individuals' income. These effects are likely to appear on the higher-order solution. Second, the perturbation method handles the complexity of heterogeneity in the overlapping generations model extremely well (Fowler, 2003). This is critical to the model with significant degrees of heterogeneity; not only for age but also idiosyncratic labor efficiency shocks.

To solve the model, the series of the intertemporal Euler equation and budget constraints (6.1) – (6.3) are reduced into the form:

$$E_{t+h}\{F(k^t_{t+h}, k^t_{t+h+1}, K_{t+h}, K_{t+h+1}, z_{t+h}, z_{t+h+1}, A^t_{t+h})\}^{N-1}_{h=0} = 0,$$

$$E_{t+h}\{F(s^{t-h}_t, s^{t-h}_{t+1}, S_t, S_{t+1}, \sigma)\}^{N-1}_{h=0} = 0 \quad , \tag{7}$$

where $s^{t-h}_t = \{k^{t-h}_t, \eta^{t-h}_t, A^{t-h}_t\}$, $s^{t-h}_{t+1} = \{k^{t-h}_{t+1}\}$, $S_t = \{z_t, K_t\}$, $S_{t+1} = \{z_{t+1}, K_{t+1}\}$ and $\sigma = \{\sigma_z, \sigma_\chi, \sigma_\upsilon, \sigma_\omega\}$. The reduced form of the Euler equation (7) obviously illustrates complicated functions of aggregate and private capital holdings, economy-wide stochastic processes, and idiosyncratic labor productivity. The complication of this

dynamic model can, however, be resolved by making the capital's transition function that relates today's state to tomorrow's as a function of the individual and aggregate state vectors. The solution at each time t is then expressed as:

$$k_{t+1}^{t-h} = \mathrm{H}^h(\mathrm{B}_t^h), \tag{8}$$

where $\mathrm{B}_t^h = (S_t, s_t^{t-h}, \sigma)$ and is the state of economy at time t. In other words, the tomorrow's individual capital holding depends upon today's individual state and aggregate state of the economy as well as a set of innovations occurring in both states.

Although agents are heterogeneous in age and labor productivity, they have to solve the same policy functions at each time period. For example, an agent born at time t+1 will optimize his or her policy function, which is the same policy function for an agent born at time t. Accordingly, the aggregate capital at any time t, is then equal to $K_{t+1} = \Sigma_{i=0}^{N-1} \mathrm{H}^i(\mathrm{B}_t^i)$.

The solution equation (8) can now be approximated by the second-order Taylor series expansion such that:

$$\begin{aligned}
\mathrm{H}^h(\mathrm{B}_t^h) = {} & \mathrm{H}_0^h + \mathrm{H}_1^h(K_t - \overline{K}) + \mathrm{H}_2^h(z_t - \overline{z}) + \mathrm{H}_3^h(\sigma_z - \overline{\sigma}_z) + \mathrm{H}_4^h(k_t^{t-h} - \overline{k}^h) + \\
& \mathrm{H}_5^h(\sigma_\omega - \overline{\sigma}_\omega) + \mathrm{H}_6^h(\sigma_\upsilon - \overline{\sigma}_\upsilon) + \mathrm{H}_7^h(\eta_t^{t-h} - \overline{\eta}^h) + \mathrm{H}_8^h(A_t^{t-h} - \overline{A}^h) + \\
& \mathrm{H}_9^h(\sigma_\chi - \overline{\sigma}_\chi) + \\
& \frac{1}{2}\mathrm{H}_{1,1}^h(K_t - \overline{K})^2 + \frac{1}{2}\mathrm{H}_{2,2}^h(z_t - \overline{z})^2 + \frac{1}{2}\mathrm{H}_{3,3}^h(\sigma_z - \overline{\sigma}_z)^2 + \ldots\ldots + \\
& \frac{1}{2}\mathrm{H}_{9,9}^h(\sigma_\chi - \overline{\sigma}_\chi)^2 + \\
& \mathrm{H}_{1,2}^h(K_t - \overline{K})(z_t - \overline{z}) + \mathrm{H}_{1,3}^h(K_t - \overline{K})(\sigma_z - \overline{\sigma}_z) + \ldots\ldots\ldots + \\
& \mathrm{H}_{8,9}^h(A_t^{t-h} - \overline{A}^h)(\sigma_\chi - \overline{\sigma}_\chi),
\end{aligned}$$

where $H_0^h = H(B_t^h)\big|_{B_t^h=\bar{B}^h}$, $H_1^h = \left.\frac{\partial H(B_t^h)}{\partial K_t}\right|_{B_t^h=\bar{B}^h}, \ldots,$ $H_9^h = \left.\frac{\partial H(B_t^h)}{\partial \sigma_\chi}\right|_{B_t^h=\bar{B}^h}$,

$$H_{1,1}^h = \left.\frac{\partial^2 H(B_t^h)}{\partial K_t \partial K_t}\right|_{B_t^h=\bar{B}^h}, \ldots, \quad H_{9,9}^h = \left.\frac{\partial^2 H(B_t^h)}{\partial \sigma_\chi \partial \sigma_\chi}\right|_{B_t^h=\bar{B}^h},$$

$$H_{1,2}^h = \left.\frac{\partial^2 H(B_t^h)}{\partial K_t \partial z_t}\right|_{B_t^h=\bar{B}^h}, \ldots, \quad H_{8,9}^h = \left.\frac{\partial^2 H(B_t^h)}{\partial A_t^{t-h} \partial \sigma_\chi}\right|_{B_t^h=\bar{B}^h}.$$

The solution process is to solve for these coefficients starting from the lower-order coefficients and then moving up to the higher-order coefficients. All coefficients are then used to build an approximation to $H^h(B_t^h)$. The expansions of state variables thus are perturbed around the deterministic steady states of the economy as the following, $\bar{B}^h = \{\bar{K}, \bar{z}, \bar{\sigma}_z, \bar{k}^h, \bar{\sigma}_\omega, \bar{\sigma}_\upsilon, \bar{\eta}^h, \bar{A}^h, \bar{\sigma}_\chi\}$. The steady states are the most common expansion points, since an economy will not deviate from its stable state when there is no uncertainty and no growth in the economy.

The study first finds the steady states by solving the certainty version of the equation (7) given by:

$$\{F(\bar{s}^h, \bar{s}^{h+1}, \bar{S}, \bar{S}, \bar{\sigma})\}_{h=0}^{N-1} = 0,$$

where $\bar{s}^h = \{\bar{k}^h, \bar{\eta}^h, \bar{A}^h\}$, $\bar{s}^{h+1} = \{\bar{k}^{h+1}\}$,

$\bar{S} = \{\bar{z} = 0, \bar{K}\}$, and $\bar{\sigma} = \{\sigma_z = 0, \sigma_\chi = 0, \sigma_\upsilon = 0, \sigma_\omega = 0\}$.

At the steady state, the first perturbation coefficient of the expansion H_0^h is equal to $\bar{k}^h$ since $\bar{k}^h = H_0^h + H_1^h(\bar{K} - \bar{K}) + H_2^h(\bar{z} - \bar{z}) + ... + H_{8,9}^h(\bar{A}^h - \bar{A}^h)(\bar{\sigma}_\chi - \bar{\sigma}_\chi)$. To obtain the first-order coefficients, the study follows the fact that the expansion of the solution around $\bar{k}^h$ must be set to zero. For instance,

$$0 = \frac{\partial F(B_t^h)}{\partial K_t}\bigg|_{B_t^h = \bar{B}^h} + \frac{\partial F(B_t^h)}{\partial K_{t+1}} \frac{\partial H(B_t^h)}{\partial K_t}\bigg|_{B_t^h = \bar{B}^h},$$

by rearranging the equation, the solution for the first-order coefficient of the aggregate capital equals to

$$H_1^h = \frac{\left.\frac{\partial F(B_t^h)}{\partial K_t}\right|_{B_t^h = \bar{B}^h}}{\left.\frac{\partial F(B_t^h)}{\partial K_{t+1}}\right|_{B_t^h = \bar{B}^h}}.$$

The other first-order coefficients and the second-order coefficients are found in a similar fashion. In this study, the expansion of the solution is only at the second order, because the uncertainties or shocks in the model economy have at most second-order effects.

Finally, the model economies with different sets of individual labor shocks and aggregate shocks are simulated 1,500 times given all perturbation coefficients, $\{H_0^h, H_1^h, H_2^h, ..., H_{1,1}^h, H_{2,2}^h, ..., H_{1,2}^h, H_{1,3}^h, ..., H_{8,9}^h\}_{h=0}^{N-1}$. To avoid any transient dynamics, the first 100 of each model's simulations are dropped.

3.4 Modeling Results

3.4.1 Steady-State Profiles

Figure 3-1 shows the steady-state age profiles of income and consumption. The estimated profiles fit certain life-cycle facts from the literature. First, the income and consumption profiles appear to track each other the over life cycle, which is consistent with Gourinchas and Parker (2002). Moreover, the slope of the consumption profile is always less than that of the income profile (Stroresletten, Telmer, and Yaron, 2004a). Second, the model labor income profile under a certainty economy is hump-shaped, peaking at age 50-51. This is consistent with the finding of Gourinchas and Parker (2002). The steady state total income thus is a hump-shaped profile and peaks at age 64-65, right before retirement.

Last, the model age profile of consumption is also hump-shaped, and the peak occurs at age 58-59, roughly 31 percent higher than at age 23. The difference in percentage between the peak and at age 23 is perfectly in the literature range of 30 to 40 percent, while the model peak deviates from the fact by only two model-periods. These results are fairly consistent with Fernández-Villaverde and Krueger (2002) and Stroresletten, Telmer, and Yaron (2004a). The deviation from the fact found in the data is potentially due to the assumption of a fixed labor supply and the omission of taxation.

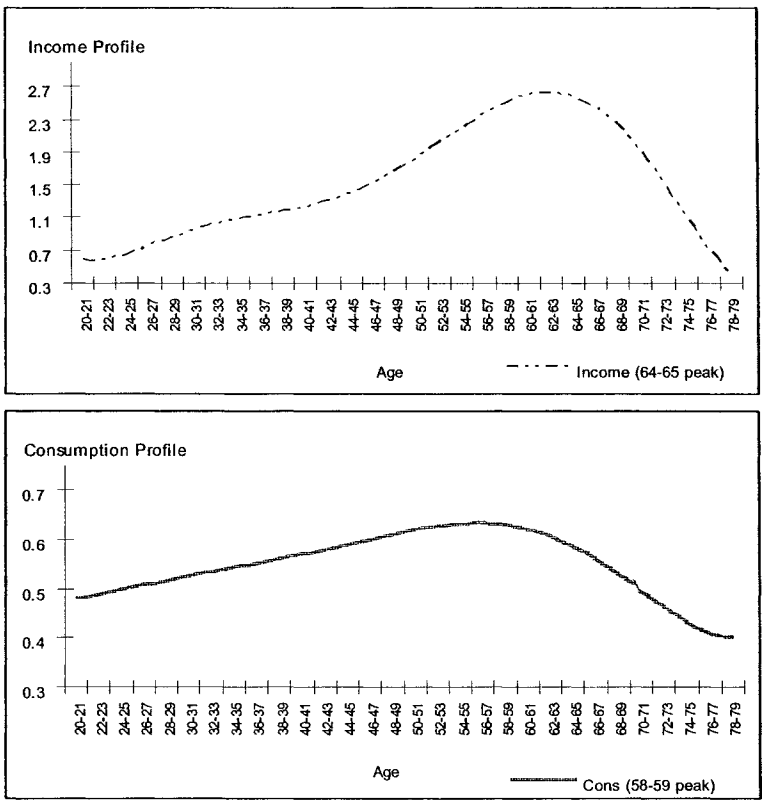


Figure 3-1: The Steady State Age Profiles of Income and Consumption. The profiles apparently are hump-shaped and track each other over the life cycle.

3.4.2 Benchmark Model

Equal shock values to total factor productivity (TFP) and three components of labor productivity are assigned for the benchmark economy model ($\sigma_z, \sigma_\chi, \sigma_\omega, \sigma_\upsilon$= 0.0114). The model is calibrated to achieve the target level of volatility in aggregate output at 0.02. In each period, the model agents realize the same exogenous TFP shock and face idiosyncratic labor-market uncertainty that directly affects individuals' total labor efficiency and then their labor income. To cope with all shocks in the economy, the

agents decide to save or hold capitals, which partially determine the next period's income. Table 3-3 reports the benchmark profiles across different age groups. The benchmark income and consumption profiles maintain the same prominent hump-shaped characteristics as those at the steady state.

Table 3-3: The Benchmark Income, Consumption, and Capital Savings across Ages

	Income		Consumption		Capital Savings	
Age Group	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
20-21	0.5453	0.0134	0.4801	0.0018	0.0652	0.0119
22-23	0.6186	0.0237	0.4886	0.0027	0.1300	0.0212
24-25	0.6912	0.0343	0.4971	0.0049	0.1941	0.0302
26-27	0.7632	0.0447	0.5058	0.0065	0.2575	0.0392
28-29	0.8350	0.0546	0.5147	0.0079	0.3204	0.0477
30-31	0.9063	0.0645	0.5237	0.0093	0.3826	0.0561
32-33	0.9768	0.0738	0.5330	0.0106	0.4437	0.0642
34-35	1.0468	0.0829	0.5426	0.0120	0.5042	0.0719
36-37	1.1163	0.0914	0.5521	0.0132	0.5641	0.0791
38-39	1.1862	0.0994	0.5617	0.0144	0.6245	0.0860
40-41	1.2571	0.1067	0.5711	0.0156	0.6860	0.0921
42-43	1.3314	0.1136	0.5805	0.0169	0.7509	0.0977
44-45	1.4125	0.1205	0.5895	0.0183	0.8231	0.1031
46-47	1.5074	0.1266	0.5981	0.0195	0.9094	0.1080
48-49	1.6341	0.1325	0.6060	0.0208	1.0281	0.1125
50-51	1.8686	0.1396	0.6130	0.0223	1.2556	0.1181
52-53	2.0193	0.1428	0.6189	0.0235	1.4003	0.1201
54-55	2.1498	0.1433	0.6239	0.0243	1.5259	0.1196
56-57	2.2744	0.1425	0.6277	0.0251	1.6467	0.1179
58-59	2.4001	0.1402	0.6298	0.0259	1.7703	0.1147
60-61	2.5317	0.1365	0.6297	0.0265	1.9018	0.1103
62-63	2.6738	0.1318	0.6272	0.0271	2.0467	0.1048
64-65	2.8319	0.1254	0.6212	0.0274	2.2106	0.0981
66-67	2.4584	0.1043	0.5170	0.0219	1.9415	0.0825
68-69	2.1592	0.0890	0.5052	0.0207	1.6540	0.0684
70-71	1.8396	0.0752	0.4900	0.0199	1.3495	0.0553
72-73	1.5010	0.0621	0.4713	0.0194	1.0296	0.0427
74-75	1.1452	0.0489	0.4488	0.0191	0.6964	0.0298
76-77	0.7746	0.0348	0.4223	0.0189	0.3524	0.0158
78-79	0.3919	0.0187	0.3919	0.0187		
Std. (Y) = 0.020			Model Poverty Threshold = 1.37197			

Note: Model poverty threshold is set to one-half of the median income.

To analyze poverty and its cyclical behavior at the aggregate and across age groups, this chapter applies the same procedures in measuring and calculating the SST poverty intensity index and an economic poverty position (EPP) as described in chapter 2. The agents are categorized into three age groups as young, middle-aged, and old households alive in periods 1 to 5, 6 to 23, and 24 to 30, respectively. The age ranges in the model are entirely comparable with the criteria employed in the data analysis. To this end, the model poverty threshold is set equal to the commonly accepted criterion of half the median income (Osberg and Xu, 2000). This poverty threshold is also used for all other model economies.

Table 3-4: Benchmark Cyclical Behavior of Poverty and Economic Poverty Position

	All Households	Young Households	Middle-Aged Households	Old Households
SST	-0.649	-0.782	+	0.167
EPP	0.226	-0.045	+	0.127
Std.(Y)	0.020			

Notes: The reported results are the correlation coefficients with respect to the log of GDP. + indicates no middle-aged households in poverty.

Table 3-4 shows the benchmark results. At the aggregate, the SST index is countercyclical with a correlation coefficient of -0.649 with respect to the log of the model GDP, indicating that good economic conditions lead to a decline in the degree of poverty intensity. Based on the structure and decomposition of the SST index discussed

in Chapter 2, this moderate decline is predominantly caused by a fall in the poverty rate.[25] The business boom obviously lifts up the households' income and, consequently, helps some poor households move across the poverty threshold. However, it may produce an adverse effect on the income distribution of the remaining poor. As a result, they indeed become worse off. Shown in Figure 3-2, the EPP presents a slight procyclicality (upward to the northeast).

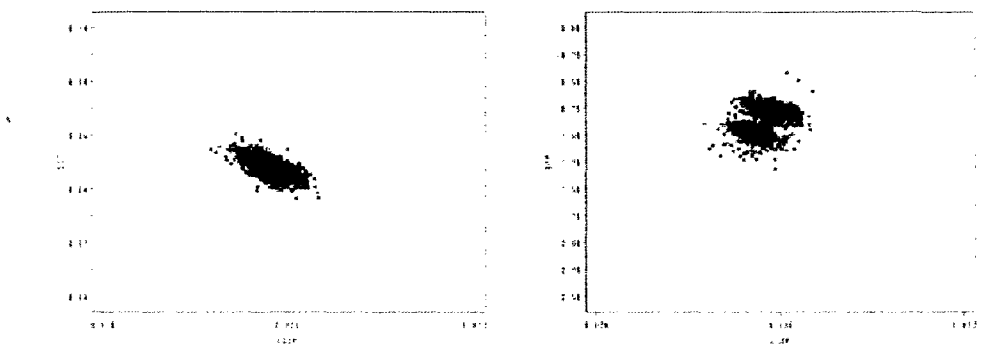


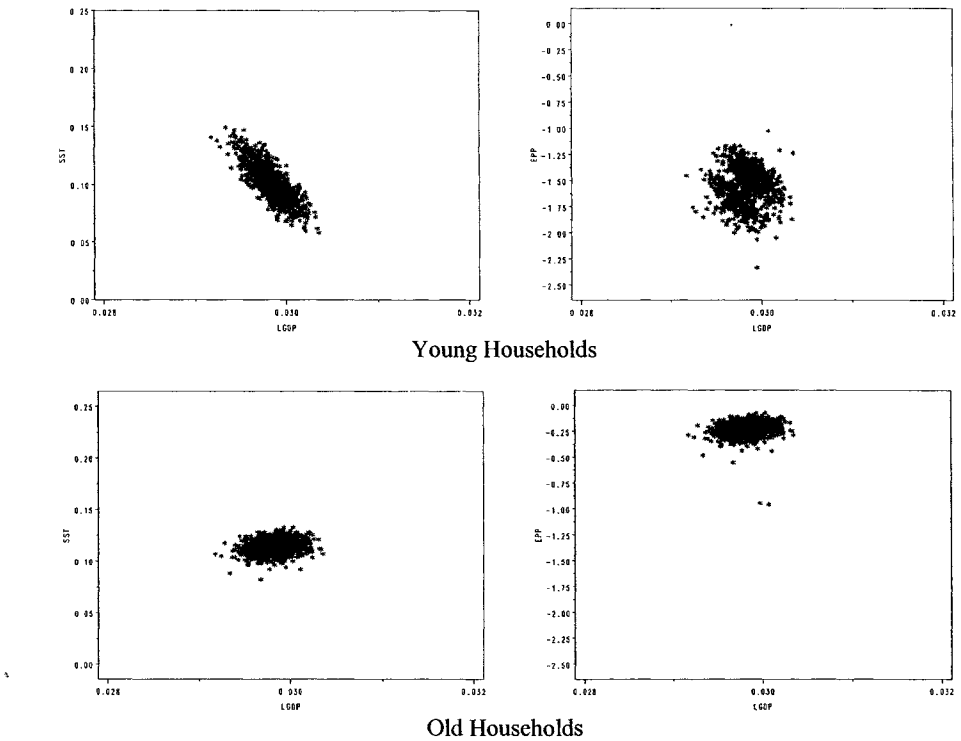
Figure 3-2: The Cyclical Behavior of Benchmark Poverty Intensity and Economic Poverty Position. The SST index is apparently countercyclical, while the EPP measure shows no clear relationship.

The cyclical behavior of the SST index and the *EPP* across age groups shows diverse directions as shown in Table 3-4 and Figure 3-3. This suggests that households respond in their own ways to a given set of benchmark shock parameters. Young households are more sensitive to economic conditions than their counterparts. The economic boom leads to a significant decrease in poverty intensity among the young with

[25] Any movement in the SST index can be caused by movement in the poverty rate (*Rate*), the economic poverty position (EPP), or both.

a correlation coefficient of -0.782 and marginally improves their economic poverty position. Simultaneously, old households appear to fare worst given the same set of productivity shocks during the economic expansion. They experience a slightly greater extent of poverty intensity and a modest deterioration in their economic position. The procyclicality of the SST index and the EPP for old households is due to their income structure. When retired, they rely solely on capital savings, which are used up in the last period. Finally, the benchmark economy model is not able to account for the cyclical behavior of the SST index and the EPP for middle-aged households found in the data.

Evidently, the simulated benchmark model can successfully account for the cyclical behaviors of the SST and the EPP measures for the young and the old households. However, the model is less effective in capturing the countercyclicality of the EPP at the aggregate level. This is possibly due to the absence of the middle-aged households in poverty. On the other hand, it is worth noting that the conflicting cyclical relationship of the two poverty indicators is consistent with the existing issue of poverty measurement. It reinforces the essence of using a more comprehensive poverty measure to better assess economic outcomes of business cycles across the poor population, which is frequently invisible from the perspective of the poverty rate measure.



Notes: The left panel shows the cyclical behavior of the SST index. The right panel shows the cyclical behavior of the economic position of the poor (*EPP*).

Figure 3-3: The Cyclical Behavior of Benchmark Poverty Intensity and the Economic Poverty Position across Age Groups. For the young and the old households, the cyclical behaviors of the SST and the EPP obviously show conflicting patterns given the same exposure to TFP and idiosyncratic labor shocks.

Even though the benchmark economy model is unable to capture all features of cyclicality of poverty observed in the data, the study intends to use the benchmark findings as points of reference against the results from alternative combinations of productivity shock parameters. The study basically aims to quantify the direction of any movement in cyclical behaviors of the SST index and the EPP measure away from the benchmark to identify potential underlying shocks that produce the cyclicality of poverty observed in the data.

3.4.3 The Role of Productivity Shocks

This section examines how innovations to productivity components influence the cyclical behavior of the SST index and the EPP through precautionary savings. The effects on individuals' capital holdings are represented by the perturbation coefficient with respect to the shock in the model. It is worthwhile to discuss the role of technology and labor productivity before considering various combinations of productivity innovations for the model. Table 3-5 illustrates the parameters applied in this section.

Table 3-5: Productivity Shocks for Model Economy Experiments

Pure TFP Shock Model	Pure Fixed Effect Model	Pure Persistent Shock Model	Pure Transitory Shock Model
$\sigma_z = 0.0182$	$\sigma_z = 0.0000$	$\sigma_z = 0.0000$	$\sigma_z = 0.0000$
$\sigma_\chi = 0.0000$	$\sigma_\chi = 0.0355$	$\sigma_\chi = 0.0000$	$\sigma_\chi = 0.0000$
$\sigma_\omega = 0.0000$	$\sigma_\omega = 0.0000$	$\sigma_\omega = 0.0455$	$\sigma_\omega = 0.0000$
$\sigma_\upsilon = 0.0000$	$\sigma_\upsilon = 0.0000$	$\sigma_\upsilon = 0.0000$	$\sigma_\upsilon = 0.0455$

I) The Cyclical Effect of Pure Total Factor Productivity (TFP) Shock

In the model economy, only TFP shock exists as total productivity uncertainty. The shock influences the economy through the individual's capital savings, which in turn determines aggregate capital savings and aggregate output. In the meantime, this shock indirectly affects agents' labor income via the real wage rate. Under this model setting, agents'

labor efficiencies are determined by the age profile of labor productivity, κ_h. The innovation of the TFP is equal to $\sigma_z = 0.0182$.[26] The findings are as follows.

(i) Table 3-6, which summarizes the distribution results of each productivity shock model, shows that the standard deviation of aggregate output is significantly high under this model economy in spite of a small value of the total shock to the economy. This suggests that the TFP is a significant determinant of cyclical fluctuations in output.

Table 3-6: The Cyclicality of Poverty and the Economic Poverty Position: Pure Shock Models

	Pure TFP Shock Model	Pure Fixed-Effect Model	Pure Persistent Shock Model	Pure Transitory Shock Model
All Households				
SST	-0.920	-0.572	-0.206	-0.255
EPP	0.303	0.336	0.187	0.097
Std.(*Y*)	0.028	0.023	0.024	0.008
Young Households				
SST	-0.943	-0.745	-0.663	-0.284
EPP	-0.192	-0.107	-0.092	-0.031
Middle-Aged Households				
SST	+	-0.401	*	+
EPP	+	-0.217	*	+
Old Households				
SST	0.277	0.396	0.228	0.167
EPP	0.281	0.182	0.064	0.166

Notes: The reported results are the correlation coefficients with respect to the log of GDP. + indicates no middle-aged households in poverty. * indicates only one household in poverty in the economy model and thus no correlation coefficient.

[26] In this model, the TFP shock is 40 percent of total productivity shock in the model (0.0455). Therefore, under the pure TFP shock setting, the value of 0.0182 is the highest possible value for this model economy.

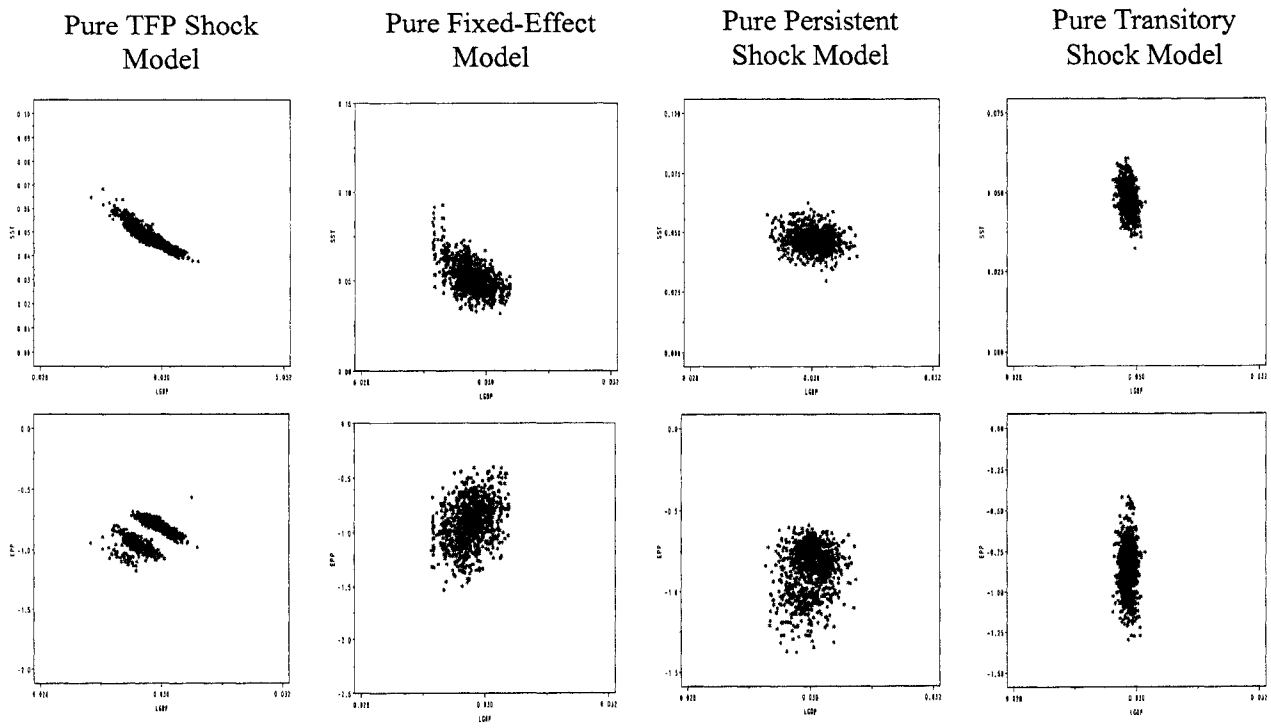
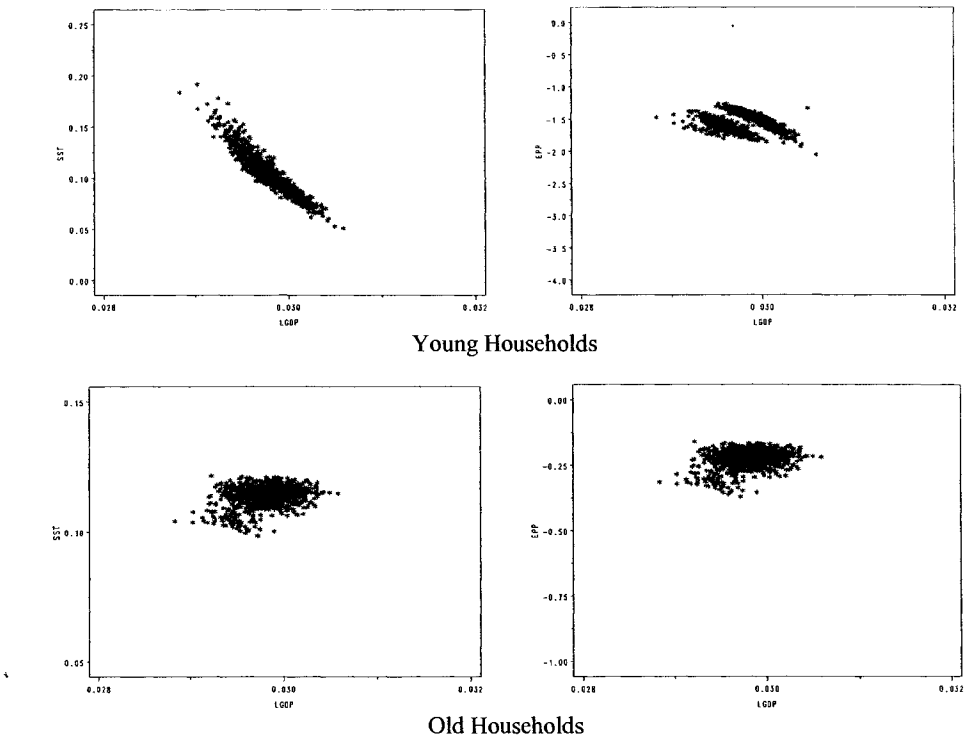


Figure 3-4: The Cyclical Behavior of Poverty Intensity and the Economic Poverty Position: Pure Shock Models. The top panel of each model shows the cyclicality of the SST index, and the bottom panel displays the cyclicality of the economic poverty position.



Notes: The left panel shows the cyclical behavior of the SST index. The right panel shows the cyclical behavior of the economic position of the poor (*EPP*).

Figure 3-5: The Cyclical Behavior of Poverty Intensity and the Economic Poverty Position across Age Groups from Pure TFP Shock Model. The behaviors of the SST index and the EPP measure of the young households are strongly countercyclical, while those of the old appear procyclical.

(ii) The TFP shock clearly causes an obvious cyclicality pattern of the SST index and the EPP measure both at the aggregate and across different age groups as shown in Figure 3-4 and Figure 3-5, respectively. For instance, the SST index for the young households is very strongly countercyclical with the correlation coefficients of -0.94. In addition, the countercyclicality of the EPP is fairly strong with the correlation coefficient of -0.192 compared to the same statistic from the other model economies. The young seem to experience great fluctuation in their EPP in this pure TFP shock economy.

(iii) Under the pure TFP shock setting, the procyclicality of the EPP for old poor households appears to be very strong with a correlation coefficient of 0.281. In addition, its procyclical behavior is even more pronounced than that of the SST index. This suggests that there could be an unfavorable redistribution of income away from the old households.

(iv) The pure TFP shock economy model is less effective in accounting for the cyclical behavior of poverty for the middle-aged households.

II) The Cyclical Effect of Pure Fixed-Effect Shock

In this model, a fixed-effect shock is the only source of uncertainty in the economy. Each agent has his or her own permanent skills, which are determined at birth, and these individual skills are maintained throughout the life cycle. The agents across age groups now differ from each other in individual fixed effects. Put differently, labor efficiency varies across individuals. The fixed-effect shock thus affects agents' labor income directly through their labor efficiencies. The innovation of the fixed-effect shock is set to $\sigma_{\chi} = 0.0355$.[27] The findings are as follows.

(i) Table 3-6 shows that the large shock of a fixed effect produces merely moderate volatility of the aggregate output at 0.023. Under this model economy, the agents differ in their own abilities and skills determined at birth, which in turn determine the agents' lifetime labor income. For instance, the agents with

[27] In this model, the fixed effect shock is 78 percent of the total productivity shock in the model (0.0455). Under the pure fixed-effect shock setting, the value of 0.0355 is the highest for this model economy.

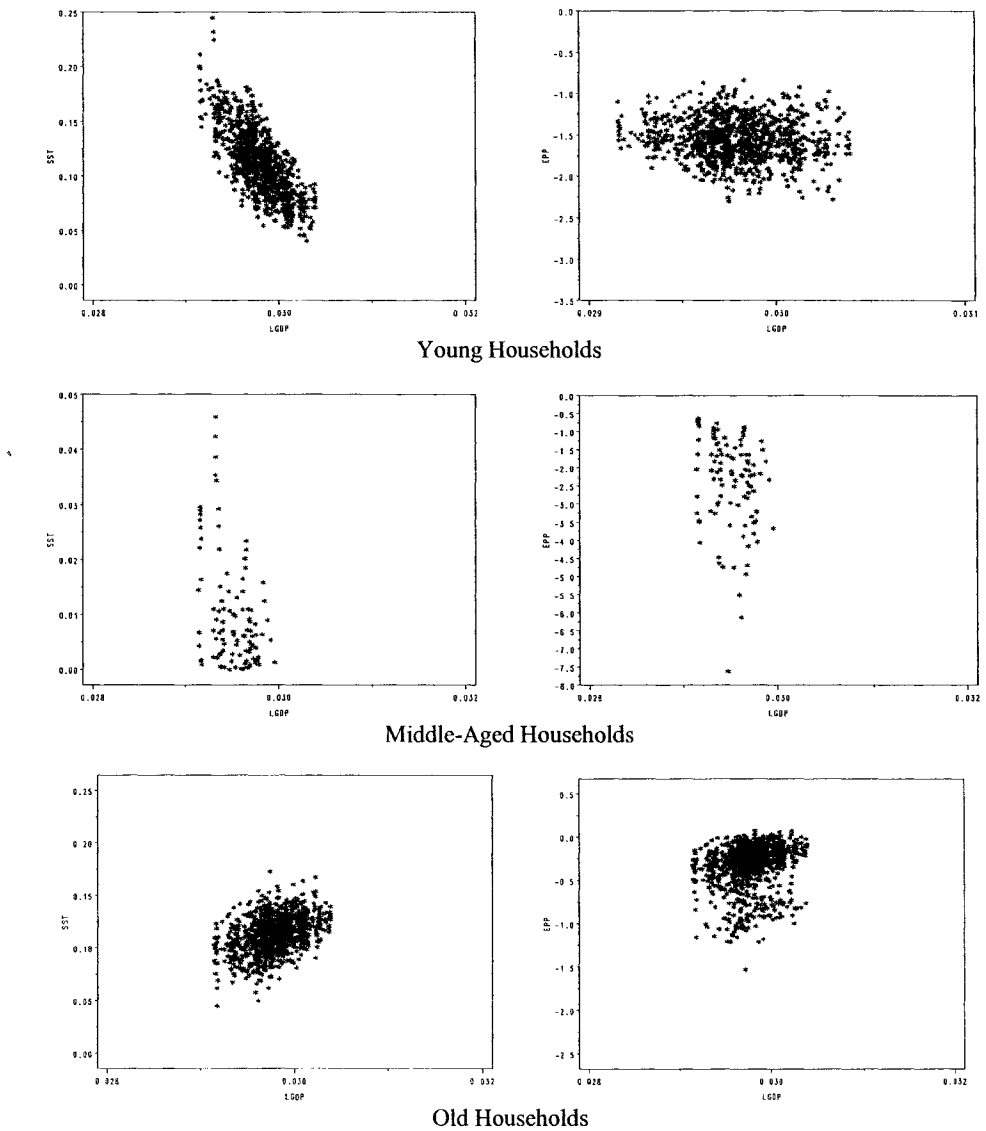
fewer-skills would have low labor productivity and thus earn less labor income. Even though the agents choose to engage in precautionary savings behavior, they can partially ensure their future consumption and income through savings throughout the life cycle. As a result, we can observe a life cycle of cyclical poverty behavior. It is important to recognize the role of a fixed-effect shock for the presence of middle-aged households in poverty.

(ii) Figure 3-4 displays the cyclicality of the SST index and the EPP, which illustrates the fact that agents' labor efficiencies are relatively dispersed, as is their labor income. As a result, the countercyclicality of the SST index at the aggregate appears to be weak, while the procyclicality of the EPP becomes notably stronger with a correlation coefficient of 0.336. This is probably due to unfavorable income redistribution toward the agents with inferior skills.

(iii) Under the pure fixed-effect shock setting, the model is able to account for the poor middle-aged households. Figure 3-6 displays the cyclicality of the SST index and the EPP across age groups, which clearly reflects the dispersion of the agents' labor productivities. Evidently, the countercyclicality of the SST index for the young is relatively stronger compared to the patterns of their older counterparts. For middle-aged poor households, the SST index and the EPP are countercyclical with the correlation coefficients of -0.401 and -0.217, respectively (Table 3-6).

(iv) It is quite clear from Figure 3-6 that older agents are least fortunate in this economy. The behavior of the SST index and the EPP with the correlation

coefficients of 0.396 and 0.182, respectively, appears to display stronger procyclicality relative to the other model economies.



Notes: The left panel shows the cyclical behavior of the SST index. The right panel shows the cyclical behavior of the economic position of the poor (*EPP*).

Figure 3-6: The Cyclical Behavior of Poverty Intensity and the Economic Poverty Position across Age Groups from Pure Fixed-Effect Model. The fixed effect as the sole source of uncertainty in the economy has a more pronounced effect on middle-aged agents than other types of shocks.

III) The Cyclical Effect of Pure Persistent Shock

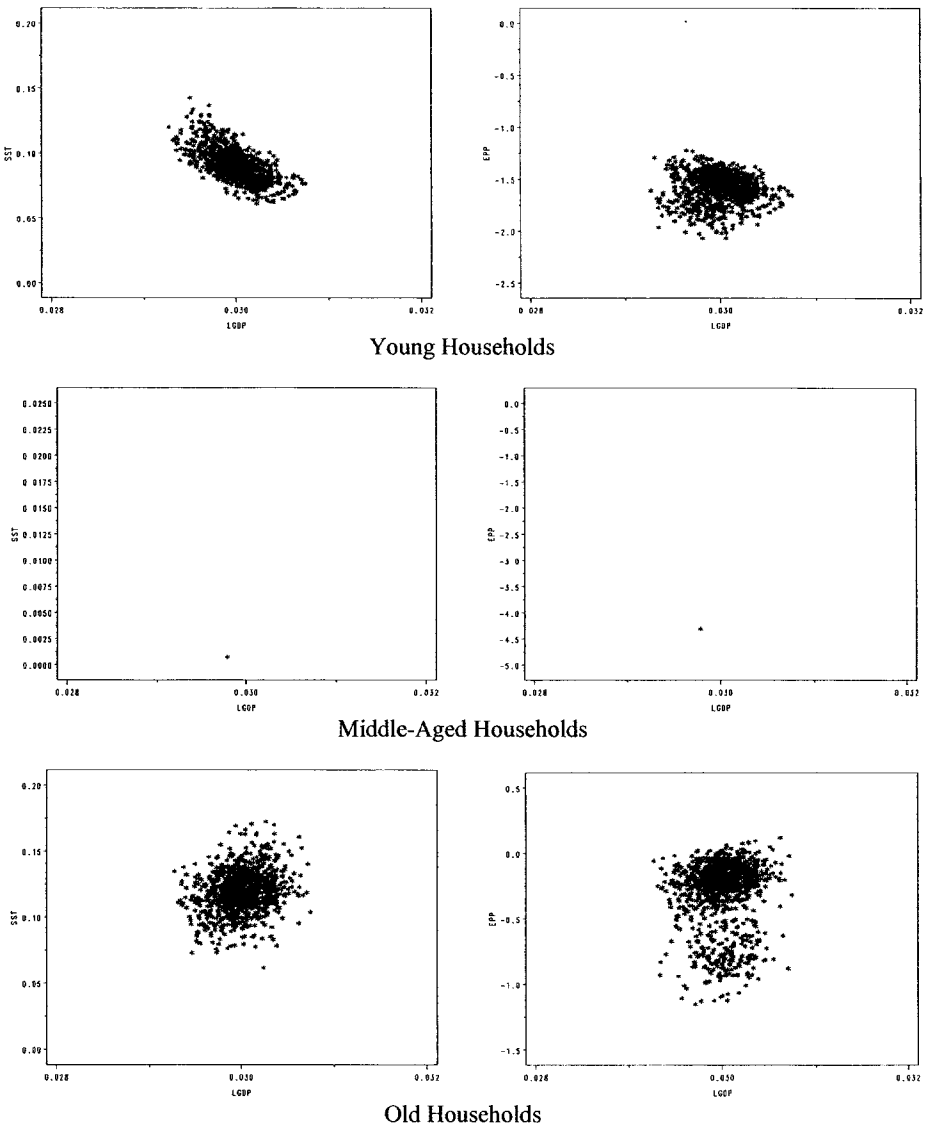
In this setting, the agents experience a persistent shock as a single source of uncertainty. The persistent shock directly affects the agents' labor productivities, which become varied across individuals in any period. The individuals differ from each other in their labor efficiency and therefore in their labor income processes. The innovation to the persistence of labor efficiency is set to $\sigma_{\omega} = 0.0455$. The findings are as follows.

(i) Table 3-6 shows that a large persistent shock generates a high standard deviation of the aggregate output at 0.024. It is the second highest among the four model economies.

(ii) Figure 3-4 displays the cyclicality of the SST and the EPP measures, which also reflects the dispersion among the agents' poverty intensity and their economic position in poverty. The higher persistent shock not only makes the SST index significantly less countercyclical (with a small correlation coefficient of -0.206) but also makes the EPP less procyclical.

(iii) Under the pure persistent shock setting, the model is still unable to account for the middle-aged households. There is only one household in poverty. Figure 3-7 displays the cyclicality of the SST and the EPP measures across all age groups, which certainly reflects the dispersion of the agents' labor productivities.

(iv) The persistent shock produces less procyclicality of the EPP with the correlation coefficient of 0.064 for the old households, indicating less fluctuation in their economic poverty position.



Notes: The left panel shows the cyclical behavior of the SST index. The right panel shows the cyclical behavior of the economic position of the poor (*EPP*).

Figure 3-7: The Cyclical Behavior of Poverty Intensity and the Economic Poverty Position across Age Groups from Pure Persistent Shock Model. The EPP measure of the young and the old households appears to be less procyclical.

IV) The Cyclical Effect of Pure Transitory Shock

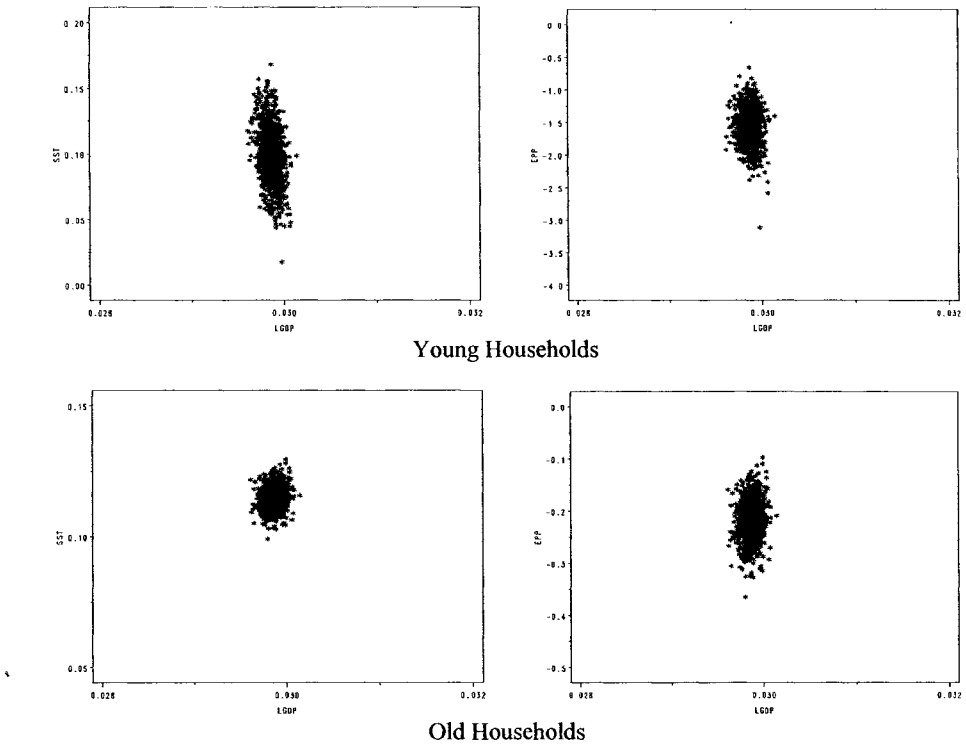
In this model, the transitory shock represents a sole source of uncertainty in the economy. Each agent receives the shock in each period. This shock also enters into the agents' labor-income processes via their labor productivity. The transitory shock is set to σ_{υ}= 0.0455. The findings are as follows.

(i) Table 3-6 shows that the greater transitory shock produces a very small standard deviation (only 0.008). It leads to a considerable decline in the volatility of the aggregate output compared to the previous three models. Under this model economy, the agents seem to successfully insure the transitory risk through their precautionary savings.

(ii) Figure 3-4 displays the unclear cyclicality of the SST index and the EPP, since the agents can insure against the risk easily via the savings. However, from Table 3-6, the higher transitory shock apparently causes the behavior of the SST and the EPP measures to become less volatile at the aggregate level.

(iii) Table 3-6 and Figure 3-8 show that, under the pure transitory shock setting, the SST index and the EPP for the young become significantly less countercyclical with the correlation coefficients of -0.284 and -0.031, respectively. In contrast, the procyclical of the EPP for the old households appears to be strong with the correlation coefficient of 0.166 relative to the pure persistent case.

(iv) The pure transitory shock model economy is less successful in explaining the cyclical behavior of poverty for the middle-aged households.



Notes: The left panel shows the cyclical behavior of the SST index. The right panel shows the cyclical behavior of the economic position of the poor (*EPP*).

Figure 3-8: The Cyclical Behavior of Poverty Intensity and the Economic Poverty Position across Age Groups from Pure Transitory Shock Model. The transitory shock appears to have no clear cyclical effect on the SST index and the EPP measure since the risk can be easily insured against by the model agents.

V) A Summary of the Role of Productivity Shocks

The role of each shock is summarized as follows. First, the TFP shock produces the highest fluctuation in output and in the cyclical behavior of the SST and the EPP measures for young households. Second, the fixed-effect shock is the most important for the cyclical behavior of poverty measures for middle-aged households. Third, the persistent shock has a more prominent effect on the cyclicality of the EPP for old

households. Last, it appears that all types of agents can mitigate the impacts of the transitory shock via savings so that it generates the lowest volatility in aggregate output.

3.4.4 Productivity Shock Experiments

This section investigates how the cyclical behaviors of the SST index and the EPP change against the benchmark cyclicality results when the shock parameters are varied. It is clear from Table 3-4 and Figure 3-2 that each productivity shock produces a distinct cyclical effect with specific magnitude on the SST and the EPP measures. The shocks to the TFP and fixed effect generate a greater fluctuation in output and a higher magnitude of the countercyclicality and procyclicality of poverty relative to the outcomes from the uncertainty in persistent and transitory components of labor efficiency. Thus, the TFP and fixed-effect shocks are more likely to play a critical role in creating fluctuations in output and poverty cyclicality in the model economy. For transparency and to minimize the complexity in searching combinations, the study adjusts the parameter values by changing the parameters' weight representing the contribution of each shock to the aggregate productivity uncertainty. The assigned weights are integers - 10 percent, 20 percent, 30 percent, and 40 percent - and the total weight sums to 100 in all twenty-four simulations of the model economy.[28] This procedure intends to find two sets of shock parameter combinations that can assimilate the cyclical behaviors of poverty observed in the pre-1984 and the post-1984 periods.

[28] The number of combinations of four choices equals four factorial, (4! = 24).

Variation in the shock parameters generates changes in the cyclical behavior of the SST index and the EPP measure that differ from the benchmark results. For the purpose of comparison, the model economies and the cyclical behaviors of poverty are classified into two types of economy: (i) an economy with high output volatility (greater than 0.02) and (ii) an economy with low output volatility (less than 0.02). The output fluctuation of 0.02 is of the benchmark simulated economy. The economy with high fluctuation in output represents the pre-1984 period, while the low output volatility economy characterizes the post-1984 period. The models that best describe the cyclical behaviors of poverty for both periods are presented in this section. The values and weights of shock parameters for the chosen models are summarized in Table 3-7.

Table 3-7: Values and Weights of Productivity Shocks for Model Economy Experiments

Productivity Shock	Benchmark		Mix I: High Model		Mix II: Low Model	
	Weight	Value	Weight	Value	Weight	Value
σ_z	0.25	0.0114	0.30	0.0137	0.10	0.0046
σ_χ	0.25	0.0114	0.40	0.0182	0.20	0.0091
σ_ω	0.25	0.0114	0.10	0.0046	0.30	0.0137
σ_υ	0.25	0.0114	0.20	0.0091	0.40	0.0182

Notes: Weight column represents the contribution of each shock to the aggregate uncertainty.

A) Mix I: High Output Volatility Model

As expected, the higher innovations of TFP and fixed effect along with the lower uncertainties in persistent and transitory components of labor efficiency cause the

economy output volatility to increase (0.024 compared to 0.02 of the benchmark model). The cyclicality of poverty generally becomes stronger, as shown in Table 3-8. Therefore, this model economy is considered representative of the pre-1984 period. It is important to note that the cyclical change column presents how the behaviors of the SST and the EPP measures of Mix I model differ from the benchmark model.

Table 3-8: The Cyclicality of Poverty and the Economic Poverty Position: Mix I Model

	Benchmark	Mix I	Cyclical Change
All Households			
SST	-0.649	-0.661	More Counter
EPP	0.226	0.203	Less Pro
Std.(*Y*)	0.020	0.024	Higher Volatility
Young Households			
SST	-0.782	-0.799	More Counter
EPP	-0.045	-0.105	More Counter
Middle-Aged Households			
SST	+	+	NA
EPP	+	+	NA
Old Households			
SST	0.167	0.199	More Pro
EPP	0.127	0.129	More Pro

Notes: The reported results are the correlation coefficients with respect to the log of GDP. + indicates no middle-aged households in poverty. The Cyclical Change column shows the change in cyclicality from Benchmark to Mix I model.

B) Mix II: Low Output Volatility Model

The economy with a decline in TFP shock along with a moderate fall in fixed-effect uncertainty is likely to experience less fluctuation in output (0.014). Even though

idiosyncratic labor efficiency now constitutes more weights to the aggregate uncertainty, and hence in determining poverty cyclicality, it produces relatively less fluctuation in the cyclical behaviors of the SST and the EPP measures. The last column of Table 3-9 presents the cyclical change of the measures between the benchmark and the Mix II models. Thus, this model economy is representative of the post-1984 period.

Table 3-9: The Cyclicality of Poverty and the Economic Poverty Position: Mix II Model

	Benchmark	Mix II	Cyclical Change
All Households			
SST	-0.649	-0.361	Less Counter
EPP	0.226	0.216	Less Pro
Std.(*Y*)	0.020	0.014	Lower Volatility
Young Households			
SST	-0.782	-0.589	Less Counter
EPP	-0.045	0.026	Less Counter
Middle-Aged Households			
SST	+	+	N/A
EPP	+	+	N/A
Old Households			
SST	0.167	0.233	More Pro
EPP	0.127	0.107	Less Pro

Notes: The reported results are the correlation coefficients with respect to the log of GDP. + indicates no correlation coefficient for middle-aged households. The Cyclical Change column shows the change in cyclicality from Benchmark to Mix II model.

C) Mix I vs. Mix II

To quantify whether Mix I and Mix II models can potentially characterize the pre-1984 and post-1984 periods, the changes in poverty cyclicality between these two models are

compared with those found in the data. Table 3-10 presents the results observed in the data. For the purpose of this study, the changes are presented in terms of a direction of countercyclicality (either stronger or weaker). In the post-1984 period, less volatility in economic activities apparently accompanies stronger countercyclicality of the SST and the EPP measures. In other words, there is more fluctuation in poverty and well-being of the poor. The poor households, particularly the middle-aged and the old, become more sensitive to business cycles, especially during the economic downturn. However, there is an exception for young households who have much less responsiveness to business cycles.

Table 3-10: Data Cyclicality of Poverty and the Economic Poverty Position

	Pre-1984	Post-1984	CounterCyclical Change
All Households			
SST	-0.427	-0.755	Stronger
EPP	-0.269	-0.593	Stronger
Std.(*Y*)	High Volatility	Low Volatility	Lower
Young Households			
SST	-0.451	-0.353	Weaker
EPP	-0.168	-0.087	Weaker
Middle-Aged Households			
SST	-0.241	-0.762	Stronger
EPP	-0.245	-0.535	Stronger
Old Households			
SST	0.102	-0.774	Stronger
EPP	0.285	-0.507	Stronger

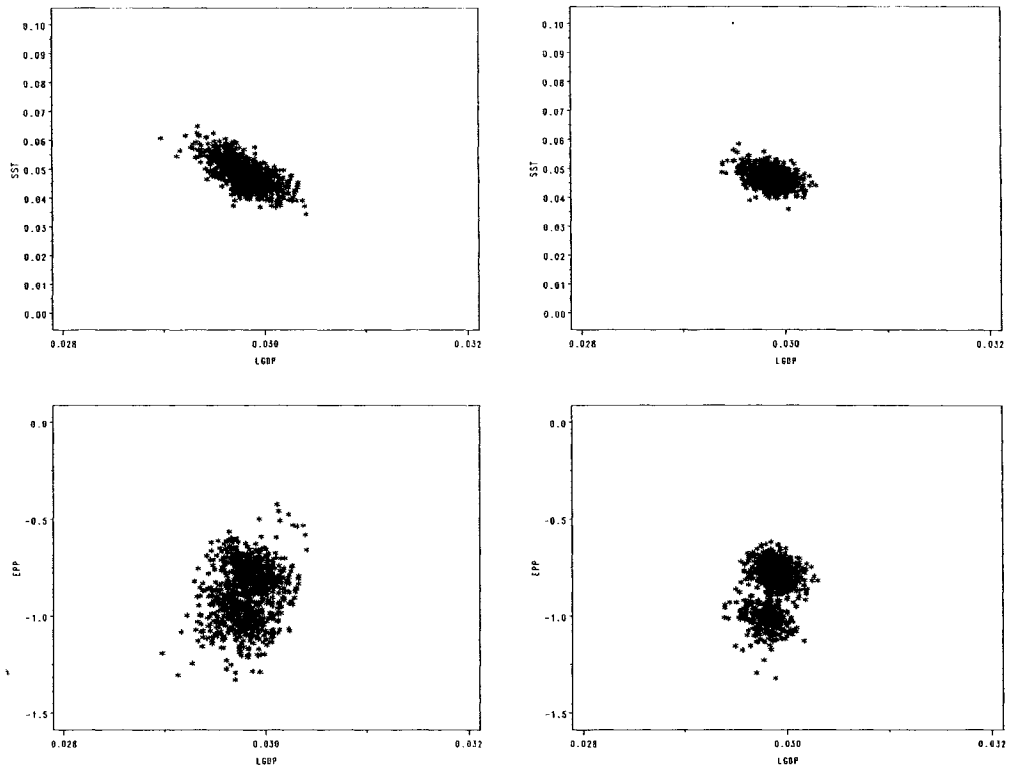
Note: The standard deviations of *Y* are based on Stock and Watson (2003), who indicates high output volatility during the pre-1984 period and low volatility in output during the post-1984 period.

Table 3-11 and Figure 3-9 display the models' findings and the countercyclical changes between the two experimental models. In general, the countercyclicality of poverty appears to be weaker along with the decline in output volatility. Because, neither the Mix I nor the Mix II model is able to replicate a meaningful number of poor middle-aged households, their poverty cyclical behaviors are unobservable. The last column shows the model evaluation of whether the cyclical changes from the models are consistent with those changes in the data.

Table 3-11: The Cyclicality of Poverty and the Economic Position of the Poor: Mix I versus Mix II

	Mix I Model	Mix II Model	CounterCyclical Change		Model Evaluation
			Mix I -> Mix II	Pre-84 -> Post-84	
All Households					
SST	-0.661	-0.361	Weaker	Stronger	×
EPP	0.203	0.216	Weaker	Stronger	×
Std.(*Y*)	0.024	0.014	Lower Volatility	Lower Volatility	✓
Young Households					
SST	-0.799	-0.589	Weaker	Weaker	✓
EPP	-0.105	0.026	Weaker	Weaker	✓
Middle-Aged Households					
SST	+	+	N/A	Stronger	N/A
EPP	+	+	N/A	Stronger	N/A
Old Households					
SST	0.199	0.233	Weaker	Stronger	×
EPP	0.129	0.107	Stronger	Stronger	✓

Notes: The reported results are the correlation coefficients with respect to the log of GDP. + indicates no correlation coefficient for middle-aged households. The last column evaluates whether the countercyclical changes from the models match those changes found in the data. ✓ denotes a match. × represents no match.



All Households

Notes: The left panel shows the results from Mix I: High Model. The right panel shows the results from Mix II: Low Model. For each group of households, the upper panel compares the cyclical behaviors of the SST index, and the lower panel compares the cyclical behaviors of the EPP measure.

Figure 3-9: The Cyclical Behaviors of Poverty Intensity and the Economic Poverty Position for All Households from Mix I Model and Mix II Model

According to the findings of the two experimental cases, the study can answer the first question posted at the beginning of the chapter. The decline in volatility of economic activities through the effects of saving behaviors can potentially explain the cyclical change of the EPP documented in chapter 2. The long expansion along with less fluctuation in the business cycle appears to have an effect on the households' attitude toward uncertainty, specifically, middle-aged households. They are less sensitive to

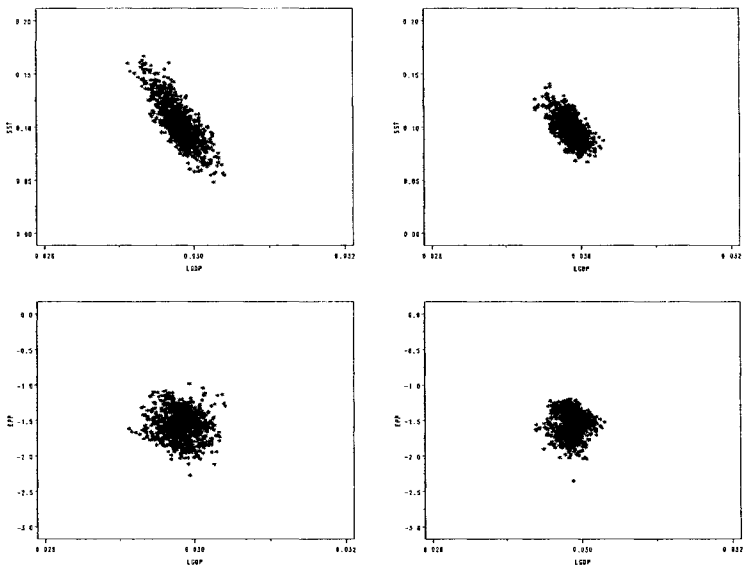
income shocks and then increase their consumption level, which in turn accumulating fewer retirement savings. Consequently, when old they are more responsive to an economic downturn. As shown in Table 3-11 and Figure 3-10, the old experience slightly higher fluctuation in their economic poverty position suggested by a stronger countercyclicality between the Mix I and Mix II model economies. Furthermore, the experimental models yield findings consistent with the data concerning the changes in countercyclicality of poverty between high and low volatility model economies for the young households. Even though they are not the principal concern of this current experiment, the findings confirm the validity of the model settings.

To observe which productivity shocks play an important role in the changes in households' saving behaviors, the study considers how the contributing weight of each shock to the aggregate uncertainty in the simulated economy varies between the Mix I and Mix II models. Table 3-12 presents the direction of how the weights of productivity shocks change.

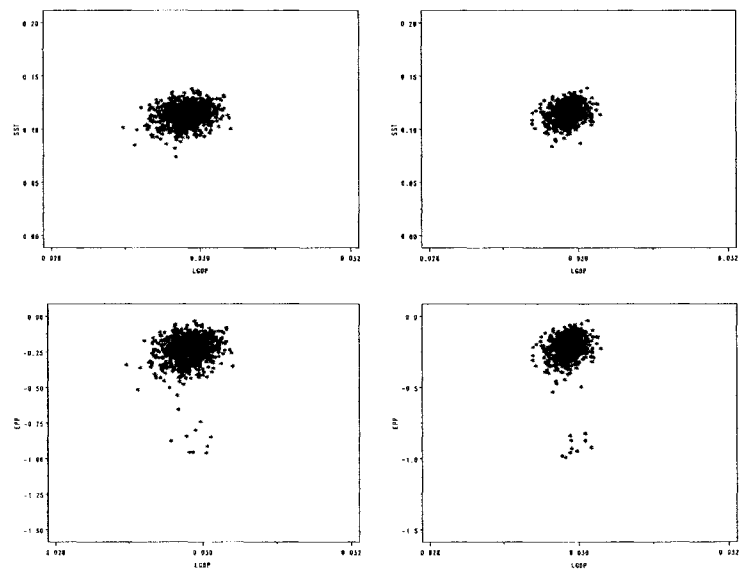
Table 3-12: Changes in Weights of Productivity Shocks in the Model Economy

Productivity Shock	Mix I Model	Mix II Model	Direction
σ_z	0.30	0.10	⇩
σ_χ	0.40	0.20	⇩
σ_ω	0.10	0.40	⇧
σ_υ	0.20	0.30	⇧

Note: The numbers are the contributing weight of each shock to the aggregate productivity uncertainty. The direction column shows how the weight changes from the Mix I model to the Mix II model.



Young Households



Old Households

Notes: The left panel shows the results from the Mix I: High Model. The right panel shows the results from the Mix II: Low Model. For each group of households, the upper panel compares the cyclical behaviors of the SST index, and the lower panel compares the cyclical behaviors of the EPP measure.

Figure 3-10: The Cyclical Behaviors of Poverty Intensity and the Economic Poverty Position across Age Groups from Mix I Model and Mix II Model

Clearly there is a shift in shock parameters' weights. The TFP and fixed-effect shocks increasingly play a less significant role in the economy. Simultaneously, the persistent and transitory shocks to idiosyncratic labor efficiency are becoming more influential in the aggregate uncertainty. Therefore, based on each shock's characteristics summarized in section 3.4.3, the study suggests the following. The moderate increase in the transitory shock is responsible for the decline in output volatility. In addition, the significant increase in the persistent shock certainly increases the fluctuation in the EPP for the old households through their saving behaviors.

Evidently, the simulated models successfully account for the cyclical changes in the SST and the EPP measures for the young and partially explain the changes in poverty cyclicality of the old. The models unsuccessfully explain the cyclical changes at the aggregate level, most likely because of the absence of the middle-aged households in poverty, which largely accounts for the cyclical behaviors of the SST and the EPP measures in the data.

The current model setting has at least two limitations. First, the study cannot apply a sizeable amount of fixed-effect shock in spite of the fact that shock to fixed-effect is crucial in determining the middle-aged households in poverty. Second, additional reasons such as the assumption of a fixed labor supply and the omission of tax incentives need to be incorporated into the model.

3.5 Summary

This chapter explores the role of changes in savings behavior on poverty intensity and economic poverty position within a stochastic overlapping generations model. The model focuses on the effects of variance to innovations in the aggregate TFP and in idiosyncratic labor efficiency on poverty over the business cycle and the life cycle. The key feature of the model is that labor productivity solely determines the model agents' labor income and their consumption and savings behaviors and hence their economic position. For instance, the agents who inherited lower ability and fewer skills before entering the labor market are most likely to be poor and stay as poor throughout their life cycle. It is important to decompose the underlying causes of the variation in the distribution of the economic poverty position into a component known prior to entering the labor market and a component realized throughout the working life.

The simulated results suggest that there is a shift in variance among labor productivity components from the pre-1984 and the post-1984 periods. The fixed-effect shock declined during these two periods. At the same time, the persistent and transitory components have become more important in determining the agents' labor income and consequently their economic poverty position. These changes in labor productivity shocks are also consistent with Heathcote, Storesletten, and Violante (2004). Various factors could cause the shift, among many others, the poverty reduction programs and welfare reforms through education and training that incrementally improve the skills of low-income individuals prior to their entering the workforce and also during their working years.

A couple of extensions to the model could form the basis for the future work. First is to vary the agents' labor supply. Despite the fact that, under the current setting, the total income profile follows the hump-shaped age profile of labor productivity, all agents supply the same maximum labor hours during their working life. This is likely to be a key explanation of such a lower number of middle-aged agents under the poverty line. As a result, the model cannot capture the distribution of the SST and the EPP measures. Second, it is possible to include poverty aid programs or transfers, specifically through education and trainings to analyze the economic poverty position of the poor and welfare effects in response to the shift in importance of labor productivity components.

Chapter 4

Conclusion

4.1 General Summary

This dissertation has provided important pieces of information to help the public and policymakers better understand the incidence of poverty persistence. By using the SST poverty intensity index as the poverty measure, the study finds that not only the number of poor people has persisted since the mid 1970s but their economic poverty position has also deteriorated over time. In particular, young and middle-aged households experienced a worsening of their economic position in poverty, especially during the expansions of the 1970s and 1980s. As Cutler and Katz (1991) and Blank (1993, 2000) suggest, the earnings gains from working more hours were offset by the falling wages for these working poor in the expansion if the 1970s and the 1980s. Furthermore, this research offers a way to quantify the outcomes of unfavorable changes in the labor market for low-skilled and less-educated workers during past economic expansions.

This study also finds that fixed-effects or individual's permanent characteristics related to innate ability and education have a profound effect on labor efficiency and are relatively important in examining the changes in economic poverty position across age groups. Changes in the components of labor efficiency significantly affect the labor

earnings of the working poor and hence their economic position in poverty. Thus it is very crucial for policymakers and the government to design effective poverty-aid programs and welfare reforms, perhaps through education and skill training that should help improve the economic poverty position of low income households or even move them out of poverty.

As the literature points out the anti-poverty power of economic expansion has returned in the 1990s expansion (Haveman and Schwabish (2000); R. Freeman (2001); D. Freeman (2003). More specifically, Blank (2000) and Freeman (2003) suggest that the wages for low-skilled and less-educated workers have increased drastically since 1996. Furthermore, low-income households increasingly participate in the labor market as a consequence of 1996 federal welfare reform. Therefore, for future research, it would be interesting to investigate whether there is any change in poverty incidence and economic poverty position for all age groups during the 1990s and 2000s caused by either macroeconomic conditions or the changes in policy reforms.

References

Anderson, W. H. (1964). "Trickling Down: The Relationship Between Economic Growth and the Extent of Poverty among American Families," *The Quarterly Journal of Economics*, 78(4), 511-524.

Balke, N. S., and Slottje, D. J. (1993). "Poverty and Change in the Macroeconomy: A Dynamic Macroeconometric Model," *The Review of Economics and Statistics*, 75(1), 117-122.

Blank, R. M. (1993). "Why Were Poverty Rates so High in the 1980s?" *In Poverty and Prosperity in the USA in the Late Twentieth Century*. D. B. Papadimitriou and Edward N. Wolff, eds., New York: St. Martin's Press, 21-55.

Blank, R. M. (2000). "Distinguished Lecture on Economics in Government, Fighting Poverty: Lessons from Recent U.S. History," *Journal of Economic Perspectives*, 14(2), 3-19.

Blank, R. M., and Blinder, A. S. (1986). "Macroeconomics, Income Distribution, and Poverty," in *Fighting Poverty: What Works and What Doesn't*. S. H. Danzinger and D. H. Weinberg, eds., Harvard University Press, Cambridge, MA.

Blank, R. M., and Card, D. (1993). "Poverty, Income Distribution, and Growth: Are They Still Connected?" *Brookings Papers on Economic Activity*, 1993(2), 285-339.

Bureau of Economic Analysis, (2004a). Gross Domestic Product (GDP), Current-Dollar and "Real" GDP (formatted in Excel). Accessed 7 January 2004. Available http://www.bea.doc.gov/bea/dn/gdplev.xls.

Burtless, G., and Smeeding, T. M. (1994). "The Level, Trend, and Composition of Poverty," in Confronting Poverty Prescriptions for Change. S. H. Danzinger, G. D. Sandefur, and D. H. Weinberg, eds., Harvard University Press, Cambridge, MA and London, England.

Carroll, C. D., and Samwick, A. A. (1998). "How Important is Precautionary saving?" *The Review of Economics and Statistics*, 80(3), 410-419.

Citro, C. F., and Michael, R. T., eds. (1995). Measuring Poverty: A New Approach. Washington, DC: National Academy Press.

Cushing, B., and Zheng, B. (2002). "Re-evaluating Differences in Poverty among Central City, Suburban, and Nonmetropolitan Areas of the U.S.," *Applied Economics*, 2000(32), 653-660.

Cutler, M. D., and Katz, L. (1991). "Macroeconomic Performance and the Disadvantaged," *Brookings Papers on Economic Activity*, 1991(2), 1-74.

Cutler, M. D., and Katz, L. (1992). "Rising Inequality? Changes in the Distribution of Income and Consumption in the 1980s," *The American Economic Review*, Papers and Proceedings of the Hundred and Fourth Annual Meeting of the American Economic Association, 82(2), 546-551.

Díaz-Giménez, J., Quadrini, V., and Ríos-Rull, J. V. (1997). "Dimensions of Inequality: Facts on the U.S. Distribution of Earnings, Income and Wealth," *Federal Reserve Bank of Minneapolis Quarterly Review*, 21, 3-21.

Danziger, S., and Gottschalk, P. (1986). "Do Rising Tides Lift All Boats? The Impact of Secular and Cyclical Changes on Poverty," *The American Economic Review*, Papers and Proceedings of the Ninety-Eighth Annual Meeting of the American Economic Association, 76(2), 405-410.

Deaton, A. (1997). "Chapter 3: Welfare, Poverty and Distribution in The Analysis of Household Surveys: A Microeconometric Approach to Development Policy," Baltimore, MD: Published for the World Bank. John Hopkins University Press, 1997.

_____. (2004). "Measuring Poverty," In Abhijit Banerjee, Roland Benabou, and Dilip Mookerjee, eds., *Poverty and Development in the World,* Oxford University Press, forthcoming.

Fernández-Villaverde, J., and Kruger, D. (2002). "Consumption over the Life Cycle: Some Facts from the CEX Data," Working paper, Stanford University and University of Pennsylvania.

Foster, J., Greer, J., and Thorbecke, E. (1984). "A Class of Decomposable Poverty Measures," *Econometrica*, 52, 761-766.

Fowler, S. J. (2003). "Computation of OLG Models by Perturbation Methods," working paper, Middle Tennessee State University.

Fowler, S. J., and Young, E. R. (2004). "The Acquisition of Skills over the Life-Cycle," working paper, Middle Tennessee State University.

Freeman, D. G. (2003). "Trickling Down the Rising Tide: New Estimates of the Link between Poverty and the Macroeconomy," *Southern Economic Journal*, 70(2), 359-373.

Freeman, R. B. (2001). "The Rising Tide Lifts...?," *NBER Working Paper Series*, paper 8155.

Garner, T., Short, K., Shipp, S., Nelson, C., and Paulin, G. (1998). "Experimental Poverty Measurement for the 1990s," *Monthly Labor Review Articles by the Division of Consumer Expenditure Surveys*, March, 39-68.

Gasper, J., and Judd, K. L. (1997). "Solving Large-Scale Rational-Expectations Models," *Macroeconomic Dynamics*, 1, 45-75.

Gottschalk, P., and Ruggles, P. (1994). "Using the Panel Study of Income Dynamics to Study Poverty and Welfare Dynamics," paper Commissioned by the PSID.

Gourinchas, P. O. (2000). "Precautionary Saving, Life Cycle, and Macroeconomics," Mimeo, Princeton University.

Gourinchas, P. O., and Parker, J. A. (2001). "The Empirical Importance of Precautionary Saving," *The American Economic Review*, Papers and Proceedings of the Hundred Thirteenth Annual Meeting of the American Economic Association, 91(2), 406-412.

Gourinchas, P. O., and Parker, J. A. (2002). "Consumption Over the Life Cycle," *Econometrica*, 70(1), 47-89.

Gouskova, E., and Schoeni, R. F. (2002). "Comparing Estimates of Family Income in the Panel Study of Income Dynamics and the March Current Population Survey, 1968-1999," *Institute for Social Research*, University of Michigan.

Haveman, R., and Schwabish, J. (2000). "Has Macroeconomic Performance Regained Its Antipoverty Bite?," *Contemporary Economic Policy*, 18(4), 415-427.

Heathcote, J., Storesletten, K., and Violante, G. L. (2004). "The Cross-Sectional Implications of Rising Wage Inequality in the United States," Working paper, Georgetown University.

Hendricks, L. (2004). "Taxation and Human Capital Accumulation," *Macroeconomic Dynamics*, 8(3), 310-334.

Juster, F. T., Smith, J. P., and Stafford, F. (1999). "The Measurement and Structure of Household Wealth," *Labour Economics*, 6, 253-275.

Lusardi, A. (1998). "On the Importance of the Precautionary Saving Motive," *The American Economic Review*, Papers and Proceedings of the Hundred and Tenth Annual Meeting of the American Economic Association, 88(2), 449-453.

Myles, J., and Picot, G. (1999). "Social Transfers, Earnings and Low-Income Intensity among Canadian Children, 1981-96: Highlighting Recent Developments in Low-Income Measurement." Mimeo. Ottawa: Statistics Canada.

Myles, J., and Picot, G. (2000). "Poverty Indices and Policy Analysis," *Review of Income and Wealth*, 46(2), 161-179.

National Bureau of Economic Research (NBER). Business Cycle Expansions and Contractions (Duration in Months). Accessed 1 June 2004. Available http://www.nber.org/cycles.html.

National Center for Health Statistics. (1992), *U.S. Decennial Life Tables 1989-1991*, Centers for Disease Control, U.S. Government, Washington D.C.

Osberg, L. (2002). "Trends in Poverty: The U.K. in International Perspective – How Rates Mislead and Intensity Matters," Working paper, The Institute for Social and Economic Research, paper 2002-10. Colchester: University of Essex.

Osberg, L., and Xu, K. (1999). "Poverty Intensity: How Well Do Canadian Provinces Compare?" *Canadian Public Policy*, 25(2), 1-17.

Osberg, L., and Xu, K. (2000). "International Comparison of Poverty Intensity: Index Decomposition and Bootstrap Inference," *Journal of Human Resources*, 35(1), 51-81.

Ostle, B. (1963). *Statistics in Research*. Ames, IA: Iowa University Press.

Rodgers, J. L., and Rodgers, J. R. (1991). "Measuring the Intensity of Poverty Among Subpopulations: Applications to the United States," *Journal of Human Resources*, 26(2), 338-361.

Rodgers, J. R., and Rodgers, J. L. (2000). "Poverty Intensity in Australia," *The Australia Economic Review*, 33(3), 235-244.

Romer, C. D., and Romer, D. H. (1999). "Monetary Policy and the Well-Being of the Poor," *Economic Review – Federal Reserve Bank of Kansas City*, 84(1), 21-49.

Sawhill, I. V. (1988). "Poverty in The U.S.: Why Is It So Persistent?" *Journal of Economic Literature*, 26(3), 1073-1119.

Schmitt-Grohé, S., and Uribe, M. (2004). "Solving Dynamic General Equilibrium Models Using a Second-Order Approximation to the Policy Function," *Journal of Economic Dynamics and Control*, 28, 645-858.

Sen, A. K. (1976). "Poverty: An Ordinal Approach to Measurement," *Econometrica*, 44, 219-231.

_____. (1983). "A Poverty Measure," *Indian Economic Journal*, 30, 55-70.

Shorrocks, A. F. (1995). "Revisiting the Sen Poverty Index," *Econometrica*, 63, 1225-1230.

Short, K., and Garner, T. (2002). "Experimental Poverty Measures: Accounting for Medical Expenditures," *Monthly Labor Review Articles by the Division of Consumer Expenditure Surveys*, August, 3-13.

Stock, J. H., and Watson, M. W. (2003). "Has the Business Cycle Changed? Evidence and Explanations," Federal Reserve Bank of Kansas City Symposium, "Monetary Policy and Uncertainty," Jackson Hole: Wyoming.

Storesletten, K., Telmer, C. I., and Yaron, A. (2001). "How Important Are Idiosyncratic Shocks? Evidence from Labor Supply," *The American Economic Review*, Papers and Proceedings of the Hundred Thirteenth Annual Meeting of the American Economic Association, 91(2), 413-417.

Storesletten, K., Telmer, C. I., and Yaron, A. (2004a). "Consumption and Risk Sharing over the Life Cycle," *Journal of Monetary Economics*, 51, 609-633.

Storesletten, K., Telmer, C. I., and Yaron, A. (2004b). "Cyclical Dynamics in Idiosyncratic Labor Market Risk," *Journal of Political Economy*, 112(3), 695-717.

Thon, D. (1979). "On Measuring Poverty," *Review of Income and Wealth*, 25, 429-440.

_____. (1983). "A Poverty Measure," *The Indian Economic Journal*, 30, 55-70.

U.S. Census Bureau, (2000). Historical National Population Estimates: July 1, 1900 to July 1, 1999. Population Estimates Program, Population Division. Available http://www.census.gov/popest/archives/1990s/popclockest.txt. Accessed 7 January 2004.

U.S. Census Bureau, (2004a). Historical poverty tables (Table 1: Weighted Average Poverty Thresholds for Families of Specified Size 1959 to 2003). Available http://www.census.gov/hhes/poverty/histpov/hstpov1.html. Accessed 7 January 2004.

U.S. Census Bureau, (2004b). Historical poverty tables (Table 2: Poverty Status of People by Family Relationship, Race, and Hispanic Origin: 1959 to 2003). Available http://www.census.gov/hhes/poverty/histpov/hstpov2.html. Accessed 7 January 2004.

Wolff, E. N. (2002). "Recent Trends in Wealth Ownership, 1983-1998," Working Paper No. 300, Jerome Levy Economics Institute.

Xu, K., and Osberg, L. (2001). "How to Decompose the Sen-Shorrocks-Thon Poverty Index: A Practitioner's Guide," *Journal of Income Distribution*, 10(1-2), 77-94.