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A WELFARE COMPARISON OF PRE-AND POST-WWII BUSINESS CYCLES: SOME IMPLICATIONS FOR THE ROLE OF POSTWAR MACROECONOMIC POLICIES

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A Welfare Comparison of Pre- and Post-WWII Business Cycles: Some Implications for the Role of Postwar Macroeconomic Policies

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Abstract

We compute the potential economic benefits that would accrue to a typical pre-WWII era US worker from the post-WWII macroeconomic policy regime. We assume that workers face undiversifiable income risk but can self-insure by saving in nominal assets. The worker's average utility is computed for two eras: pre-WWII (1875-1941) and post-WWII. In the pre-WWII era, the worker endured business cycles that were large in amplitude and quite volatile, a procyclical aggregate price level with large cyclical amplitude, a high average unemployment rate, and virtually no trend in the aggregate price level. In the post-WWII era, the same worker would have encountered business cycles with smaller amplitude and less volatility, a countercyclical aggregate price level with small cyclical amplitude, a much lower mean unemployment rate, and a positive trend in the aggregate price level. Depending on what is assumed about the effects of macroeconomic policies on the mean and variance of the unemployment rate, the potential gain in the worker's welfare ranges between -0.9 (if policies affected the inflation rate but not the mean or variance of the aggregate unemployment rate) to 4.19 percent of consumption (if policies affected the inflation rate and lowered the mean and variance of the aggregate unemployment rate).

1 Introduction

In this paper we assess the gain in welfare resulting from changes in the character of US business cycles between the pre- and post-WWII eras. The question we ask is: what fraction of consumption would a typical US industrial worker from the pre-WWII era give up (in perpetuity) to live under the post-WWII stochastic processes for de-trended income and price level? Our welfare calculation is in the spirit of Lucas's (1987) calculation of the welfare cost of business cycles in that our intent is to obtain an estimate of the welfare gains resulting from the change in the macroeconomic policy regime between the pre- and post-WWII eras.

That there was a major change in macroeconomic policy regime between the pre-WWII era (defined in this paper as the period 1875-1941) and the post-WWII period has been documented by economic historians (Temin (1989)). In the pre-WWII era, macroeconomic policies in the US and other European countries were aimed primarily at maintaining the external value of domestic currency, defined as the amount of gold a unit of currency could purchase. The governments of countries participating in this "gold standard regime" were required to maintain convertibility between their domestic currency and gold at some fixed exchange rate. Since the ability to maintain convertibility depended crucially on the government's having adequate reserves of gold, protecting gold reserves took precedence over other macroeconomic objectives. Indeed, there are many instances in US monetary history where the concern with maintaining parity with gold determined key policy actions.

In contrast, the focus of macroeconomic policies in the post-WWII era has been on domestic, as opposed to external, stability.[1] In the United States, this focus on domestic stability manifested itself in three broad classes of aggregative policies: (i) automatic stabilizers that shored up aggregate demand during cyclical downturns (income maintenance programs such as unemployment insurance and progressive income taxation), (ii) policies aimed at averting financial crises (such as insurance of bank deposits and the Federal Reserve's activities as lender of last resort), and (iii) discretionary aggregate demand management policies (such as countercyclical monetary and fiscal actions). The first two classes of policies were instituted during the Depression years, and the authority to undertake the third was written into the Full Employment Act of 1946.

The question addressed in this paper is: what difference did this change in regime make to the typical US industrial worker? Ideally, this question would be answered by constructing a model in which the change in macroeconomic policy arrangement is explicitly modelled and its ramifications for economic welfare (and other operating characteristics of the economy) worked out. Instead, we take a more elementary approach. We use a simple model of consumer behavior to "identify" changes in key operating characteristics of the US economy between the two eras and ask how these changes affected economic welfare of a typical worker. Obviously, the changes in operating

[1] Although the post-WWII period started out with an international monetary arrangement of fixed exchange rates (the Bretton Woods Agreement), the agreement failed to stand the test of time. Indeed, scholars have argued that the arrangement was flawed from the beginning because of the unwillingness of US officials to accept provisions that entailed sacrificing domestic interests in favor of international stability.

characteristics we identify reflect, in part, factors unrelated to changes in the policy regime. So, the welfare effects we report cannot all be attributed to changes in the policy regime. To minimize this ambiguity we do our welfare calculations in several steps, starting with changes we are confident reflect a change in the policy regime, then proceeding to analyze the effects of changes that we are less confident were caused by the change in policy regime.

The model of consumer behavior we use is a variant of the model studied by Imrohoroglu (1989). The model abstracts from economic growth and assumes that each individual faces an idiosyncratic risk of unemployment against which insurance is not possible. Importantly, the probability of employment and the level of real earnings when employed are lower when economic activity is cyclically low, and they are both higher when economic activity is cyclically high. As a precaution against these fluctuations in income (due both to fluctuations in employment status and in earnings when employed), agents self-insure through the holding of money. Because individuals save in nominal assets, the cyclical *and* secular behavior of the price level is important to the consumer. Thus, in this model of consumer behavior, the two stochastic processes that matter for individual welfare are the ones for (de-trended) income and for the level of consumer prices.

Briefly, our findings are as follows. In the pre-WWII era, a typical industrial worker endured business cycles that were large in amplitude and quite volatile, a procyclical aggregate price level with large cyclical amplitude, a high unemployment rate on average, and virtually no trend in the aggregate price level. In the post-WWII era, industrial workers encountered business cycles with smaller amplitude and less volatility, a countercyclical aggregate

price level with small cyclical amplitude, a much lower unemployment rate on average, and a positive trend in the aggregate price level. When we confront the pre-WWII individual with stochastic processes for income and prices from the post-WWII era, we find that the individual is willing to pay 4.19 percent of his consumption in perpetuity to live under the new regime.

In what ways did the change in macroeconomic policy regime contribute to this overall gain in welfare? First, we assume that the post-WWII policy regime was a key factor in the post-WWII inflation rate. This is consistent with the view that the post-WWII policy regime gave US policymakers discretion in setting domestic monetary policy. We estimate the welfare loss from post-WWII inflation to be 0.9 percent of consumption (in perpetuity).

Second, we assume that the shift in policy regime had *some* role in reducing the volatility in real economic activity. Given the importance attached to domestic stability by the post-WWII regime, this would seem a reasonable assumption. It is generally accepted that volatility in real economic activity (real GNP, consumer expenditures, the unemployment rate, etc.) was higher during the pre-WWII period as compared to the post-WWII period (Zarnowitz (1992)). Although many factors contributed to this change, it seems reasonable to assume that some of that reduction happened because of policies such as automatic stabilizers and the Fed's lender-of-last-resort activities. We estimate the gain in welfare from this source to be 0.13 percent of consumption (in perpetuity).

Third, we assume that the shift in policy regime *may* have lowered the average unemployment rate in the post-WWII period. If the post-WWII policy regime "filled in business cycle troughs without shaving off business

cycle peaks" (to quote a phrase used by DeLong and Summers (1988)), then it may have contributed to a lower average unemployment rate. Although such an outcome is possible, there is much less consensus on this issue than on the proposition that policies reduced cyclical volatility. We estimate the potential gain in welfare from this source to be 4.61 percent of consumption (in perpetuity).[2]

Our study adds a historical perspective to the literature on the welfare cost of business cycles. Lucas's original calculation, which focused on the welfare gain from the elimination of all cyclical volatility in postwar aggregate consumer spending, suggested that the representative consumer with a relative risk aversion parameter of 1 would be willing to pay 0.008 percent of average consumption in perpetuity to get rid of business cycles. Imrohoroglu (1989) recalculated the welfare gain under the assumption that individuals faced uninsurable unemployment risk and found that an individual with a relative risk aversion parameter of 1.5 would be willing to pay 0.3 percent of his average consumption in perpetuity to get rid of business cycles. Since then, Atkeson and Phelan (1994) and Krusell and Smith (forthcoming) have noted that Imrohoroglu's results depend on how the elimination of business cycles is assumed to affect the probability of unemployment at the level of the individual worker. If the elimination of business cycles merely removes the *correlation* between changes in employment status of different workers, the gain in welfare will be nonexistent or very small.[3] In contrast to these

[2] We do not evaluate the welfare effects of the mean growth rate of consumption between the two eras.

[3] Atkeson and Phelan provide an ingenious model in support of their contention that stabilization policies may merely remove the correlation between changes in employment

studies, our calculations are based on *actual* changes in cyclical volatility between the pre- and post-WWII eras.[4] To that extent, they are subject to less ambiguity than the ones performed by Imrohoroglu and Krusell and Smith.

Nevertheless, the ambiguities stressed by Atkeson and Phelan and Krusell and Smith resurface when we attempt to relate the changes in the business cycle environment (i.e., changes in means as well as volatility) to the changes in macroeconomic policies between the two eras. Indeed, one of the lessons of our study is that changes in the mean unemployment rate and the mean duration of unemployment spells (in good and bad times) are the two factors that an individual worker cares most about. If there are good reasons to think that macroeconomic policies pursued in the post-WWII era did *not* affect these aspects of the worker's environment (i.e., the declines in the mean unemployment rate and the mean duration of unemployment spells that did occur in the post-WWII period happened for reasons unrelated to macroeconomic policies), then macroeconomic policies probably had a *negative* effect on individual welfare.

The paper is organized as follows. Section 2 contains a brief description of the pre-WWII macroeconomic policy regime and its likely implications for the volatility of economic activity. Section 3 describes the economic environment we study. Section 4 contains the calibration of the model to the

status of workers. Krusell and Smith assume this is so and focus on welfare consequences of the general equilibrium price effects of elimination of aggregate variability.

[4]Our finding that changes in cyclical environment contributed a 0.8 percent gain in welfare assumes a risk aversion parameter of 1.5 and is thus comparable to Imrohorglu's finding of a 0.3 percent gain in welfare.

pre- and post-WWII macroeconomic environments. Section 5 contains the key findings and section 6 concludes.

2 The Pre-WWII Macro Policy Regime

Scholars who have studied the operation of the pre-WWII "gold standard regime" agree that the regime tended to subordinate the health of a country's domestic economy to that of maintaining its currency's parity with gold. For instance, if a fall in commodity prices reduced export earnings for some country and began a drain on its gold reserves, the policy response was likely to be an increase in domestic interest rates. The rise in interest rates attracted foreign capital and, at the same time, reduced domestic aggregate demand and, hence, imports. Both effects worked to offset the initial decline in gold reserves, but by causing a decline in domestic aggregate demand, the policy aggravated the decline in income and employment caused by the initial decline in export earnings. On the positive side, adherence to the gold standard regime ensured that a country did not suffer from persistent inflation. A sustained rise in domestic prices was impossible because it led eventually to an adverse trade balance and a decline in gold reserves. Once reserves began declining, interest rates rose – which served to slow the growth in domestic money, credit, and prices.

The vulnerability of the domestic economy to adverse foreign-sector shocks was, arguably, greater for the US than for other countries on the gold standard. Unlike most European countries, the US did not have the benefit of a central bank until 1913. This meant that when gold flowed out of the country

for whatever reason (as it did, for example, whenever the Bank of England raised its discount rate), it drained reserves from private US banks and led directly to contractions in domestic credit and money supply.[5] In contrast, European central banks often mitigated the adverse effect of specie outflow on domestic credit by drawing down official gold reserves. In addition, the US banking system operated under regulations that made it susceptible to bank runs during periods of reserve scarcity. Thus, while the period between 1870 and 1913 is generally viewed as a stable one from the perspective of the gold standard regime, it was less so from the perspective of US money supply and credit.

The founding of the Fed in 1913 eliminated some of the problems that plagued the US banking system. However, the period between the two world wars was destined to be far more turbulent for the US than the period between 1870 and 1913. While the pre-WWI volatility in domestic monetary and financial conditions was the result of the interaction between a stable gold standard regime and domestic monetary institutions, the instability of the interwar years stemmed from the instability of the gold standard regime itself. The war had raised domestic prices in most European countries and had caused hyperinflation in Germany, Austria, Hungary, and Poland. Partly in response to these adverse inflationary developments, there was a concerted European attempt to resurrect the prewar gold standard. This meant that European governments had to follow deflationary policies to lower their domestic price levels to those that prevailed before the war. As a result, from

[5] See Calomiris and Hubbard (1989) for evidence on the role of disturbances to credit availability in output fluctuations during the pre-WWI era.

about the middle 1920s, when most European countries had resumed convertibility into gold, deflationary pressures strengthened in Europe. Predictably, European unemployment rates rose and economic activity weakened. This time, though, the political backlash against deflationary policies was severe. As the depth of political opposition became increasingly clear, country after country fell victim to speculative attacks on their currencies and were forced to suspend convertibility. Although the United States maintained convertibility throughout this tumultuous period, the inability of key European countries to make the gold standard work was probably an important contributing factor to the uncertainties that prevailed during the Great Depression.

Thus, for the US, the entire period from 1870 to the beginning of the Second World War was characterized by monetary and financial volatility. This monetary volatility was charted by Friedman and Schwartz (1963) in their celebrated book. The point of the brief discussion of the pre-WWI gold standard regime, and the interwar attempt to resurrect it, is to emphasize that pre-WWII macroeconomic policies were aimed primarily at maintaining convertibility of the dollar rather than at domestic stability. This "overriding" objective of maintenance of a stable currency is the backdrop against which the pre-WWII volatility in US monetary, financial, and real activity needs to be placed.

3 Environment

Our environment builds on work by Imrohoroglu (1989). The economy evolves through good (g) and bad (b) times, which have implications for employment prospects, earnings, and the prices at which agents purchase commodities. The state of the economy $n \in \{g, b\}$ is assumed to follow a first order Markov process. The transition matrix of n is given by:

$$\Lambda = \begin{bmatrix} \lambda_{gg} & \lambda_{bg} \\ \lambda_{gb} & \lambda_{bb} \end{bmatrix}$$

where, for example, $\Pr\{n_{t+1} = g | n_t = b\} = \lambda_{gb}$.

The economy consists of a large number of infinitely lived agents who differ at any point in time in their cash balances and employment opportunities. They maximize

$$E \sum_{t=0}^{\infty} \beta^t U(c_t)$$

where $0 < \beta < 1$ is their discount factor and c_t is their consumption in period t. The utility function is given by

$$U(c_t) = \frac{c_t^{1-\sigma}}{1-\sigma}$$

where $\sigma > 0$.

Agents are endowed with one indivisible unit of time each period. Each agent receives an employment opportunity that is independent across agents. The employment opportunity has two states, $i = e, u$. If the employed state occurs $i = e$, an agent produces y_n units of the consumption good in state

n. If the unemployed state occurs $i = u$, an agent produces θy_n units of the consumption good through household production in state n, where $0 < \theta < 1$.

The individual-specific employment state is assumed to follow a first order Markov process. The transition matrix is given by:

$$\Lambda^n = \begin{bmatrix} \lambda^n_{ee} & \lambda^n_{ue} \\ \lambda^n_{eu} & \lambda^n_{uu} \end{bmatrix}$$

where, for example, $\Pr\{i_{t+1} = e | i_t = u, n_{t+1} = g\} = \lambda^g_{eu}$is the probability that an agent will be employed in good times at $t + 1$, given the agent was unemployed in period t.

The overall employment prospects faced by each individual depends on both the aggregate and individual states; that is, $s = \{n, i\}$. There are four such states, where s^1 stands for employed in a good state, s^2 stands for unemployed in a good state, s^3 stands for employed in a bad state, and s^4 stands for unemployed in a bad state. The process governing s is a first-order Markov process with transition matrix given by $\Phi = \left[\phi_{jk}\right]$, where $\Pr\{s_{t+1} = s^j \mid s_t = s^k\} = \phi_{jk}$. The transition probabilities are determined by Λ and Λ^n. For example, if $s_t = s^1$, then the probability of $s_{t+1} = s^2$, i.e., ϕ_{21}, is given by $\lambda_{gg}\lambda^g_{ue}$.

While event-contingent insurance is not permitted, agents can insure themselves through holdings of money. Agents enter period t with individual nominal money holdings M_t held over from the previous period. The nominal price of consumption goods at time t in state n is given by P^n_t. Then an agent's budget constraint can be written:

$$P_t^n c(s_t) + M_{t+1} = P_t^n y(s_t) + M_t, \forall t, s$$

$$M_t \geq 0$$

We assume that $P_t^n = (1+\pi)^t P^n$ so we can re-write the agent's budget constraint as:

$$c(s_t) = y(s_t) - \frac{(m_{t+1}(1+\pi) - m_t)}{P^n} \geq 0$$

where $m_t = M_t(1+\pi)^{-t}$. Finally, we require non-negativity of money holdings.

The maximization problem faced by an individual in this economy can be represented as a dynamic programming problem where the state variables are $m = m_t$ and $s = s_t$, while the decision variable is $m^{'} = m_{t+1}$and the future state variable is $s^{'} = s_{t+1}$. The Bellman equation can be written:

$$V(m,s) = \max_{m' \geq 0} \; U(c(m,s)) + \beta \sum_{s'} \Phi(s',s) V(m',s') \tag{1}$$

subject to

$$c(s,m) = y(s) - \frac{(m'(1+\pi) - m)}{P^n} \geq 0, \forall s \tag{2}$$

Since agents face idiosyncratic shocks, they may hold different levels of money. Let $\mu_t(m,s)$ be the probability that an individual attains state (m,s) in period t. Then, given the decision rule $m'(m,s)$, the probability that (m',s') occurs in period $t+1$ is:

$$\mu_{t+1}(m',s') = \sum_{s} \sum_{m \in \Omega(m',s)} \Phi(s',s) \mu_t(m,s) \tag{3}$$

where $\Omega(m', s) = \{m : m' = m'(m, s)\}$. Under mild regularity conditions (ergodicity of the Markov process and the absence of cyclically moving subsets), the sequence of recursively defined distributions converges to a unique invariant distribution $\mu(m, s)$ from any initial distribution.

4 Calibration

The calibration of this environment involves selecting parameter values for two broad groups of variables: (i) aggregative variables, including the aggregate state transition matrix Λ, the average inflation rate π, and the detrended price levels P^n, and (ii) the individual-level variables, including the individual state transition matrix Λ^n, the individual-level real earnings $y(s)$, and the preference parameters β and σ.

A challenging aspect of this calibration is that we need to do it for both the pre-and post-WWII eras. This means assembling long time series (stretching back into the nineteenth century) on as many relevant variables as possible. We succeeded in obtaining long time series on real GNP[6], the CPI[7], and real earnings[8] going back to the late or mid-nineteenth century and on the

[6]The series for quarterly real GNP was assembled from the following sources: (i) for 1875.1 -1983.4 from the real GNP series reported in Table 2, Appendix B of Gordon (1986); for 1984.1-1997.4 from NIPA.

[7]The series for annual CPI ('all items') was assembled by linking together the series obtained from the following sources. For 1851-1880, from Table 1 p. 142 in Hoover (1960); for 1881-1889 from Historical Statistics of the United States, Series E 135; for 1890-1914, from Rees (1961), Table 22; for 1915-1970 from Historical Statistics of the United States, Series E 135; for 1971-1997, BLS.

[8]The series on annual money earnings of nonfarm employees was assembled from the

unemployment rate going back to 1900.[9]

The Aggregate State Transition Matrix

We used the time series on quarterly real GNP to determine the aggregate state transition matrix. We began with the time series on the logarithm of quarterly real GNP between 1875.1 and 1997.4 and extracted fluctuations at business cycle frequencies using the band-pass filter recommended by Baxter and King (1995). Because the extraction distorts business cycle components at the end points of a sample period, the recommended band-pass filter drops three years of data at both the beginning and the end of the sample period.

We propose measuring the expected duration of "good" and "bad" times in the pre- and post-WWII eras by classifying any quarter in which real GNP was above trend as being a "good time" and any quarter in which it was below trend as being a "bad time." The average duration of good and bad times in the two eras is taken as an estimate of the expected duration of good and bad times in the two eras. In view of this, we eliminated the first six and the last two quarters of the detrended series because they belonged to episodes of bad times whose beginning and ending dates, respectively, are not

following sources: (i) for 1860-1899: Historical Statistics of the United States, series D 735; (ii) for 1900-1960: Lebergott (1964), Table A-17; (iii) for 1961-1963: Historical Statistics of the United States, series D 722, scaled up by the average ratio (for 1955-1960) between this series and Lebergott's series; (iv) 1964-1997: calculated as the average hourly earnings of nonfarm production workers multiplied by 52 x the average weekly hours worked by nonfarm production workers (both series provided by the BLS). The resulting series was adjusted by the annual CPI series to give the real earnings series.

[9]The series for the unemployment rate was assembled from the following sources: For 1900-1960 from Lebergott Table A-3 (the unemployment rate of nonfarm employees); for 1961-1997 from the BLS.

known. We also wanted to maintain equal numbers of good and bad times over the entire period so we terminated our sample at 1994.3, the quarter in which the most recent episode of bad times ended.

Inspection of the de-trended series shows that the economic boom associated with World War II began in the third quarter of 1941. Thus, we treat the period 1879.3-1941.2 as belonging to the pre-WWII era and the period 1941.3-1994.3 as the post-WWII era. This gave us 19 episodes of good and bad times in the pre-WWII era and 10 episodes of good and bad times in the post-WWII era. The average duration of good and bad times for the two eras, D^n, $n = g, b$, is reported in the top panel of Table 1. The average duration of good times lengthened from 21.6 months in the pre-WWII era to 30.5 months in the post-WWII period. Also, the average duration of bad times lengthened from 19.6 months to 26.7 months.

The fact that the duration of spells of below-trend economic activity lengthened during the post-WWII era may seem odd in light of the conventional wisdom that the duration of contractionary spells (as dated by the NBER) has fallen in the post-WWII era. Note, however, that the NBER's "expansion-contraction" classification scheme is different from ours in that an NBER expansion begins in a trough and ends in a peak. Thus, it includes periods of both below-trend and above-trend economic activity. Furthermore, the fact that both good and bad times have lasted longer in the post-WWII era is consistent with evidence that fluctuations in real GNP became more persistent after WWII (see, for instance, DeLong and Summers (1988)).[10]

[10]There is also some uncertainty about the early reference dates in the NBER chronology. The early reference dates were based upon de-trended data, whereas the reference

From the information in the top panel of Table 1, the diagonal elements of the aggregate state transition matrix for the two eras were computed using the fact that $\lambda_{nn} = 1 - 1/D^n$, $n = g, b$. The fact that each row of each transition matrix sums to 1 then determined the off-diagonal elements. These matrices are displayed in the bottom panel of Table 1.

Table 1 - Aggregate Transition Parameters

Pre-WWII	Post-WWII
$D^g = 21.6$, $D^b = 19.6$ months	$D^g = 30.5$, $D^b = 26.7$ months
$\Lambda = \begin{bmatrix} 0.9538 & 0.0462 \\ 0.0508 & 0.9492 \end{bmatrix}$	$\Lambda = \begin{bmatrix} 0.9673 & 0.0327 \\ 0.0374 & 0.9626 \end{bmatrix}$

The De-trended Price Levels

We used annual time series on the CPI to determine the de-trended price levels P^n. We began with the time series on the logarithm of the CPI from 1851 to 1997 and extracted its business cycle components using the recommended band-pass filter for annual data. Once again, the recommended filter drops three years of data at the beginning and the end of the sample period.

dates after 1927 are based on data in levels. According to Romer (1994), removing this inconsistency makes the NBER reference cycles show a lengthening of the contractionary spells between the pre-WWI and post-WWII eras as well. The average duration of a contractionary spell goes from 9.7 months in the pre-WWI era to 10.9 in the post-WWII era. Romer's dates also indicate that the average duration of a cycle went from a little under 42 months in the pre-WWI period to a little over 62 months in the post-WWII period. If we view consecutive episodes of good and bad times as a business "cycle," our filter-based classification scheme also implies that the duration of the business cycle lengthened from a little over 41 months in the pre-WWII era to a little over 57 months in the post-WWII era.

As a first step toward determining P^n, we ran separate regressions of de-trended CPI on annual de-trended real GNP (where annual de-trended real GNP was created using the same procedure as that for de-trended CPI) for the pre- and post-WWII eras. Second, the coefficient on real GNP (which measures the elasticity of price with respect to output) was multiplied by the average deviation from trend of real GNP in good and bad times in the two eras. This led to the finding that, on average, the difference in de-trended price levels between good and bad times was 1.68 percentage points in the pre-WWII era but -0.65 percentage points in the post-WWII era. Thus consumer prices were procyclical and more volatile in the pre-WWII period, but countercyclical and much less volatile in the post-WWII period.[11] Finally, the values of P^n, $n = g, b$, for each era was determined by setting the unconditional expected value of the price level to 1 in both eras. For instance, for the pre-WWII era, P^g and P^b are chosen to satisfy $1 = \lambda^g P^g + \lambda^b P^b$ and $P^g - P^b = 0.0168$, where λ^n denotes the unconditional probability of being in state $n = g, b$. The resulting values of P^n are displayed in the top panel of Table 2.

Table 2 - Price Data Parameters

Pre-WWII	Post-WWII
$P^g = 1.008,\ P^b = 0.991$	$P^g = 0.997,\ P^b = 1.004$
$\pi = 0.055\%$ monthly	$\pi = 0.350\%$ monthly

[11] The finding that the cyclical behavior of the (de-trended) price level changed between the pre- and post-WWII era confirms the earlier findings of Cooley and Ohanian (1991). Cooley and Ohanian did not examine the CPI series used in this study, and they did not use a band-pass filter to de-trend their series.

The Inflation Rate

We used the average CPI inflation rate between 1851 and 1941 as the average inflation rate for the pre-WWII era and the average CPI inflation rate between 1942 and 1997 as the average inflation rate for the post-WWII period. At an annual rate, these inflation rates were 0.66 percent and 4.16 percent, respectively. These values are noted in the bottom panel of Table 2.

The Individual-Level State Transition Matrix

For each era, the individual-level state transition matrix is built up from two pieces of information: the average unemployment rate in good and bad times and the average duration of unemployment spells in good and bad times.

The average unemployment rate in good and bad times in the pre-WWII era was determined using a procedure similar to that for determining the de-trended price levels in good and bad times. We regressed the annual unemployment rate for the period 1900-1941 on a constant term and annual de-trended real GNP. The estimate of the constant term, which came out to be 10.65 percent, was taken to be a measure of the average unemployment rate for the pre-WWII era. The estimated coefficient on real GNP was multiplied by the difference in the average deviation from trend between good and bad times in real GNP to give a measure of the difference in unemployment rates between good and bad times in the pre-WWII era. The difference was -7.16 percentage points. The unemployment rates in good and bad times (denoted as U^g and U^b, respectively) were then determined by the requirement that the unconditional unemployment rate in the pre-WWII era equal 10.65 percent (i.e., by the requirement that $0.1065 = \lambda^g U^g + \lambda^b U^b$ and

$U^g - U^b = -0.0716$). This implied an average unemployment rate of 7.24 percent in good times and 14.41 percent in bad times (Table 3).[12]

Table 3 - Unemployment Rates and Durations

Pre-WWII	Post-WWII
$U^g = 0.0724, U^b = 0.1441$	$U^g = 0.0515, U^b = 0.0678$
$D_u^g = 2$, $D_u^b = 4$ months	$D_u^g = 1.44$, $D_u^b = 1.96$ months

There is no comprehensive source of information on the duration of unemployment spells in the pre-WWII era. For the nineteenth century, the only source (we are aware of) is Keyssar's (1977) study of unemployment in Massachusetts. By the end of the nineteenth century, industrial unemployment in Massachusetts (then America's preeminent industrial state) had become a big enough problem to attract the attention of state authorities. The commonwealth of Massachusetts conducted two censuses of unemployment, the first in 1885 and the second in 1890. The number unemployed in 1885 was high (a depressed year) while that in 1890 was relatively low (a prosperous year). Thus, the duration statistics from the two censuses give us some indication of how the length of unemployment spells varied between bad and good times in the late nineteenth century.

[12]Since these estimates are based on unemployment rates for 1900-1941, they are heavily influenced by the Depression. Thus, it's possible that our procedure exaggerates the volatility of unemployment rates and their average value for the pre-WWII era. On the other hand, the scattered evidence on late nineteenth century industrial unemployment does suggest that the average unemployment rate during this period was quite high and that the unemployment rate was very volatile (Lebergott (1964, Table A-15), Romer (1986b, Table 9), and Keyssar (1977)).

Table 4

Year Ending	# of Males Unemp.	for 1-3 m	4-6 m	7-12 m
May 01, 1885	178,628	42.5	47.0	10.5
May 31, 1890	136,374	57.1	32.8	10.1

Table 4 is adapted from Table II-5 in Keyssar (p.73). Taken at face value, these figures suggest that more than half the unemployed workforce had been without work for more than four months in the year ending in May 1, 1885 and more than half of the workforce was unemployed for less than three months in the year ending May 31, 1890. However, for our purposes, the use of these facts poses a problem. While the censuses recorded the duration of unemployment spells, they did not distinguish between different causes of idleness. Keyssar suggests that there was a significant *seasonal* component to unemployment, which means that some spells of unemployment were predictable. Predictable spells of unemployment reduce average annual earnings but do not entail any risk.

For the 1900-1941 period, data on unemployment duration were collected in the 1910 and 1930 censuses and in a special census of unemployment taken in 1931. The duration results from the 1910 census were tabulated in 1948 but not officially published. The 1930 census recorded both duration of unemployment and reasons for idleness. Excluding workers who were unemployed for seasonal reasons, the distribution of unemployed male workers by weeks of unemployment is shown in Table 5.

Table 5 - Duration of Unemployment, April 1930

Weeks of Unemployment	<1	1-2	3-4	5-8	9-13	14-26	>27
Percent of Unemployed	2.64	13.07	13.13	15.22	14.81	26.13	15.00
Source: Table 2, p. 318, *Unemployment, Vol II, Fifteenth Census of the United States.*							

Thus, by early 1930, the average duration of unemployment exceeded 12.5 weeks, and more than 41 percent of workers had been unemployed for at least 14 weeks. The special census of unemployment undertaken in January 1931 was done for selected cities. The percentages of workers unemployed for at least 18 weeks in Boston, New York, Philadelphia, Chicago, and Los Angeles were 45.3 percent, 60.9 percent, 45.2 percent, 61.0 percent, and 33.2 percent, respectively.

On the basis of this scattered information on duration of unemployment in the pre-WWII period, we tentatively set the average duration of unemployment to four months in bad times and two months in good times for the pre-WWII era.

Fixing the average duration of unemployment in good and bad times allows us to pin down λ_{uu}^g as $1 - 1/2$ and λ_{uu}^b as $1 - 1/4$. The fact that each row of the individual state transition matrices must sum to one determined λ_{eu}^g and λ_{eu}^b. Next, note that the evolution of the aggregate unemployment rate is given by:

$$U_t = U_{t-1}\lambda_{uu}^{n(t)} + (1 - U_{t-1})\lambda_{ue}^{n(t)}$$

where $n(t) \in \{g, b\}$. Since λ_{uu}^n etc. depend only on the current state, we may expect U_t to converge to some constant if the state remains unchanged for

some length of time. We choose $\lambda_{ue}^n, n = g, b$, so that:

$$U^n = U^n \lambda_{uu}^n + (1 - U^n)\lambda_{ue}^n$$

This choice implies that in our model the average unemployment rate in good times is somewhat larger than U^g and the average unemployment rate in bad times is somewhat less than U^b. However, since both the good and bad states are highly persistent, these discrepancies are minor.

The Λ^n matrix for the post-WWII period was determined in a similar way. Since we have quarterly data for this period, we regressed the quarterly unemployment rate on a constant term and de-trended quarterly real GNP. The constant term was estimated to be 5.91 percent and was taken as the average unemployment rate in the post-WWII period. The coefficient on real GNP implied that the difference in the unemployment rate between good and bad times is -1.63 percent. This implies unemployment rates of 5.15 percent in good times and 6.78 percent in bad times.

There is comprehensive data on the median duration of unemployment spells beginning in 1967. We regressed this series on a constant term and de-trended quarterly real log GNP. The estimate of the constant term was 6.74 weeks and was taken as the average duration of unemployment in the post-WWII period. The coefficient on the logarithm of real GNP implies that the difference in the duration of unemployment in good and bad times is -2.03 weeks. This implies a median duration of unemployment of 1.44 months in good times and a median duration of unemployment of 1.96 months in bad times. This information allows us to pin down λ_{uu}^g as $1 - 1/1.44$ and λ_{uu}^b as $1 - 1/1.96$. The remaining elements of the Λ^n matrices were determined

following the same procedure as for the pre-WWII case. These parameters are summarized in Table 6.

Table 6 - Individual- Level Transition Parameters

Pre-WWII	Post-WWII
$\Lambda^g = \begin{bmatrix} 0.9609 & 0.0391 \\ 0.5 & 0.5 \end{bmatrix}$	$\Lambda^g = \begin{bmatrix} 0.9625 & 0.0375 \\ 0.6905 & 0.3095 \end{bmatrix}$
$\Lambda^b = \begin{bmatrix} 0.9579 & 0.0421 \\ 0.25 & 0.75 \end{bmatrix}$	$\Lambda^b = \begin{bmatrix} 0.9628 & 0.0372 \\ 0.5113 & 0.4887 \end{bmatrix}$

De-Trended Earnings

To determine the earnings process for the two eras, we began with a series on the average real annual earnings of nonfarm workers for the period 1860-1997. We took logarithms of the series and extracted its business cycle component using the recommended band-pass filter for annual data. Again, three years of data were dropped at each end of the sample.

To determine earnings in the employed state during good and bad times in the pre-WWII era, we regressed de-trended real earnings on de-trended annual real GNP for the period 1878-1941. The coefficient on real GNP (which measures the elasticity of real earnings with respect to real GNP) when multiplied by the average difference between real GNP in good and bad times implies a difference of 0.95 percent in real earnings between good and bad times. A similar procedure for the post-WWII period (1942-1994) revealed that the difference in real earnings between good and bad times was 1.94 percent. Thus, real earnings were *less* volatile in the pre-WWII as compared to the post-WWII era. This result is driven by the different behavior of de-trended prices in the two eras. Since prices were procyclical

in the pre-WWII era, they partially countered the procyclical movement in nominal earnings; no such offset occurred in the post-WWII era. These differences in earnings in good and bad times and the requirement that the unconditional mean of earnings be 1 in both eras allowed us to pin down the value of $y^n, n = g, b$,for both eras. These values are noted in the top panel of Table 7.

Table 7 - Earnings Parameters

Pre-WWII	Post-WWII
$y^g = 1.0045, y^b = 0.9950$	$y^g = 1.0091, y^b = 0.9897$
$\theta = 0.25$	$\theta = 0.25$

Specification of the earnings process also requires a value of the earnings loss from unemployment. In the pre-WWII period there was no state unemployment insurance. Furthermore, as documented by Keyssar, by 1875 industrial unemployment was an urban phenomenon. Workers who lost their jobs did not have the option of returning to the countryside (many were immigrants from Europe). For some households, earnings of wives and children provided some cushion against the loss of earnings of the primary breadwinner. With these facts in mind, we tentatively assume that in the pre-WWII era, the earnings of an unemployed worker was a quarter of that of an employed worker.

In the post-WWII era, all laid-off workers are eligible for unemployment benefits. However, our interest is not in the welfare effects of unemployment insurance per se, but on the effects that such insurance may have had on the stability of aggregate demand and, hence, on the aggregate unemployment

rate and other macroeconomic variables.[13] For this reason, we maintain the same earnings loss from unemployment in the post-WWII era as in the pre-WWII era.

Compound Transition Matrix

Given Λ and Λ^n, it is possible to construct Φ. This is given in Table 8.

Table 8: Compound Transition Matrices

$$\Phi_{pre} = \begin{bmatrix} 0.9166 & 0.0373 & 0.0444 & 0.0018 \\ 0.4769 & 0.4769 & 0.0231 & 0.0231 \\ 0.0487 & 0.0021 & 0.9092 & 0.0399 \\ 0.0127 & 0.0381 & 0.2373 & 0.7119 \end{bmatrix}$$

$$\Phi_{post} = \begin{bmatrix} 0.8939 & 0.0733 & 0.0303 & 0.0025 \\ 0.6679 & 0.2993 & 0.0226 & 0.0101 \\ 0.0349 & 0.0025 & 0.8985 & 0.0641 \\ 0.0191 & 0.0183 & 0.4922 & 0.4704 \end{bmatrix}$$

Preference Parameters

Following Imrohoroglu, we set $\beta = 0.9967$ and $\sigma = 1.5$.

[13] The welfare effects of unemployment insurance have been analyzed for this class of models in Hansen and Imrohoroglu (1992).

5 Findings

5.1 A Welfare Comparison of the Pre- and Post-WWII Eras

We obtain decision rules for optimal money holdings by successive approximations on the value function $V(m, s)$. Following Imrohoroglu (1989), we discretize the state space of money holdings to lie between 0 and 8.1 in increments of 0.027 for a total of 301 grid points.[14] The upper bound, again the same as in Imrohoroglu, is roughly equal to eight months of income if the employed state continues for that long. In equilibrium, this constraint is never binding. We found that the sequence of decision rules typically converged after 500 iterations.[15] We denote the value function for the pre-WWII stochastic processes for income and prices as $V_{pre}(m, s)$ and that for the post-WWII stochastic processes as $V_{post}(m, s)$.

We are interested in the welfare gain experienced by pre-WWII individuals from changes in the stochastic process for income and prices that occurred during the post-WWII period. If the changes were improvements, we would expect $V_{post}(m, s)$ to exceed $V_{pre}(m, s)$. For an individual in state (m, s), the improvement could be expressed in terms of consumption by computing γ such that $V_{pre}(m, s) = \gamma(m, s)^{1-\sigma} V_{post}(m, s)$. Then $1 - \gamma(m, s)$ is the fraction of consumption the individual can give up every period in an environment

[14] We also doubled the number of grid points and found no appreciable differences from what is presented in the text.

[15] We used a sup norm convergence criterion, stopping when $\max_{m,s} \frac{|V_{i+1}(m,s) - V_i(m,s)|}{|V_i(m,s)|} <$ .0001.

characterized by post-WWII stochastic processes without his utility falling below that available to him in the pre-WWII environment. Denoting the invariant measure for the pre-WWII environment by $\mu_{pre}(m, s)$ (this distribution gives the unconditional probability of a worker's having money m in state s in the pre-WWII environment), the average gain in utility to pre-WWII individuals is given by $\overline{\gamma} = \sum_{m,s} \mu_{pre}(m, s)\gamma(m, s)$.

Table 9 reports the key operating characteristics of the economy under the pre- and post-WWII eras and the gain in welfare experienced by pre-WWII individuals from the change in the stochastic process governing income and prices. On average, pre-WWII individuals would be willing to give up 4.19 percent of their consumption in perpetuity to live under the post-WWII stochastic processes for income and prices. This substantial increase in welfare is mirrored in the substantial changes in the stochastic process for individual consumption. The average value of individual consumption (denoted $\bar{c}$) rises from 0.92 to 0.95 and the variance of consumption (denoted $v(c)$) drops from 0.76 percent to 0.55 percent. Furthermore, the average value of real money balances (denoted $\bar{m}$) falls from 3.74 to 1.52 and the variance of real money holdings (denoted $v(m)$) also drops from 0.19 to 0.01. Obviously, the decrease in risk of spells of unemployment cuts precautionary saving.

Figures 1 and 2 compare the pre- and post-WWII value functions of an employed and unemployed agent in a good aggregate state for this experiment, respectively. Figures 3 and 4 contrast the pre- and post-WWII changes in money holdings ($m' - m$) of an employed and unemployed agent in a good aggregate state for the same experiment, respectively. It is clear that when

employed, agents who have low current holdings of money accumulate savings while those who have high current holdings decumulate. It should be noted that beginning-of-period money balances for which an employed agent chooses to switch from accumulation to decumulation are in the range of six units for pre-WWII; they are in the range of two units for post-WWII. When unemployed, however, an agent always decumulates if he has any savings. Finally, Figures 5 and 6 compare the pre- and post-WWII distributions of money holdings for employed and unemployed agents in a good aggregate state for this experiment, respectively. The major spikes in the distributions arise where switching points from saving to dissaving occur.

Table 9- Change from Pre- to Post-WWII Stochastic Processes

	Model	$1-\bar{\gamma}$	$1-\bar{\gamma}_{ss}$	
	POST	0.041870	0.035218	
Model	$\bar{m}$	$v(m)$	$\bar{c}$	$v(c)$
PRE	3.7434	1.6162	0.91995	0.00758
POST	1.51555	0.19301	0.95059	0.00546

Table 9 also reports the welfare gain between the two regimes from a "steady state" perspective. In this calculation (denoted by $1-\overline{\gamma}_{ss}$) we first determine $\gamma_{ss}(m,s)$ to satisfy $V_{pre}(m,s) = \gamma_{ss}^{1-\sigma}(m,s)\overline{V}_{post}$, where $\overline{V}_{post} = \sum_{m,s}\mu_{post}(m,s)V_{post}(m,s)$. In other words, we ask how much would pre-WWII individuals be willing to give up to obtain the steady state welfare associated with the post-WWII stochastic processes. Then $\overline{\gamma}_{ss}$, calculated as $\sum_{m,s}\mu_{pre}(m,s)\overline{\gamma}_{ss}(m,s)$, is the fraction of consumption that pre-WWII individuals would be willing to give up on average to obtain the steady state utility associated with post-WWII stochastic processes. This measure of the

welfare gain is 3.53 percent of individual consumption in perpetuity. Why is $1-\overline{\gamma}_{ss}$ lower than the $1-\overline{\gamma}$? The answer lies in the fact that the average money holdings of workers in the post-WWII regime is less than half of the average money holdings of consumers in the pre-WWII regime: 3.74 months of income versus 1.52 months of income. Because unemployment risk is a good deal lower in the post-WWII regime, workers hold less money balances as a precaution against loss of income. As a result, the change in stochastic processes allows pre-WWII individuals to decumulate money balances and enjoy a valuable consumption spree. When attention is focused on the comparison of steady-state welfare, the gain in welfare accruing along the transition path to the new steady state is not taken into account. For this reason, $1-\overline{\gamma}_{ss}$ is lower than the $1-\overline{\gamma}$.

We should also note that operating characteristics of the pre-WWII regime lends some support to our choice of earnings loss from unemployment. Recall that we set earnings when unemployed to a quarter of earnings when employed ($h = 0.25$). This choice implied an average holdings of money balances of 3.74 months of income. According to Friedman and Schwartz (Table A-5, p. 774), the US economy held, on average 2.67 months of (national) income as balances in currency and checking accounts in 1915 (the midpoint, roughly, of the pre-WWII era). Assuming that two-thirds of national income accrues to labor, their findings imply that the economy held four months of national labor income as balances. Since some portion of currency and checking deposits were held by firms, these facts suggest that an average money holding of 3.74 months for the pre-WWII era is reasonable.

5.2 Welfare Gains and the Role of Post-WWII Macroeconomic Policy Regime

We turn now to finding out how much of this increase in welfare can reasonably be ascribed to the change in the macroeconomic policy regime between the two eras.

Welfare Effects of Post-WWII Inflation

As noted earlier, most macroeconomists would agree that the macroeconomic policy arrangement in the post-WWII era was an important cause of higher inflation during the 1960s and 1970s. Thus, our first (thought) experiment is to ask: how much would a pre-WWII individual have to be paid to live in a world that resembles the pre-WWII environment in all respects except that it has the post-WWII inflation rate? The results are displayed in Table 10. The loss in welfare of an increase in the annual inflation rate from 0.66 percent to 4.16 percent is 0.99 percent of individual consumption in perpetuity. As deadweight losses go, this is a fairly large reduction in welfare. Note that the steady-state reduction in welfare is even larger, with welfare being lower by 1.35 percent of consumption in perpetuity. Again, the steady-state calculation gives a lower figure because it does not take into account the reduction in the average money holdings from 3.74 months of income to 2.73 months of income

Table 10 - Change from Pre- to Post-WWII Mean Inflation Rate

	Model	$1-\bar{\gamma}$	$1-\bar{\gamma}_{ss}$	
	INF	-0.009873	-0.013499	
Model	$\bar{m}$	$v(m)$	$\bar{c}$	$v(c)$
PRE	3.7434	1.6162	0.91995	0.00758
INF	2.73163	0.86645	0.91249	0.01049

The large reduction in welfare reflects the large increase in volatility of individual consumption. Note that the variance of consumption rises from 0.76 percent in the pre-WWII era to 1.05 percent in this hypothetical world. Furthermore, average consumption drops a small amount. The increase in the volatility of consumption is what we would expect, given the drop in precautionary money holdings. Of course, precautionary money holdings drop because anticipated inflation discourages money holdings.[16]

Welfare Effects of Changes in Cyclical Volatility

In this section we attempt to evaluate the potential welfare gains from reduction in cyclical volatility between the two eras. As noted earlier, the shift in the focus of macroeconomic policies from external to domestic stability probably reduced post-WWII cyclical volatility.

In this thought experiment we situate the worker in an environment in which the mean unemployment rate and the mean inflation rate is identical to that in the pre-WWII era, but the persistence of aggregate states, the variance of the aggregate unemployment rate, and the cyclical behavior of

[16] Anticipated inflation also imposes costs stemming from distortion of the capital accumulation decision and labor-leisure choice, which are not being taken into account here.

prices and real earnings are those from the post-WWII period. In particular, in this hypothetical world, U^g and U^b are 9.89 and 11.52 percent, respectively (so that the mean unemployment rate is 10.65 percent (the same as in the pre-WWII period) but the difference between good and bad states is 1.63 percentage points (that of the post-WWII period)). These aggregate unemployment rates in good and bad times were coupled with the "appropriate" Λ^g and Λ^b matrices. We used the observed relationship between the probability of continuing in the unemployed state (or, equivalently, the duration of unemployment spells) and aggregate unemployment rates to "back out" the probability of continuing in the unemployed state for aggregate unemployment rates of 9.89 and 11.52 percent. Our procedure implied that for an aggregate unemployment rate of 9.89 percent, the probability of continuing in the unemployed state is 0.5752 and for an aggregate unemployment rate of 11.52 percent the probability of continuing in the unemployed state is 0.6439. The other elements of the individual-level transition matrices were determined following the procedure described for pre-WWII (and post-WWII) Λ^g and Λ^b matrices.

As noted in Table 11, pre-WWII individuals are willing to pay 0.13 percent of individual consumption in perpetuity to live under these, less volatile, income and price processes. When attention is confined to steady states, the individual worker is willing to give up 0.008 percent of consumption. The negligible steady gain in welfare suggests that the 0.13 percent gain in welfare is probably entirely due to the fact that the individuals held somewhat less money balances in the new, less volatile steady state (3.41 months of income as opposed to 3.74 months of income)

Table 11- Change from Pre- to Post-WWII Cyclical Volatility

	Model	$1-\bar{\gamma}$	$1-\bar{\gamma}_{ss}$	
	C	0.001251	0.000080	
	C1	−0.000778	−0.000822	
	C2	0.001429	0.000244	
	C3	−0.000203	−0.000250	
Model	$\bar{m}$	$v(m)$	$\bar{c}$	$v(c)$
PRE	3.7434	1.6162	0.91995	0.00758
C	3.41443	1.37024	0.91844	0.00650
C1	3.73314	1.61286	0.91951	0.00779
C2	3.41526	1.37115	0.91847	0.00640
C3	3.73912	1.61239	0.92002	0.00782

These are strikingly small numbers. It appears, therefore, that the welfare gains from the post-WWII reduction of business cycle volatility are quite small. In particular, they are smaller than the welfare loss from higher post-WWII inflation. The fundamental reason for these small welfare gains is that individuals can self-insure effectively by holding precautionary balances. As a result, they do not put a high premium on reduction in volatility per se. We find this result of some significance because of the ongoing controversy about how volatile the pre-WWII era really was. In two influential papers, Christina Romer (1986a,1986b) has argued that the high volatility of pre-WWII data, in particular the pre-WWI data, is spurious and is caused by biases in the construction of the data.[17] Our finding suggests that the

[17] The data series we use include ones that Romer has criticized, in particular, the ones for real GNP and the unemployment rate.

resolution of this debate may have little consequence for the evaluation of macroeconomic policies. The evaluation of macroeconomic policies must be ultimately related back to the individuals they affect. Even if the post-WWII era was as volatile as the "official" data series suggest, we cannot ignore the possibility that pre-WWII individuals may have neutralized that volatility by adapting to it in various ways. In the simple model analyzed here, the adaptation takes the form of holding higher precautionary balances.

Table 11 also reports on the results of some additional thought experiments designed to "parcel" out the (small) gain in welfare into that stemming from an increase in persistence of aggregate states alone (C1), from a reduction in the variance of aggregate unemployment alone (C2), and from the cyclical change in the behavior of the price level and real earnings alone (C3). As these results show, the effects of the change in persistence and the changes in the cyclical behavior of prices and earnings are very small (and, in fact, negative). The bulk of the 0.13 percent gain in welfare comes from the reduction in the volatility of the aggregate unemployment rate. Again, we find this result informative because some economists have argued that a key consequence of postwar stabilization policies has been a reduction in transitory fluctuations in economic activity and, hence, an increase in the persistence of fluctuations in real GNP (DeLong and Summers (1988)). While that may be so, our thought experiment shows that the change in persistence itself had negligible welfare effects.

Welfare Effects of Changes in Mean Unemployment Rate

Our final thought experiment is to situate the pre-WWII worker in an environment in which the inflation rate, the variance of the aggregate unem-

ployment rate, the persistence of aggregate states, and the cyclical behavior or the price level and real earnings are the same as in the pre-WWII era but the mean unemployment rate is the same as in the post-WWII era. In particular, in this hypothetical world U^g and U^b are 2.57 and 9.73 percent, respectively (so that the mean unemployment rate is 5.91 percent (that of the post-WWII era) but the difference between good and bad states is 7.16 percentage points (that of the pre-WWII era)). These aggregate unemployment rates were "matched up" with probability of continuing in the unemployed state of 0.2657 and 0.5683, respectively.

As shown in Table 12, the pre-WWII individual would be willing to give up 4.61 percent of consumption in perpetuity to live under these stochastic processes for income and prices. Comparing steady states, the gain in welfare is 4.15 percent of consumption. In this case, the increase in welfare is reflected in changes in all three important operating characteristics of the hypothetical economy: the average level of money balances drops from 3.74 months of income to 2.23 months of income; the mean level of consumption rises from 0.92 to 0.96; and the volatility of consumption falls from 0.76 percent to 0.47 percent. All these changes reflect the substantial reduction in unemployment risks compared to the pre-WWII environment.

Table 12- Change from Pre- to Post-WWII Mean Unemployment Rate

	Model	$1-\bar{\gamma}$	$1-\bar{\gamma}_{ss}$	
	UN	0.046108	0.041486	
Model	$\bar{m}$	$v(m)$	$\bar{c}$	$v(c)$
PRE	3.7434	1.6162	0.91995	0.00758
UN	2.22620	0.40409	0.95551	0.00471

Thus, the overall gain in welfare of 4.19 percent between the pre- and post-WWII eras stems mostly from a reduction in the mean unemployment rate.[18] Thus, the validity of the proposition that post-WWII policy regime improved welfare rests on these policies' having lowered the average unemployment rate. Again, this is informative in that macroeconomists haven't directed any attention to understanding why the average unemployment rate fell so much between the pre- and post-WWII eras. Our findings suggest that it is important to find out how much of the decline in the unemployment rate can be attributed to macroeconomic policies.

6 Conclusions

We computed the potential economic benefits that would accrue to a typical pre-WWII era US worker from the post-WWII macroeconomic policy regime.

[18] A sum of the welfare gains (and losses) from changes in the inflation rate, cyclical volatility, and mean unemployment rate is 3.58 percent. The discrepancy between this sum and the overall gain in welfare of 4.19 percent reflects the fact that post-WWII inflation has less of an adverse effect on welfare when unemployment risk is at the lower post-WWII level rather than the higher pre-WWII level.

We assumed that workers face undiversifiable income risk but can self-insure by saving in nominal assets. The worker's average utility is computed for two eras: pre-WWII (1875-1941) and post-WWII. In the pre-WWII era, the worker endured business cycles that were large in amplitude and quite volatile, a procyclical aggregate price level with large cyclical amplitude, a high average unemployment rate, and virtually no trend in the aggregate price level. In the post-WWII era, the same worker would have encountered business cycles with smaller amplitude and less volatility, a countercyclical aggregate price level with small cyclical amplitude, a much lower mean unemployment rate, and a positive trend in the aggregate price level. We find that a pre-WWII individual would be willing to pay 4.19 percent of his consumption in perpetuity to live under the post-WWII business cycle environment. Most macroeconomists would agree that the higher post-WWII inflation was a consequence of the post-WWII macroeconomic policy regime. By itself, the higher inflation reduced welfare by 0.9 percent of consumption (in perpetuity). There is much more controversy about how post-WWII macroeconomic policies affected the mean and variance of aggregate unemployment. Depending on what is assumed about the effects of post-WWII macroeconomic policies on the mean and variance of the aggregate unemployment rate, the potential gain in the worker's welfare from post-WWII macroeconomic policies could range between -0.9 percent of consumption (no effect of macroeconomic policies on mean and variance of aggregate unemployment) to 4.19 percent of consumption (macroeconomic policies were largely responsible for the decline in the mean and variance of aggregate unemployment).

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Fig.1:Value Functions of those Employed in Good State

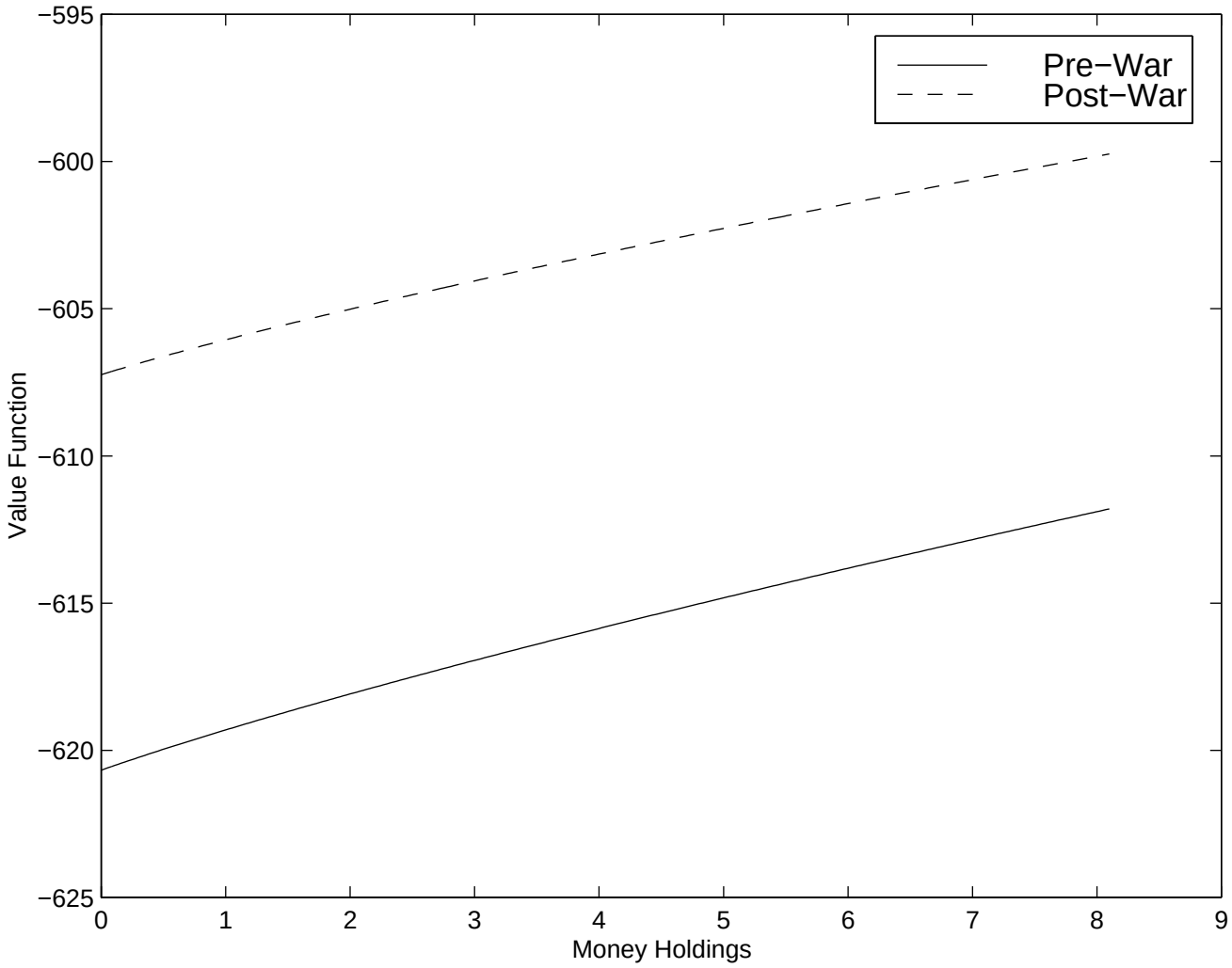

Fig.2:Value Functions of those Unemployed in Good State

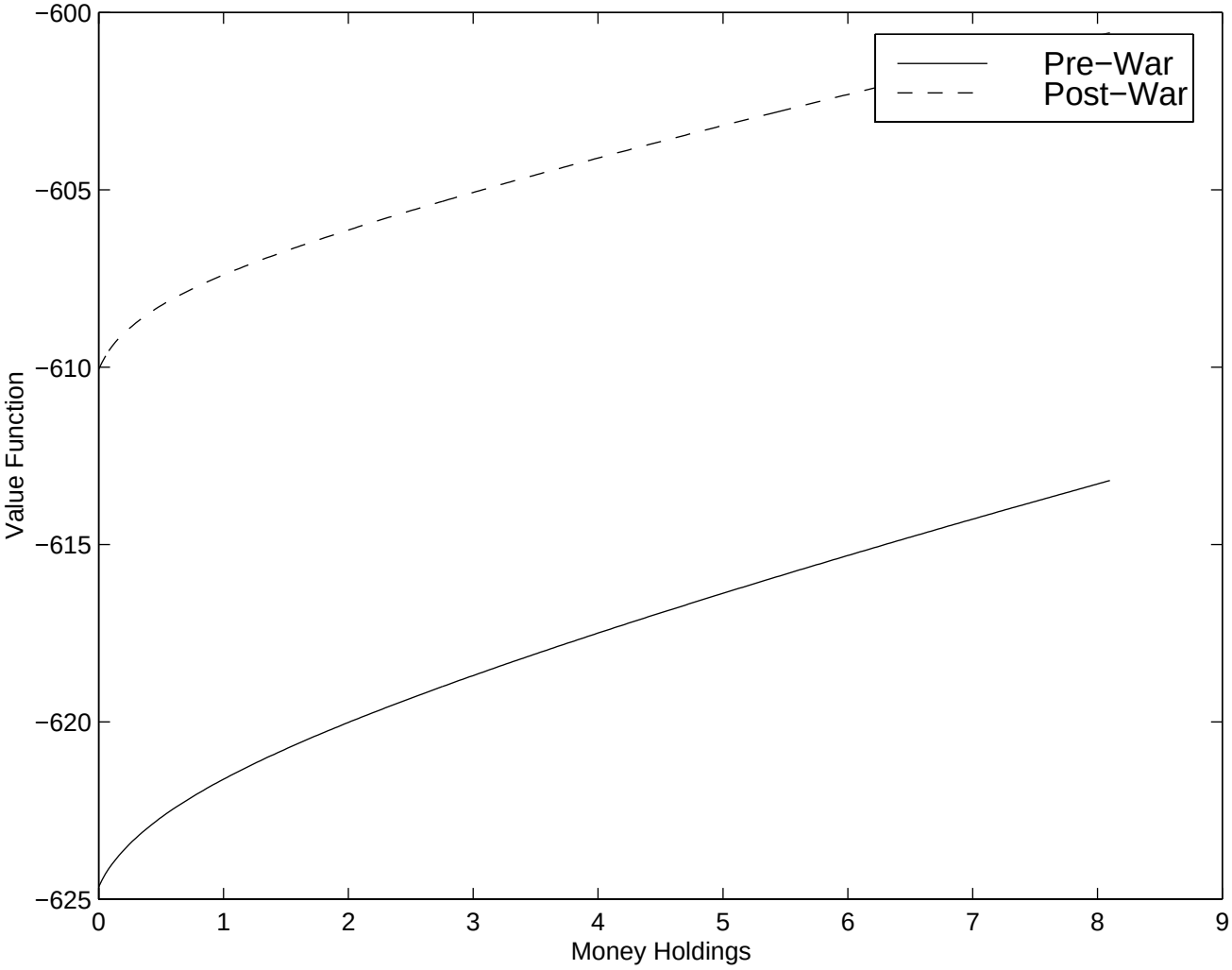

Fig.3:Money Accumulation/Decumulation of those Employed in Good State

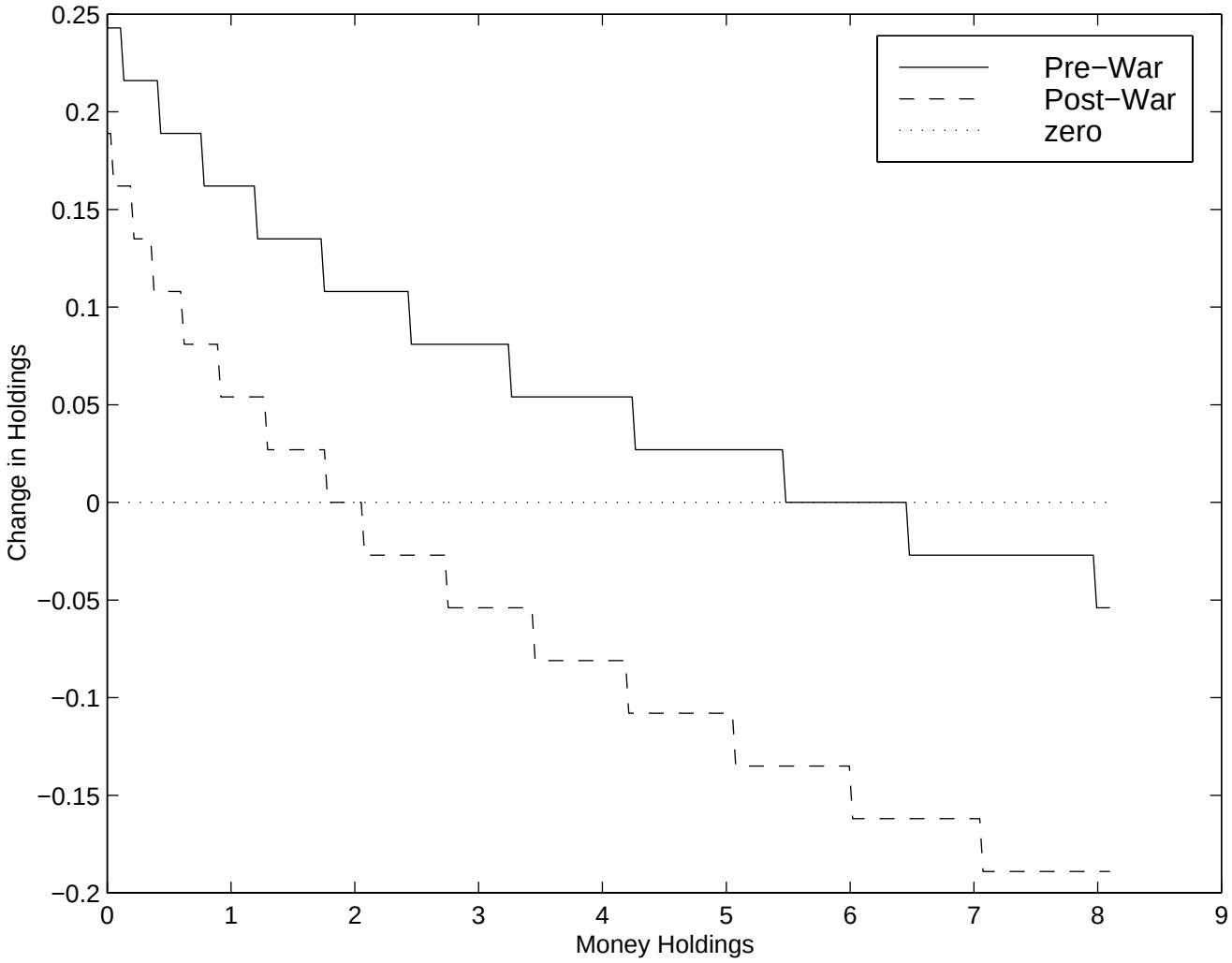

Fig.4:Money Accumulation/Decumulation of those Unemployed in Good State

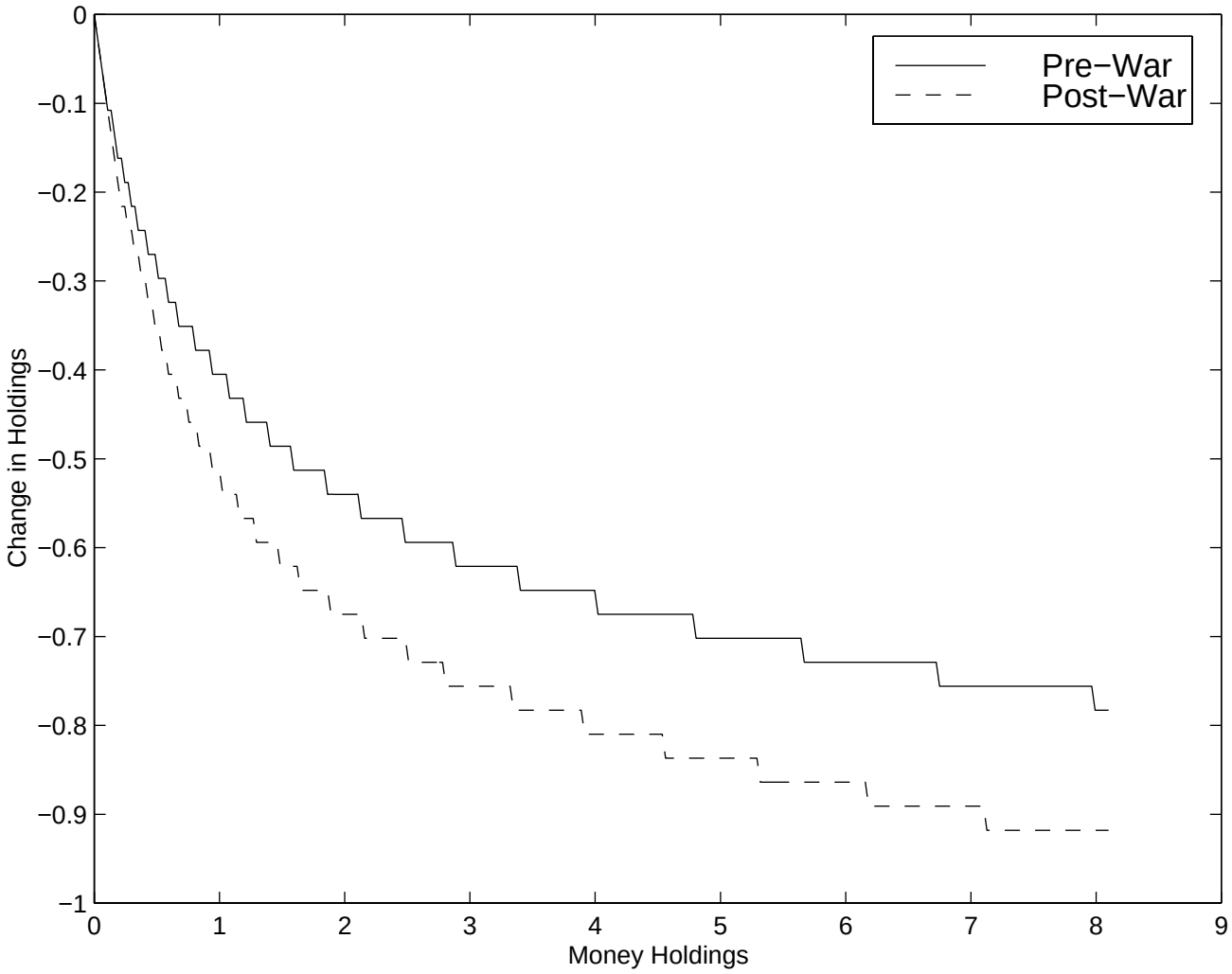

Fig.5:Distributions of Money Holdings of those Employed in Good State

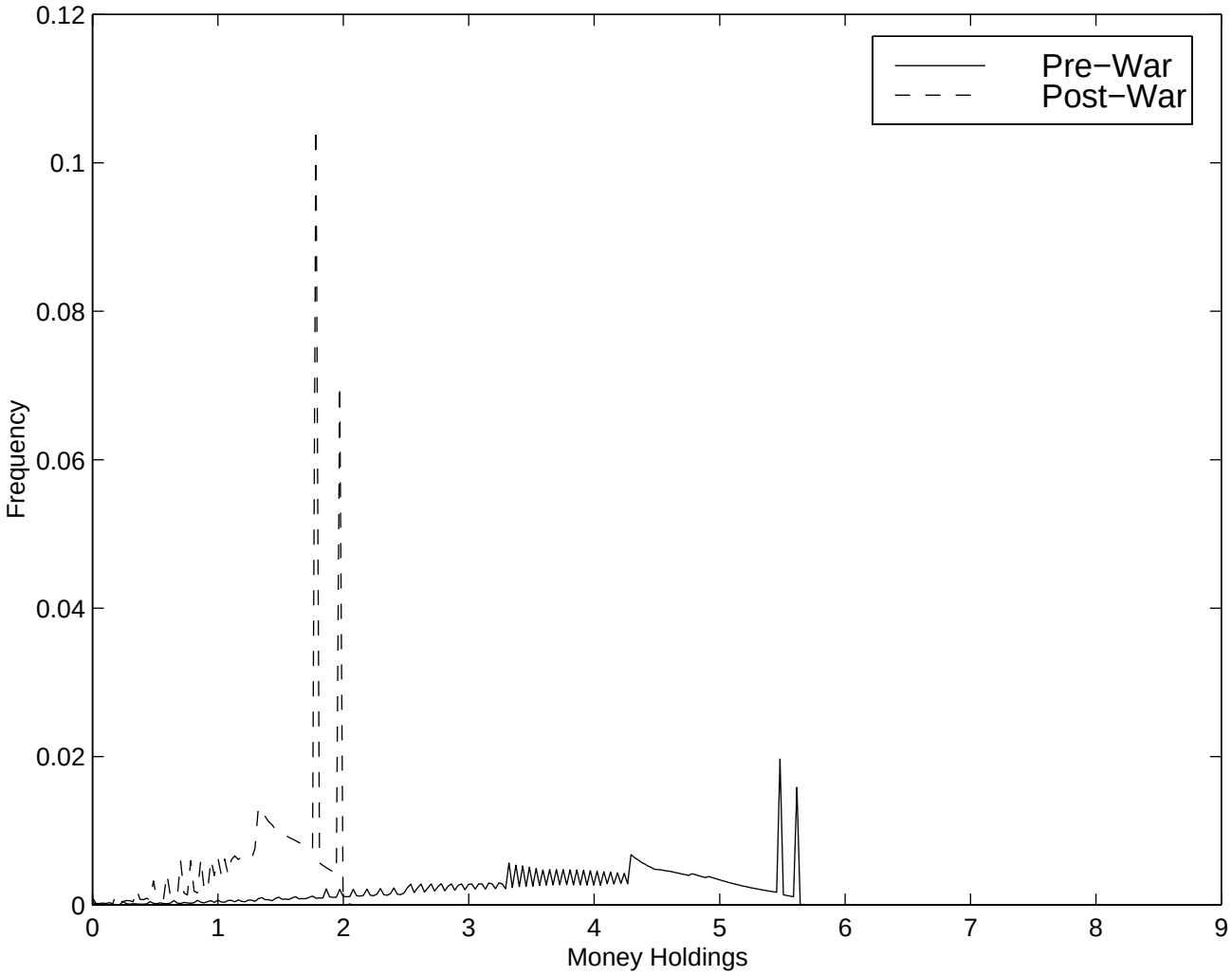

Fig.6: Distributions of Money Holdings of those Unemployed in Good State