

Studies in Nonlinear Dynamics & Econometrics

Volume 11, Issue 1

2007

Article 4

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Abstract

The quasi-geometric (hyperbolic) literature typically assumes that agents are short-run impatient. In this paper, we deviate from this assumption by considering an economy in which a fraction of the population is short-run patient and the remaining population is short-run impatient. In a calibrated version of a neoclassical growth model with uninsurable risk and liquidity constraints, we find that the presence of few short-run patient and many short-run impatient agents leads to empirically plausible degrees of wealth inequality.

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1 Introduction

The quasi-geometric (hyperbolic) discounting literature typically assumes that agents are short-run impatient. In this paper, we deviate from this assumption by considering an economy in which a fraction of the population is short-run patient and the remaining population is short-run impatient. In a calibrated version of a neoclassical growth model with uninsurable risk and liquidity constraints, we find that the presence of few short-run patient and many short-run impatient agents leads to empirically plausible degrees of wealth inequality.

Aiyagari (1994) shows that a one-sector neoclassical growth model with consumers that differ solely on the grounds that they bear idiosyncratic labor-productivity risks, can mimic features of the empirical wealth and income distributions qualitatively but not quantitatively. To be precise, such a model severely overpredicts wealth held by the poor and underpredicts wealth held by the rich (see Aiyagari, 1994, and Quadrini and Ríos-Rull, 1997). Departures from Aiyagari's (1994) setup involve introducing heterogeneity either on the side of production or on the side of consumer's preferences. The former type of heterogeneity is considered in an important work of Quadrini (2000), who stresses the role of heterogeneous technologies and occupational choice in determining the wealth distribution, while the latter type of heterogeneity is advocated in Krusell and Smith (1998), Carroll (2000), and Maliar and Maliar (2006), who emphasize the role of heterogeneity in individual rates of time preferences.

The literature on heterogeneous preferences exploits the following common idea. If the individual rates of time preference differ from the market interest rate, an individual is inclined to save either more or less than the average. Because capital markets deliver one interest rate, different rates of time preference create "savers" (more patient relative to the mean) and "spenders" (less patient relative to the mean). Savers tend to climb to the top of wealth distribution, while spenders remain at the bottom. In Krusell and Smith (1998), rates of time preference are random, so that at each point in time there are savers and spenders, and this creates a high dispersion of savings behavior. In Krusell and Smith's (1998) model, anyone who is a spender today can be a saver tomorrow. In contrast, Carroll (2000) argues that in the data, the poor (the rich) always have a high (a low) Marginal Propensity to Consume (MPC), so that some people are always spenders and other people are always savers. To match this empirical observation, Carroll

(2000) assumes that heterogeneity in rates of time preferences is permanent.

Maliar and Maliar (2006) propose a mechanism for generating heterogeneity in individual rates of time preferences endogenously. The mechanism is based on the recently popular concept of quasi-geometric discounting. Specifically, in the Markovian solution of a quasi-geometric consumer's problem, the effective rate of time preference depends on the agent's accumulated wealth, so that when an agent becomes poorer (richer), she tends to decrease (increase) her savings rate. This brings more dispersion in individual savings rates. However, Maliar and Maliar (2006) find that the baseline model with agents that have ex-ante identical preference primitives is still unable to match the wealth data. Given this negative result, in the present paper, we ask the following question: "how much of Carroll's (2000) type of permanent heterogeneity (but only in the short-run discount factors) should we put in the model in order to match the wealth distribution data quantitatively?"

In a calibrated version of a neoclassical growth model with uninsurable risk and liquidity constraints, we find that short-run impatient and short-run patient agents have very differing consumption-savings behavior. For example, under the baseline parametrization, the MPC of a short-run patient consumer is on average almost 10 times lower than the MPC of a short-run impatient one. Under this result, it is no surprise that our model predicts a sharp polarization of the population: short-run impatient agents get very poor, whereas short-run patient agents get very rich. We find that if the population is composed of few short-run patient and many short-run impatient agents, then the degrees of wealth inequality in our model are comparable to those in the data. Also, our model generates more inequality in income than the standard one-sector growth model does, however, the improvement is not sufficient to account for the income data.

Concerning the empirical relevance of preference heterogeneity assumed in the present paper, findings of empirical literature support the hypothesis about the connection between wealth and patience. In particular, Atkeson and Ogaki (1991) and Becker and Mulligan (1994) observe that consumption growth is more rapid for higher income families; Carroll and Samwick (1997) show that the wealth-accumulation pattern over the life cycle can be well explained by the value of the household's rate of time preferences; Samwick (1998) observes that individual discount rates significantly decline across income groups; etc. The above evidence can be reconciled both within models with heterogeneity in long-run discount factors, like ones studied in Krusell and Smith (1998) and Carroll (2000), and within models with heterogeneity

in short-run patience, like ones studied in Maliar and Maliar (2006) and in the present paper. However, there is also specific evidence indicating that real-world consumers differ in the degrees of their short-run patience. From one side, Laibson (1997) and Laibson, Repetto and Tobacman (1998), provide numerous examples when real-world consumers have a bias toward instantaneous gratification, namely, they tend to postpone unpleasant tasks like quitting smoking or commencing a diet; they finance overconsumption by using high-interest credit cards; they deposit their savings in low-liquidity low-interest accounts like Christmas clubs to regulate savings flows; etc. From the other side, Hall (1998) and Krusell, Kuruşçu and Smith (2002b) argue that too short-run patient agents are also empirically plausible, for example, "workaholics" or investors with a short-run urge to save. Another piece of evidence is provided by Collado, Maliar and Maliar (2003) who use Spanish household data to estimate the Euler equation derived from Harris and Laibson's (2001) model with quasi-geometric (hyperbolic) discounting and who find that the degrees of short-run patience significantly differ across consumers.

The rest of the paper is organized as follows. Section 2 formulates the model. Section 3 describes the methodology of our numerical study and discusses the results, and finally Section 4 concludes.

2 The model

We consider a one-sector neoclassical growth model with ex-ante heterogeneous quasi-geometric consumers. Time is taken in discrete intervals, $t = 0, 1, 2, \dots$. The economy is populated by $H \geq 1$ types of infinitely-lived agents indexed by $h = 1, 2, \dots, H$. Within a type h , there is a continuum of agents with names on a closed interval $[0, \lambda_h]$, where $\sum_{h=1}^H \lambda_h = 1$. The parameter $\lambda_h > 0$ reflects the relative size of type h . Heterogeneity across types is in the dimension of the discounting parameter β_h . In period t , an agent puts the weight 1 on the utility of period t and the weights $\{\beta_h \delta, \beta_h \delta^2, \dots\}$ on the utilities of the subsequent periods $\{t+1, t+2, \dots\}$, where $\beta_h > 0$ and $0 < \delta < 1$. Agents are subject to idiosyncratic labor productivity shocks. The process for shocks is a first-order stationary Markov one; it is identical for all agents and uncorrelated across agents.

On each date t , an agent of type h solves the following problem

$$\max_{\{c_{h,\tau}, a_{h,\tau+1}\}_{\tau=t}^{\infty}} \left\{ u(c_{h,t}) + E_t \sum_{\tau=t}^{\infty} \beta_h \delta^{\tau+1-t} u(c_{h,\tau+1}) \right\} \quad (2.1)$$

subject to

$$c_{h,\tau} + a_{h,\tau+1} = w s_{h,\tau} + (1+r) a_{h,\tau}, \quad (2.2)$$

$$a_{h,\tau+1} \geq -b, \quad (2.3)$$

$a_{h,\tau} \in \mathcal{A}$ and $s_{h,\tau} \in \mathcal{S}$ are given, where $\mathcal{A} = [-b, \infty) \subset R$ and $\mathcal{S} = [s_{\min}, s_{\max}] \subset R_+$. Here, E_t denotes the expectation, conditional on all information available at t ; $c_{h,\tau}$, $a_{h,\tau}$ and $s_{h,\tau}$ are consumption, asset holdings and idiosyncratic shock to labor productivity, respectively; r is the interest rate and w is the wage per unit of efficiency labor; b is the borrowing limit. The momentary utility function $u(c)$ is continuously differentiable, strictly increasing, strictly concave and satisfies $\lim_{c \rightarrow 0} u'(c) = \infty$.

The assumption of $\beta_h \neq 1$ generates time-inconsistent choices. If $\beta_h < 1$, the short-run discount factor (the one between the periods t and $t+1$), $\beta_h \delta$, is smaller than the long-run discount factor (the one between any two adjacent periods further in the future), δ . As a result, an agent systematically under-saves relative to what she would have committed to in the past if commitment had been available. If $\beta_h > 1$, then the opposite is true: an agent saves more than she would have committed to in the past. We refer to a consumer whose short-run discount factor is lower (higher) than the long-run discount factor as a short-run impatient (short-run patient) one. If $\beta_h = 1$, then the agent is standard geometric and her preferences are time-consistent: a choice perceived to be optimal in the past remains to be optimal in all subsequent periods.

Output is produced according to a Cobb-Douglas production function, $K_t^\alpha N_t^{1-\alpha}$, with $\alpha \in [0, 1]$, where K_t and N_t are the aggregate capital and labor inputs, respectively. The depreciation rate of capital is $d \in (0, 1]$. Therefore, the production technology is given by $K_t^\alpha N_t^{1-\alpha} + (1-d) K_t$.

Equilibrium We restrict our attention to a first-order stationary recursive (Markov) equilibrium. Also, we assume that the solution to the individual problem (2.1) – (2.3) is interior. If such a solution exists, the optimal choice

of an agent of type h must satisfy the quasi-geometric Euler equation

$$u'(c_{h,t}) \geq \delta E \left\{ u'(c_{h,t+1}) \left[1 + r - (1 - \beta_h) \cdot \frac{\partial C_h(a_{h,t+1}, s_{h,t+1})}{\partial a_{h,t+1}} \right] \right\}, \quad (2.4)$$

where u' is a derivative of u and $C_h(a_{h,t+1}, s_{h,t+1})$ is the optimal consumption function, see Maliar and Maliar (2006) for the derivation of (2.4). If the borrowing constraint is not binding, i.e., $a_{h,t+1} > -b$, then (2.4) holds with equality.

Let $P_h(a_h, s_h, B)$ be the conditional probability that an agent of type h with state (a_h, s_h) will have a state lying in set $B \in \mathcal{B}$ in the next period

$$P_h(a_h, s_h, B) = \text{Prob}(\{s'_h \in \mathcal{S} : [A_h(a_h, s_h), s_h] \in B\} \mid s_h),$$

where \mathcal{B} denotes the Borel subset of the set of all possible individual states $\mathcal{A} \times \mathcal{S}$, and $A_h(a_h, s_h) \equiv ws_h + (1 + r)a_h - C_h(a_h, s_h)$ is the decision function for assets (the asset function).

Given that there is a continuum of agents of each type h and that the individual processes for labor productivity shocks are stationary, we have that $N_t = \sum_{h=1}^H \lambda_h \int_{\mathcal{A} \times \mathcal{S}} s_{h,t} dx_h$ is constant; for convenience, we normalize it to unity, $N_t = 1$ for all t .

Definition. An equilibrium is defined as a set of stationary probability measures $\{x_h\}_{h \in H}$, a set of optimal consumption functions $\{C_h(a_h, s_h)\}_{h \in H}$ and four positive real numbers (K, N, r, w) such that

- (1) $x_h = \int_{\mathcal{A} \times \mathcal{S}} P_h(a_h, s_h, B) dx_h$ for all $B \in \mathcal{B}$ and $h \in H$;
- (2) $C_h(a_h, s_h)$ solves (2.2), (2.3), (2.4) for all $h \in H$;
- (3) $K = \sum_{h=1}^H \lambda_h \int_{\mathcal{A} \times \mathcal{S}} A_h(a_h, s_h) dx_h$ and $N = 1$;
- (4) r and w are equal to the corresponding marginal products

$$r = \alpha K^{\alpha-1} - d, \quad w = (1 - \alpha) K^\alpha.$$

Thus, in the economy studied, the aggregate quantities and prices are constant even though the individual quantities vary stochastically.

3 Numerical analysis

In this section, we study the implications of the model by simulation. First, we describe the methodology of our numerical analysis and then, we present the results.

3.1 Methodology

We calibrate most of the parameters as in Aiyagari (1994). The model's period is one year. We assume $\delta = 0.96$, $\alpha = 0.36$ and $d = 0.08$. We set the borrowing limit at $b = 0$. The momentary utility function is of a Constant Relative Risk Aversion (CRRA) type

$$u(c) = \frac{c^{1-\gamma} - 1}{1-\gamma}, \quad (3.1)$$

where γ is the coefficient of relative risk aversion. In the baseline case, we set $\gamma = 1$, which leads to a logarithmic utility function, $u(c) = \log(c)$. The process for idiosyncratic shocks of all types is $AR(1)$,

$$\log s_{h,t+1} = \rho \log s_{h,t} + \sigma (1 - \rho^2)^{1/2} \varepsilon_{h,t+1}, \quad \varepsilon_{h,t+1} \sim N(0, 1), \quad (3.2)$$

where $\rho \in [0, 1]$ is the autocorrelation coefficient, and $\sigma \geq 0$ is the unconditional standard deviation of the variable $\log s_{h,t}$. Our baseline parameterization is $\rho = 0.6$ and $\sigma = 0.2$. We also study the case $\rho = 0.9$ and $\sigma = 0.4$.

Regarding the discounting parameter β_h , we consider several alternatives. The Benchmark Model (BM) is the one studied in Aiyagari (1994): all consumers have identical time-consistent preferences, $H = 1$ and $\beta_1 = 1$. We then consider two one-type agents economies with time inconsistent preferences: one, populated by short-run patient consumers, $H = 1$ and $\beta_1 = 1.2$, and another, populated by short-run impatient consumers, $H = 1$ and $\beta_1 = 0.8$. We finally analyze the economies populated by two types of consumers, $H = 2$, such that $\beta_1 = 0.8$ and $\beta_2 = 1.2$.¹ The shares of the first and second types are λ and $1 - \lambda$, respectively; we consider $\lambda \in \{0.25, 0.5, 0.75\}$.

In this paper, we solve the model by a parameterized expectations algorithm implemented on a grid of prespecified points. The description of the algorithm is provided in Maliar and Maliar (2006). Maliar and Maliar (2005) study the convergence properties of this algorithm in the context of the one-agent neoclassical growth model with quasi-geometric discounting and show that it yields the same solutions as those obtained by the perturbation method proposed by Krusell, Kuruşçu, and Smith, (2002a).

¹Laibson, Repetto and Tobacman (1998) argue that empirically plausible value of β_h for the short-run impatient consumers will be around 0.6. Given this estimate, the assumed difference in short-run patience between the two types seems to be reasonable.

3.2 Results

Before presenting the results, we shall discuss how the degree of the agent's short-run patience affects her consumption-savings decisions. As can be seen from the Euler equation (2.4), the future rate of return on assets from the perspectives of an agent of type h is

$$R_h(a_{h,t+1}, s_{h,t+1}) \equiv r - (1 - \beta_h) \cdot \frac{\partial C(a_{h,t+1}, s_{h,t+1})}{\partial a_{h,t+1}}. \quad (3.3)$$

Under our assumptions, the Marginal Propensity to Consume (MPC) out of assets is strictly positive, $\frac{\partial C(a_{h,t+1}, s_{h,t+1})}{\partial a_{h,t+1}} > 0$ for all $a_{h,t+1}, s_{h,t+1}$, see Lemma 1 in Maliar and Maliar (2006). Thus, if $\beta_h > 1$ ($\beta_h < 1$), the individual subjective rate of return on assets, $R_h(a_{h,t+1}, s_{h,t+1})$, is higher (lower) than the actual one, r , which induces the agent to save more (less) relative to the case $\beta_h = 1$. Moreover, if the consumption function is strictly concave, which was the case in our simulations, then $R_h(a_{h,t+1}, s_{h,t+1})$ is strictly decreasing (increasing) in the level of wealth under $\beta_h > 1$ ($\beta_h < 1$). This implies that if $\beta_h > 1$ ($\beta_h < 1$), the rich have a lower (higher) savings rate than the poor.

We now describe the quantitative expression of the effects associated with quasi-geometric discounting. We start by analyzing the economy populated by one type of agents ($H = 1$). In *Figure 1*, we plot the stationary probability distributions of shocks and assets for three parameterizations: $\beta_1 = 0.8$ ($\lambda = 1$), $\beta_1 = 1.0$ (BM) and $\beta_1 = 1.2$ ($\lambda = 0$). We assume $\rho = 0.6$ and $\sigma = 0.2$. As we can see, a larger value of β_1 leads to a larger amount of average asset holdings and to a lower fraction of liquidity-constrained people.

In *Table 1*, we provide the Gini coefficient of the wealth distribution and the percentages of wealth held by different groups of the population in the artificial and the U. S. economies. The main thing to notice here is that with one type of agents, the wealth is much more equally distributed in the model than in the data. A lower degree of quasi-geometric discounting, β_1 , leads to a higher dispersion of wealth across agents. Thus, the assumption of short-run patient agents, $\beta_1 > 1$, only worsens the model's predictions about wealth inequality in comparison to those under the equal short- and long-run patience, $\beta_1 = 1$. Specifically, under $\beta_1 > 1$, the fraction of wealth held by the bottom 40% of the population is 22.8% and that held by the top 1% of the population is 2.3% (i.e., increases by 34% and declines by 26%, respectively, compared to the case $\beta = 1.0$); the Gini coefficient goes down

to 0.23 (i.e., declines by 30%). Overall, if there is only one type of agents, the effect of short-run patience on the wealth distribution is modest.

We now turn to the economy with two types of agents, $H = 2$. In *Figure 1*, we plot the stationary probability distributions of shocks and assets for the economies with $\lambda = 0.25$, $\lambda = 0.5$ and $\lambda = 0.75$ (we again assume $\rho = 0.6$ and $\sigma = 0.2$). As we can see, the probability distribution is two-peaked. Agents who are short-run patient ($\beta_2 = 1.2$) are distributed around the high-mean peak whereas those who are short-run impatient ($\beta_1 = 0.8$) are concentrated tightly around zero. Thus, most of the short-run impatient agents are liquidity-constrained.

The results in *Table 1* demonstrate that the introduction of two types of agents can substantially increase the wealth inequality in the model. The noteworthy case is one where the economy is composed of many short-run impatient and few short-run patient agents ($\lambda = 0.75$).² Compare, for example, this economy with the one populated by short-run impatient agents only ($\lambda = 1$) under $\rho = 0.6$ and $\sigma = 0.2$. After incorporating 25% of the short-run patient population, the percentages of wealth held by the richest 99 – 100% and 95 – 99% of the population increase from 3.5 to 7.1 and from 10.4 to 22.4, respectively; the percentage of wealth held by the bottom 40% reduces from 12 to 0; the Gini coefficient rises from 0.39 to 0.78. As we see, all the statistics get closer to their empirical counterparts except of the percentage of wealth held by 90 – 95% of the population, which is now too high relative to the data.³ Also, the model still considerably underpredicts the wealth held by the richest 1% of the population.⁴

A significant increase in wealth inequality occurs because the assumed two types of agents have very different consumption-savings behavior. To illustrate this fact, in *Table 1*, we provide the mean and the standard deviation (in brackets) of the MPC out of assets. In the economies with two types, the average MPC of the short-run impatient consumers (MPC_1) is almost

²In fact, the assumption that there are few short-run patient and many short-run impatient agents is consistent with an empirical observation discussed in Krusell et al. (2002b) that in actual economies, there are few investors who have a short-run urge to save and many non-investors who have a short-run urge to consume.

³This drawback is related to the fact that the wealth distribution has two peaks. Including more than two types in the model will help to generate a more realistic shape of the wealth distribution.

⁴This drawback of the model is not surprising. The very top-wealth group in the U.S. economy includes CEOs and superstars in sports and Hollywood, and our model is obviously too simple to account for this source of wealth inequality.

10 times higher than that of the short-run patient consumers (MPC_2). The consequence is that consumers of the first type are poor, whereas those of the second type are rich.⁵

Do we observe so large differences between MPC s of rich and poor agents in the data? McCarthy (1995) splits households in the Panel Study of Income Dynamics (PSID) sample according to their wealth and examines whether households with low and high wealth differ in their MPC s out of individual income shocks. He reports that when the PSID sample is split into low-wealth and high-wealth groups, the MPC s of the two groups are equal to 1.1349 and 0.0657, respectively (see the instrumental-variable regression in their Table 2a). Further, when the PSID sample is split into three groups, namely, low-liquid low-total wealth, low-liquid high-total wealth and high-liquid high-total wealth, the MPC s of the three group considered are equal to 0.9160, 1.033 and 0.0627, respectively (see the instrumental-variable regression in their Table 4a). In sum, the difference between MPC s of rich and poor U.S. households is very large and is comparable to that predicted by our model.

We next discuss a non-monotonic relation between λ and the degrees of wealth inequality observed in our model. To understand this relation, we shall analyze a connection between an individual's effective discount rate and the equilibrium interest rate. In a two-type economy, $0 < \lambda < 1$, the interest rate is determined mostly by the discount rate of the short-run patient agents. The gap between the equilibrium interest rate and the effective discount rate of the short-run impatient agents is therefore large enough that such agents choose not to accumulate much wealth. Consequently, the MPC s of the short-run impatient agents are much larger than those of the short-run patient agents. If, instead, all agents become short-run impatient, $\lambda = 1$, or all agents become short-run patient, $\lambda = 0$, then the gap between the individual effective discount rates and the interest rate becomes small as the interest rate adjusts in equilibrium to clear asset markets.⁶

We next focus on income inequality. *Table 2* summarizes the statistics on the income distribution in the artificial and the U. S. economies. The tenden-

⁵Hence, the mechanism that produces a large dispersion of wealth in our model is similar to one advocated by Krusell and Smith (1998) and Carroll (2000). In particular, Carroll (2000) argues: "the crucial requirement for many purposes is likely to be simply that the model have multiple classes of households, some with little wealth and a high MPC and some with substantial wealth and a low MPC ...".

⁶A similar phenomenon occurs in the model by Krusell and Smith (1995) where agents are heterogeneous in the (long-run) discount factors.

cies here are parallel to those established for the distribution of wealth. In a one-type economy, variations in the degree of the agents' short-run patience do not significantly affect the size of income inequality. The introduction of two types makes the income distribution more unequal as a higher wealth inequality leads to a higher dispersion of capital income. The increase in income inequality is modest, however.

We assess the robustness of our results to variations in the parameters ρ and σ . As an example, in *Tables 1 and 2*, we report the model's predictions under $\rho = 0.9$ and $\sigma = 0.4$. As we see, the difference between the MPCs of the short-run impatient and short-run patient agents is now lower than that in the baseline case $\rho = 0.6$ and $\sigma = 0.2$. The MPCs of the short-run impatient agents reduce because higher idiosyncratic uncertainty increases their precautionary savings. A precautionary motive for savings is practically missing for the short-run patient agents who are rich enough not to face the liquidity constraint. The MPCs of such agents increase because the interest rate goes down in response to higher precautionary savings of the short-run impatient population. Although the differences between the MPCs of types get smaller relative to the baseline case, the resulting degrees of wealth inequality are of roughly the same magnitude. Regarding the income distribution, we observe that higher labor income uncertainty leads to a higher dispersion of income across agents. As in the baseline case, introducing two types of agents makes the income distribution even more unequal. Still, the model's predictions on income inequality are far from the data. We finally check the sensitivity of our results to variations in the coefficient of risk aversion γ . We find that under $\gamma \in [0.5, 3]$, the degrees of wealth and income inequality are similar to those under our baseline parameterization $\gamma = 1$ (these results are not reported). In sum, the tendencies described in this section proved to be robust to all modifications considered.

4 Conclusion

This paper investigates the quantitative implications of a general equilibrium model with two types of quasi-geometric consumers, one is short-run impatient and the other is short-run patient. We find that a modest difference between the types' short-run discount factors can lead to very differing consumption-savings behavior: in the baseline case, the average MPCs of the types differ by almost the factor of 10! We show that the two-type model is

capable of generating the degrees of wealth inequality which are much larger than those predicted by the standard one-sector growth model and which are comparable to those observed in the data. The feature of the model that is crucial for our results is that there are both short-run impatient and short-run patient agents in the economy. Indeed, a similar two-type setup in Maliar and Maliar (2006), where one type is short-run impatient and the other type is standard geometric, does not produce sufficiently differing MPCs between the two types and consequently, does not generate degrees of wealth inequality comparable to the data.

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Table 1. Selected statistics of the wealth distribution in the U.S. and artificial economies.

Model		MPC ¹	MPC ²	r, %	Gini	0-40%	80-100%	90-95%	95-99%	99-100%
$\rho=0.6$	BM	.0523 (.0192)	-	3.98	0.32	17.12	38.08	9.4	9.4	3.1
$\sigma=0.2$	$\lambda=0$	.0493 (.0080)	-	3.09	0.23	22.8	31.2	8.1	7.5	2.3
	$\lambda=1$	.0576 (.0368)	-	5.05	0.38	12.2	40.4	10.4	10.3	3.4
	$\lambda=.25$	.3695 (.1561)	.0450 (.0066)	3.20	0.42	8.9	39.6	10.1	9.4	2.9
	$\lambda=.50$	.3563 (.1567)	.0402 (.0040)	3.31	0.60	0.2	53.3	13.7	13.1	4.1
	$\lambda=.75$	.3436 (.1573)	.0362 (.0027)	3.42	0.78	0	86.5	22.7	22.4	7.1
$\rho=0.9$	BM	.0716 (.0344)	-	3.3	0.44	10.5	46.3	11.70	11.96	4.1
$\sigma=0.4$	$\lambda=0$	.0621 (.0223)	-	2.38	0.41	13.3	43.2	11.0	11.0	3.6
	$\lambda=1$	.0820 (.0576)	-	4.40	0.46	9.8	46.8	12.1	12.6	4.3
	$\lambda=.25$	.2689 (.1456)	.0556 (.0175)	2.59	0.51	6.4	50.1	12.7	12.8	4.3
	$\lambda=.50$	.2337 (.1376)	.0486 (.0132)	2.85	0.62	1.5	60.7	15.4	15.8	5.4
	$\lambda=.75$	.2137 (.1305)	.0444 (.0127)	3.01	0.73	0.8	77.8	21.0	23.5	8.3
U.S. ^(a)					0.76	2.2	77.1	12.6	23.1	28.2

^(a)Source: Quadrini and Rios-Rull (1997)

Table 2. Selected statistics of the income distribution in the U.S. and artificial economies.

Model		Gini	0-40%	80-100%	90-95%	95-99%	99-100%
$\rho=0.6$	BM	0.12	31.6	26.5	6.6	5.9	1.7
	$\sigma=0.2$						
	$\lambda=0$	0.12	32.2	26.2	6.5	5.8	1.7
	$\lambda=1$	0.13	31.2	27.0	6.7	6.0	1.8
	$\lambda=.25$	0.13	31.5	26.7	6.6	5.8	1.7
	$\lambda=.50$	0.14	30.2	27.5	7.0	6.1	1.8
	$\lambda=.75$	0.18	25.2	30.7	7.8	7.1	2.1
$\rho=0.9$	BM	0.23	24.8	33.5	8.4	8.1	2.3
	$\sigma=0.4$						
	$\lambda=0$	0.23	25.1	33.2	8.3	8.0	2.3
	$\lambda=1$	0.23	24.8	33.4	8.4	8.1	2.4
	$\lambda=.25$	0.23	25.1	33.1	8.4	8.1	2.3
	$\lambda=.50$	0.23	24.6	33.5	8.5	8.1	2.4
	$\lambda=.75$	0.27	22.9	35.6	9.2	8.7	2.9
U.S. ^(a)		0.51	10.3	53.6	10.7	13.5	14.1

^(a)Source: Quadrini and Ríos-Rull (1997).

Figure 1. The stationary distribution with one type of agents: $\beta^1=0.8$, $\beta^1=1.0$ and $\beta^1=1.2$, respectively.

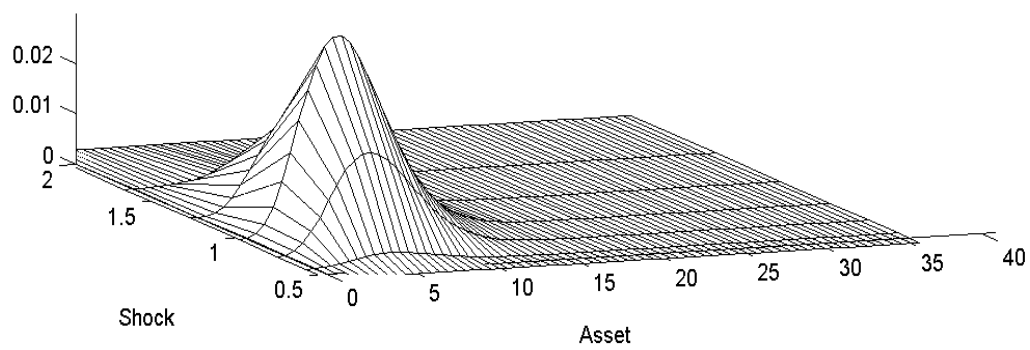
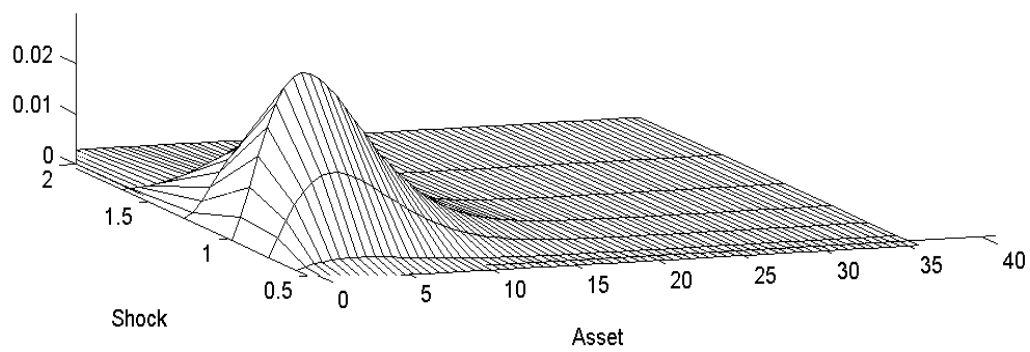
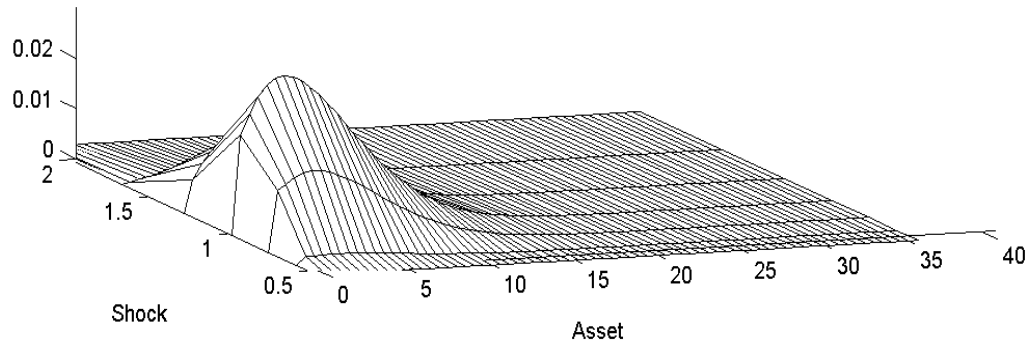


Figure 2. The stationary distribution with two types of agents: $\lambda=0.25$, $\lambda=0.50$ and $\lambda=0.75$, respectively.

