Taxation, transfer income and stock market participation

Current draft: January 14, 2011

Abstract

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This article studies the impact of taxing investment returns to finance wealth transfers from richer to poorer investors in a general equilibrium model with heterogeneous agents. Since the level of tax revenues depends on the evolution of the stock market, the level of the wealth transfer also depends on the evolution of the stock market. As a consequence, recipients of transfer income are subject to stock market risk through the transfer mechanism. As a consequence, it can be optimal for them not to further engage in the stock market. In particular, transfer income can thereby help understanding the low empirically documented stock market participation rates of poorer investors.

JEL Classification Codes: G11, E21, H24
Key Words: portfolio choice, taxation, heterogeneous agents, stock market participation

1 Introduction

According to the 2007 Survey of Consumer Finances (SCF), only 51.1% of U.S. families have stock holdings in direct or indirect form, even though theoretical research concludes that households should usually hold stocks to earn the equity premium and to diversify risks. The same fraction when only direct stock holdings is accounted for is 17.9%. At the same time, 91.0% of the 10% of households with the highest income have stock holdings in direct or indirect form, whereas stock market participation drops to only 13.6% for the 20% of households with the lowest income. The same numbers for direct stock holdings show a drop from 47.5% to 5.5%.

In this paper we demonstrate that public wealth transfers from richer to poorer agents can be part of the explanation for the low empirically observed stock market participation rates of the latter group. We formulate a stylized general equilibrium model with heterogeneous agents in which transfer payments from richer to poorer agents are financed by taxing returns on financial investments. The tax system together with the government budget constraint establishes a relation between the evolution of the stock market and the level of transfer payments. In particular, transfer income is subject to stock market risk which might already meet poorer agents' risk-appetite; this may even happen to such an extent that it would be optimal for them to short stocks. Given that households usually are constrained from short-selling stocks or can only do so at substantial costs, it might be optimal for such households not to engage in the stock market.

It has long been observed empirically that stock market participation historically has been far from universal (Blume and Friend (1974), Mankiw and Zeldes (1991), King and Leape (1998)). Although participation varies greatly across countries and has increased recently (Guiso et al. (2003), Giannetti and Yrjö (2005)), the overall impression is that participation is still low (Campbell (2006)). Empirical research documents that participation is increasing with wealth, age and education (Mankiw and Zeldes (1991), Haliassos and Bertaut (1995), Bertaut (1998), Guiso et al. (2003), Shum and Fair (2006), Christelis et al. (2011)).

There are two larger strands of literature that tries to explain the empirically observed low stock market participation:

- Behavioral approaches, which include loss aversion (Ang et al. (2005), Dimmock (2005)), ambiguity aversion (Knox (2003)), lack of trust in financial markets (Guiso et al. (2008)), low experienced stock returns (Bilias et al. (2010), Malmendier and Nagel (2011)), and narrow framing (Barberis et al. (2006))
- Approaches considering market frictions, which include stock market entry costs (Abel (2001), Gomes and Michaelides (2005, 2008), Campanale (2009)), differences between risk-free return and borrowing rate (Davis et al. (2005)), lack of insurance (Gormley et al. (2010)) transaction costs and liquidity needs (Allen and Gale (1994), Williamson (1994)) lacking diversification of labor income risk and its correlation to stock returns (Haliassos and Bertaut (1995), Mankiw and Zeldes (1991), Vissing-Jørgensen (2002), Guo (2004)), and liquidity constraints (Haliassos and Michaelides (2003))

In addition, there are several other attempts to explain the stock market participation puzzle. These approaches include model uncertainty (Dow and Werlang (1992), Epstein and Schneider (2007)), intelligence (Christelis et al. (2010), Grinblatt et al. (2010)), financial literacy (van Rooij et al. (2007)), social factors like neighborhood (Brown et al. (2008), Hong et al. (2004)), the crowding out effect of housing investment and of annuities on stock investments (Yao and

Zhang (2005), Horneff et al. (2009), Horneff et al. (2010)), background risk correlated with the stock market (Heaton and Lucas (2000), Benzoni et al. (2007) Cardak and Wilkind (2009)), changes in correlation of equity, income and consumption over the life cycle (Constantinides et al. (2002)), marital status and children (Love (2010)), health status (Rosen and Wu (2004)), internet access (Bogan (2008)) and political preferences (Kaustia and Torstila (2007)).

We contribute to this literature by showing that the redistribution of wealth through taxation and transfer income adds to these effects in explaining the low empirically observed stock market participation rates of poorer investors. This is to the best of our knowledge the first analysis in this direction. We deliberately keep the modeling framework at an analytically simple level in order to avoid being preoccupied with numerical issues of solving very demanding utility optimization problems. However, the key mechanism readily generalizes to more complicated settings.

The paper proceeds as follows. Section 2 introduces our model. In section 3, we present numerical results; section 4 concludes.

2 The model

2.1 Heterogeneous agents

Throughout the following we allow for heterogeneity among agents. More specifically, we limit the model to two agents, A and B, with CRRA preferences, who may differ along two dimensions. First, the two agents may have different degrees of risk aversion, γ_A and γ_B, respectively. Second, they may initially be endowed with different levels of wealth. In particular, through most of our note we assume that agent A is the relatively poor agent and thereby the net recipient of transfer income. Because of well known aggregation properties for CRRA utility functions,[1] this setup is similar to having a model with two groups of investors, both of which are homogeneous in terms of their utility function. Allowing for heterogeneity in investors' preferences will turn out to be an important factor in explaining stock market participation.

2.2 Investment opportunity set

We consider a market on which two assets can be traded. First, agents can trade a (locally) risk-free asset paying a pre-tax return of r_t from time $t-1$ to t. This asset comes in zero net supply. That is, if agent A, e.g., wants to hold a positive fraction of his wealth in the risk-free asset, the market equilibrium has to bring about an interest rate r that makes agent B willing to issue such a risk-free asset. Secondly, agents can trade a risky stock that represents the ownership to aggregate consumption. Risk is modeled by assuming that aggregate consumption is the fruit/dividend D from a binomial Lucas tree (Lucas (1978)). The dividend growth from time $t-1$ to t is either "high" or "low" and the probability for the two outcomes is assumed to be $1/2$ each. The risky stock comes in net supply normalized to one unit. The initial endowments of the two agents are denoted by $\alpha_A(0-)>0$ and $\alpha_B(0-)>0$, respectively, and $\alpha_B(0-)=1-\alpha_A(0-)$. Throughout most of this note we assume that agent A is the relatively poor agent, i.e. that $\alpha_A(0-)<\alpha_B(0-)$; hence, agent A will also be the net recipient of transfers. Investment returns are subject to taxation at rate $\tau \in [0,1)$.

[1]Classical references are, e.g., Brennan and Kraus (1978), Merton (1971) and Rubinstein (1974).

2.3 Transfer payments

By taxing investment returns, the tax system collects a tax revenue of

$$\tau\,(P_t + D_t - P_{t-1}) \quad t = 1, 2 \tag{1}$$

at time t where P_t is the price of the risky stock at time t and D_t is its dividend payment at time t. Since the net supply of the risky stock is one and the net supply of the risk-free asset is zero, the tax revenue only depends on the evolution of the price and the dividend of the risky stock.

We assume that the government redistributes the tax revenue among the two agents. We require that the redistribution mechanism fulfills two conditions. First, it has to fully distribute the collected tax revenues, i.e. the government neither builds up wealth nor debt. This is the government budget constraint in this paper. Secondly, the redistribution of tax revenues must increase the relatively poor agent's wealth level and decrease the relatively rich agent's wealth level; but the relatively rich (poor) agent must remain the relatively rich (poor) agent after taking transfers into account. A simple mechanism that fulfills these two conditions is to redistribute the total tax revenue equally among the two agents. We will therefore use this transfer mechanism throughout the remainder of the paper.

2.4 The optimization problem

We assume that both agents maximize expected present discounted utility. In order to study dynamic effects, we allow for multiple periods and assume that the investment horizon of our agents is two periods, such that they dynamically have to make consumption and investment decisions at time $t = 0$ and $t = 1$ and consume their remaining wealth at time $t = 2$. If

- ρ denotes the agents' utility discount factor
- $\alpha_A(t)$ denotes the number of units of the risky stock held by agent A from time t to $t+1$
- $\beta_A(t)$ is the number of units of the risk-free asset held by investor A from time t to $t+1$
- the superscripts $+$ and $-$ indicate the states with "high" and "low" dividend payments from the risky stock at time $t = 1$

agent A's optimization problem can be stated as follows:[2]

$$\max_{\{\alpha_A(0),\beta_A(0),\alpha_A^+(1),\alpha_A^-(1),\beta_A^+(1),\beta_A^-(1)\}} \frac{C_{0A}^{1-\gamma_A}}{1-\gamma_A} + \rho\mathbb{E}_0\left[\frac{C_{1A}^{1-\gamma_A}}{1-\gamma_A}\right] + \rho^2\mathbb{E}_0\left[\frac{W_{2A}^{1-\gamma_A}}{1-\gamma_A}\right] \tag{2}$$

s.t.

$$C_{tA} = W_{tA} - \alpha_A(t)P_t - \beta_A(t) \qquad t = 0, 1 \tag{3}$$

$$W_{tA} = [\alpha_A(t-1)(P_t + D_t) + \beta_A(t-1)R_{t-1}] - \tag{4}$$

$$\left[\alpha_A(t-1)(P_t + D_t - P_{t-1}) + \beta_A(t-1)r_{t-1}\frac{\tau}{2}\right] +$$

$$\left[(1-\alpha_A(t-1))(P_t + D_t - P_{t-1}) - \beta_A(t-1)r_{t-1}\frac{\tau}{2}\right] \qquad t = 1, 2 \tag{5}$$

$$W_{0A} = (P_0 + D_0)\,\alpha_A(0-) \tag{6}$$

where

- C_{tA} is agent A's consumption at time t
- r_t ($R_t = 1 + r_t$) is the net (gross) risk-free rate from time t to $t+1$
- W_{tA} is agent A's wealth level at time t

Equations (3) and (5) are equalities between random variables reflecting the binomial filtration. Equation (5) shows that agent A's wealth level at time t consists of three terms. The first term describes the wealth level agent A would have attained in the absence of taxes. The second term defines the net tax payment of agent A. The third term shows the transfer income the agent receives due to tax payments by agent B. The impact of the public reallocation on agent A's wealth level can best be seen by rewriting Equation (5):

$$W_{tA} = \alpha_A(t-1)\left[(P_t + D_t) - (P_t + D_t - P_{t-1})\,\tau\right] + \beta_A(t-1)\cdot R_{t-1}^{a.t.} + (P_t + D_t - P_{t-1})\,\frac{\tau}{2} \tag{7}$$

where $R_t^{a.t.} = 1 + r_t\,(1-\tau)$ is the gross after-tax return on the risk-free asset from time t to $t+1$.

Equation (7) consists of three terms. The first two shows the total final after-tax wealth level the agent would have attained if the government did not redistribute tax revenues. The last term describes the impact of the distribution of the tax revenues on his wealth level. In particular, the wealth transfer mechanism implies that each agent's evolution of wealth depends on the return on the risky stock even if the agent does not invest in the risky stock, i.e. if $\alpha_A(t) = 0$. In section 3 we demonstrate that this imputed stock market risk can cause poorer agents optimally not to engage in the stock market to avoid being overexposed to stock market risk.

As a necessary condition for an extremum, the first-order partial derivatives of the objective function (2) with respect to the choice variables have to be equal to zero, which provides 6 optimality conditions for agent A and another 6 optimality conditions for agent B. This system

[2]The optimization problem for agent B is structurally the same. We therefore restrict ourselves to present only agent A's optimization problem here.

of 12 equations has 12 unknowns: The 3 risk-free rates r_0, r_1^+, r_1^-, the prices of the risky stock P_0, P_1^+, P_1^- and the decision variables $\alpha_A(0)$, $\beta_A(0)$, $\alpha_A^+(1)$, $\alpha_A^-(1)$, $\beta_A^+(1)$ and $\beta_A^-(1)$. The optimal values of the decision variables for agent B are determined by the value of the decision variables for agent A and the fact that the risky asset is in unit net supply and the risk-free asset is in zero net supply. Due to the lack of a closed-form solution, we solve numerically for these 12 unknowns.

2.5 Base case parameter choice

In this section, we specify our choice of base case parameters. We set the tax rate to $\tau = 35\%$ in line with the marginal tax rate for a U.S. household falling into the highest tax bracket. $\alpha_A(0-)$ is set to 0.25, indicating that agent A initially has a claim on 25% on aggregate consumption in the economy whereas agent B is endowed with a claim on $\alpha_B(0-) = 1 - \alpha_A(0-) = 75\%$ of aggregate consumption. That is, agent A is assumed to be the relatively poor agent and agent B the relatively rich agent. We study other values for this initial distribution of wealth among the two agents in section 3.1. Guiso and Paiella (2008) document that risky aversion decreases in an agent's endowment. We therefore assume agent A to be the relatively most risk averse and set the degrees of risk aversion to $\gamma_A = 5$ and $\gamma_B = 3$, which are in the range of values considered reasonable by Mehra and Prescott (1985) and in line with common choices in the portfolio choice literature. The subjective utility discount factor ρ is set to $\rho = 0.98$. The evolution of the price of the risky asset as well as the risk-free rate are determined endogenously. The initial dividend from the Lucas tree at time $t = 0$ is normalized to 1 and comes with an expected growth of 4.01% and a standard deviation of 12.24% as estimated by Lettau and Ludvigson (2005). In particular, this parameter choice makes sure that the tax revenue collected is always positive, thereby implying a positive transfer of wealth from the relatively rich to the relatively poor agent.

3 Numerical results

Having introduced our model, we next turn to a numerical demonstration of how taxes and transfer income affect our agents' desire to engage in the stock market. The heterogeneity of the agents is one of the driving forces, but the redistribution mechanism also plays a significant role. With homogeneous agents with CRRA utility functions there will be no effect on the prices of the risky asset and there will be no holding of risk-free assets by anyone in a scenario with no taxation and redistribution; but with taxation and redistribution this is no longer true. The redistribution mechanism implies not only a transfer of wealth, but also a transfer of stock market risk. As can be seen from Equation (7), this implies that the poorer agent A will be endowed with stock market risk even if he does not invest in the stock market. That is, even when agents A and B are subject to the same level of risk aversion, the poorer agent would invest less in the stock market due to the imputed stock market risk.

Table 1 summarizes the equity premium, the risk-free rate r, the number α_A of units of the risky asset held by agent A and his optimal consumption C_A at time $t = 0$ and $t = 1$ in the state with high and low dividend payment.

Please insert Table 1 about here

In our base case parameter setting, the agent optimally holds -0.016 units of the risky asset from time $t = 0$ to $t = 1$, even though his initial holding in that asset is $\alpha_A(0-) = 0.25$ units. This remarkable decrease in his exposure to the risky asset can be attributed to two sources. First, agent A is more risk averse than agent B. If agent A had the same risk aversion as agent B, his optimal equity exposure would be 12.1%. Secondly, given that agent A is the poorer agent, he may expect a net transfer from agent B, which further reduces his optimal exposure to the risky asset. Since private investors are often constrained from short-selling, agent A optimally does not engage in the stock market at all. The risk-free rate is relatively high, reflecting that both investors have a strong incentive to smooth their consumption stream over time; hence, in order for investor B to willingly lend money to investor A the interest rate must provide a substantial compensation to him.

Throughout the remainder of this section, we demonstrate how the initial distribution of wealth, investor A's risk aversion, the tax rate and different tax mechanisms affect stock market participation of the two agents.

3.1 Impact of initial distribution of wealth

The initial distribution of wealth to the two agents affects to which extent they are net beneficiaries or net payers of transfers. The lower agent A's initial share, $\alpha_A(0-)$, of the risky stock is, the higher the transfer payment he can expect to receive from agent B.

Please insert Figure 1 about here.

In Figure 1 we study the impact of agent A's initial share, $\alpha_A(0-)$, of the risky stock on the equity premium (upper left graph), the risk-free rate (upper right graph), agent A's exposure to the risky stock (lower left graph) and his optimal consumption level (lower right graph).

The upper left graph indicates that the equity premium increases in $\alpha_A(0-)$. This is due to the fact that agent A is the more risk averse agent. Consequently, an increase in his share of aggregate wealth results in an increase in the equity premium. For the same reason, we can observe that the risk-free rate decreases in $\alpha_A(0-)$.

The lower left graph shows that agent A's exposure to the risky stock increases in $\alpha_A(0-)$. That agent A increases his holdings in the risky stock when his wealth level increases makes intuitive sense. In the absence of taxation and redistribution, the agents would both respond linearly to changes in their initial wealth. However, with taxation and redistribution the relation between his holding $\alpha_A(0)$ and his initial wealth $\alpha_A(0-)$ is not linear, but convex. This reflects the fact that as agent A becomes richer in terms of initial wealth, he will increase his direct exposure in a progressive manner. This is so because as $\alpha_A(0-) < 0.5$ increases the transfer mechanism will reduce the level of wealth transferred to him and thereby also reduce the level of imputed stock market risk. At the point $\alpha_A(0-) = 0.5$ the roles of the two agents changes and agent B now becomes the net recipient of transfer income. As $\alpha_A(0-) > 0.5$ increases the transfer mechanism will result in an increased transfer of wealth from A to B and thereby again reduce agent A's direct exposure to stock market risk.

For $\alpha_A(0-) \leq 0.26$, agent A wants to choose a negative exposure to the risky stock in order to hedge the stock market risk his indirect exposure due to the transfer payment. The lower right graph indicates that agent A's optimal consumption level increases in $\alpha_A(0-)$.

3.2 Impact of risk aversion

An agent's risk aversion is one of the key determinants driving the relation between the demand for risky and risk-free assets. In this subsection, we study how different levels of agent A's risk aversion γ_A affect the risk-return characteristics of the two assets and optimal consumption-investment strategies. We allow γ_A to very between 0 and 10, the range of degrees of risk aversion considered reasonable by Mehra and Prescott (1985).

Please insert Figure 2 about here.

The upper graphs in Figure 2 show the impact of the agent's risk aversion on the equity premium (upper left graph) and the risk-free rate (upper right graph). They indicate that the equity premium increases in agent A's degree of risk aversion, which is in line with economic intuition. The impact of agent A's level of risk aversion on the risk-free rate is non-monotonic, reflecting the change in agent A's demand for and supply of the risk-free asset. The lower agent A's level of risk-aversion, the stronger his motive to lever up in order to earn the equity premium. For higher levels of risk-aversion however, investor A seeks to hold the risk-free asset to reduce future period's consumption volatility. As a consequence, agent A's holdings in the risk-free asset increase in his level of risk aversion. For levels of risk aversion $\gamma_A \precsim 2$, agent A wants to lever up and therefore wants to sell the risk-free asset to agent B. For $\gamma_A \succsim 2$, agent A wants to hold the risk-free asset and therefore has to buy it from agent B. Note that investor A does not switch from the role of a lender to the role of a borrower exactly when $\gamma_A = \gamma_B = 3$. He does so at a lower level of risk aversion, since agent A is the relatively poor agent and therefore the net recipient of transfer income, implying that agent A is already subject to the imputed stock market risk. As a consequence, he has an incentive to hold a long position in the risk-free asset already when his degree of risk aversion exceeds 2.

The lower graphs in Figure 2 show the impact of agent A's risk aversion on his holdings of the risky stock (lower left graph) and his consumption level (lower right graph), respectively. The lower left graph shows that the agent's optimal holding of the risky stock decreases in his level of risk aversion. For levels of risk aversion $\gamma_A \geq 4.7$, the agent wants to go short in the risky stock to hedge away the stock market risk he is already subject to via the transfer payments. Given that private investors usually cannot short assets, it is rational for such an investor not to participate in the stock market at all.

The lower right graph shows that agent A's consumption at time $t = 0$ is not very sensitive to changes in his level of risk aversion. At time $t = 1$, however, we observe that the consumption level increases in the agent's level of risk aversion in the bad state while it increases in the good state, reflecting the more conservative investment strategy the agent optimally chooses at time $t = 0$.

3.3 Impact of level of tax rate

In this section we return to the base case parameter setting, except for the value of the tax rate τ, which is the parameter to be varied.

The level of the transfer payments from the relatively rich to the relatively poor agent depends crucially on the tax rate.

Please insert Figure 3 about here.

In Figure 3 we depict the impact of the tax rate on the equity premium, the risk-free rate, agent A's optimal exposure to the risky stock and agent A's consumption.

The upper graphs in Figure 3 show that both the equity premium and the risk-free rate increase in the level of the tax rate. This makes intuitive sense as the before-tax equity premium and risk-free rate have to increase in the level of the tax rate to make sure that the after-tax premium and risk-free rate remain stable.

As already noted in Domar and Musgrave (1944), the taxation of profits does not only decrease the expected return on an asset, but also its volatility. This suggests that the equity premium might even decrease. Whereas taxation actually reduces the risk of a risky asset in models like those of Domar and Musgrave (1944), where tax revenues are not distributed, in our model the transfer mechanism does not only reallocate wealth, but also stock market risk. In our model, fiscal authorities do not absorb the risk but rather redistribute it. In order to obtain comparable levels of after-tax return, the pre-tax risk-free return and the equity premium therefore have to increase in the level of the tax rate.

The lower graphs show that as the tax rate increases, agent A, the net recipient of transfer income, optimally decreases his exposure to the risky stock and increases his consumption level. If the tax rate increases to a level above 33%, agent A wants to short the risky asset to hedge the imputed stock market risk. Agents lacking short-selling opportunities optimally do not engage in the stock market to hold their stock market risk as low as possible.

3.4 Impact of different personal tax rates

Throughout our paper, we have so far assumed that agent A and agent B are subject to the same tax rate. A common feature of many tax codes found around the world, however, is progressive taxation, i.e. that high incomes are taxed at higher marginal tax rates than lowers. Throughout this section, we study how a lower personal tax rate for the relatively poor agent A affects our results.

If $\tau_B > \tau_A$ denote agent A's and B's tax rates, respectively, the evolution of agent A's wealth is given by

$$\begin{aligned} W_{tA} =& \alpha_A(t-1)\left(P_t + D_t\right) + \beta_A(t-1)R_{t-1} \\ & - \left(\alpha_A(t-1)\left(P_t + D_t - P_{t-1}\right) + \beta_A(t-1)r_{t-1}\right)\frac{\tau_A}{2} \\ & + \left(\left(1-\alpha_A(t-1)\right)\left(P_t + D_t - P_{t-1}\right) - \beta_A(t-1)r_{t-1}\right)\frac{\tau_B}{2} \end{aligned} \tag{8}$$

Similar to Equation (5), the first term describes the wealth level agent A would have attained in the absence of taxes. The second and the third term are the net tax payments of agent A and the transfer income received from agent B, respectively. It can be rewritten as follows:

$$\begin{aligned} W_{tA} =& \alpha_A(t-1)\left(P_t + D_t - \left(P_t + D_t - P_{t-1}\right)\frac{\tau_A + \tau_B}{2}\right) \\ & + \beta_A(t-1)\left(R_{t-1} - r_{t-1}\frac{\tau_A + \tau_B}{2}\right) \\ & + \left(P_t + D_t - P_{t-1}\right)\frac{\tau_B}{2} \end{aligned} \tag{9}$$

It consists of three terms. The first two show the direct impact of investments in the risky and the risk-free asset, respectively. These two terms indicate that agent A should consider a net tax rate corresponding to the weighted average of the two agents' tax rates in his marginal investment decision. This finding is due to a direct and an indirect effect. First, agent A is subject to a net tax payment of $\tau_A/2$ on his profits earned, which accounts for the direct effect. Second, the limited net supply of the two assets implies that each unit of the two assets held by agent A cannot be held by agent B. As a consequence, agent A misses a net wealth transfer of $\tau_B/2$ times the profit, which accounts for the indirect effect. In total, these two effects imply a situation in which the agent should consider a tax rate being equal to the weighted average of the two tax rates in his marginal investment decision. The third term defines a net tax subsidy agent A may expect from agent B.

Equation (9) further indicates that both agents' tax rates affect the expected after-tax returns on both assets as well as the volatility on the risky asset. Studying a setting with two different tax rates thereby allows us to disentangle the effective tax rates applicable to marginal investments and the net wealth transfer defined in the last term in Equations (7) and (9).

Please insert Figure 4 about here.

In Figure 4 we study the impact of varying agent A's tax rate between $\tau_A = 0\%$ and $\tau_A = 35\%$, when agent B's tax rate is held constant at $\tau_B = 35\%$.

The upper two graphs in Figure 4 indicate that the equity premium and the risk-free rate increase with agent A's tax rate. According to Equation (9), the higher agent A's tax rate, the lower the marginal after-tax return on both assets. To compensate for that effect, the pre-tax return has to increase with the tax rate.

The lower left graph indicates that agent A's holdings in the risky stock decrease in his tax rate. Equation (9) indicates that this stems from the fact that the risky asset's after-tax return decreases whereas the transfer defined through the third term which only depends on agent B's tax rate remains constant. In contrast to our results in Figure 3, where not only the marginal after-tax return, but also the level of the transfer payment was affected, the quantitative impact on agent A's holdings in the risky stock are modest.

Even though agent A's tax rate affects his budget constraint, the lower right graphs showing the impact of agent A's tax rate on his optimal consumption level, indicate that this effect is quantitatively negligible.

4 Conclusion

In this paper, we propose a new explanation for the empirically documented fact that poorer agents participate in the stock market less frequently than richer. We demonstrate that public wealth transfers from richer to poorer agents that are financed by taxing investment returns do not only result in the intended wealth transfer, but also imply a risk transfer. In particular, the level of the transfer income the poorer agent receives depends – via the government's budget constraint – on the level of tax revenues collected and thereby on the return of our risky asset. As a consequence, the amount of transfer income the poorer agent receives depends on the return on that asset. That is, the transfer income itself is subject to stock market risky which might already meet that agent's risk-appetite; this might even happen to such an extent that it would be optimal for the agent to short stocks. Given that private households usually are constrained from short-selling stocks or can only do so at substantial costs, it can be optimal for poorer agents not to engage in the stock market.

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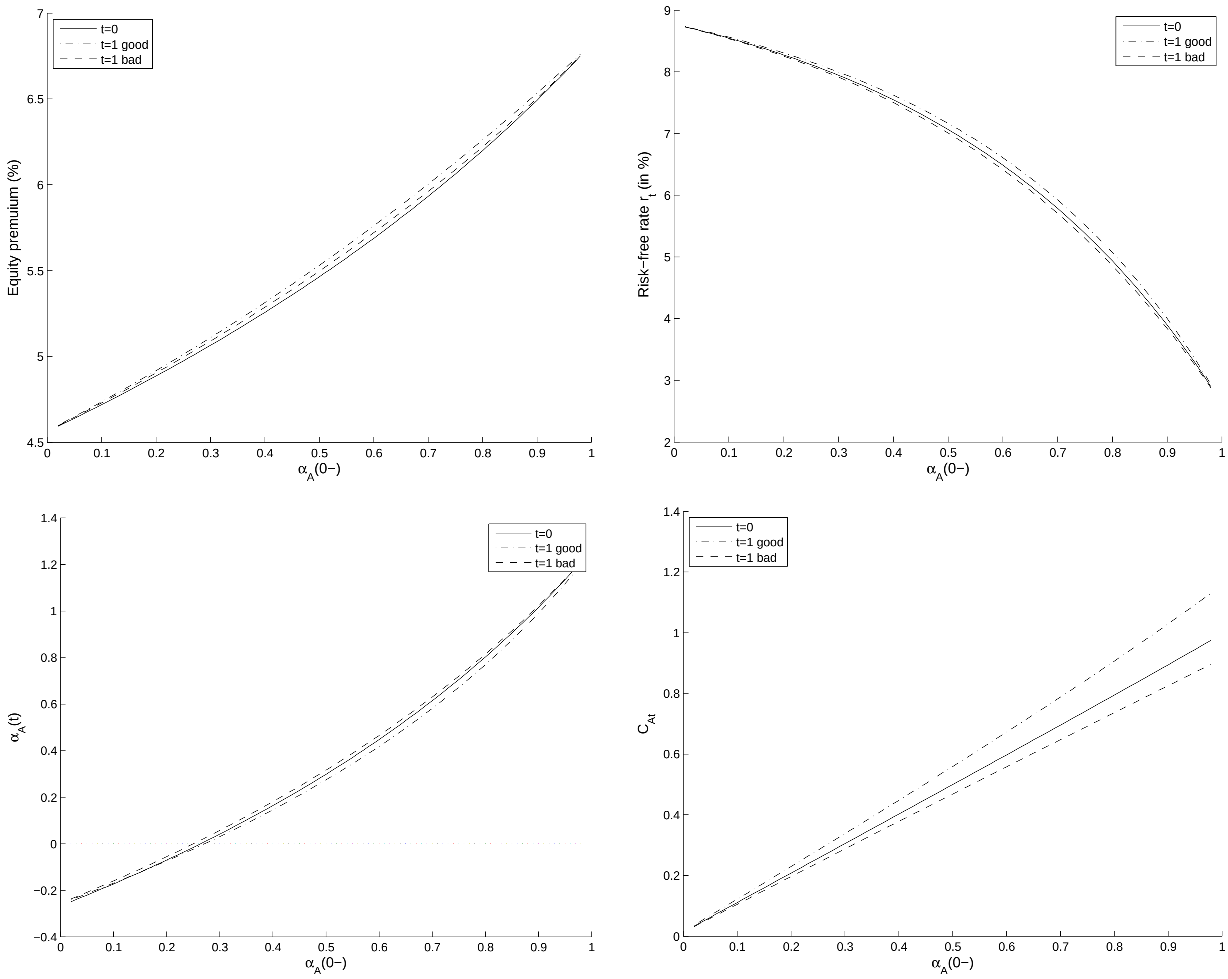

Figure 1: **Impact of initial distribution of wealth:** This figure shows the impact of the initial distribution of wealth $\alpha_A(0-)$ on the equity premium (upper left graph), the risk-free rate (upper right graph), agent A's holdings of the risky stock from time t to $t+1$ (lower left graph) and his consumption (lower right graph).

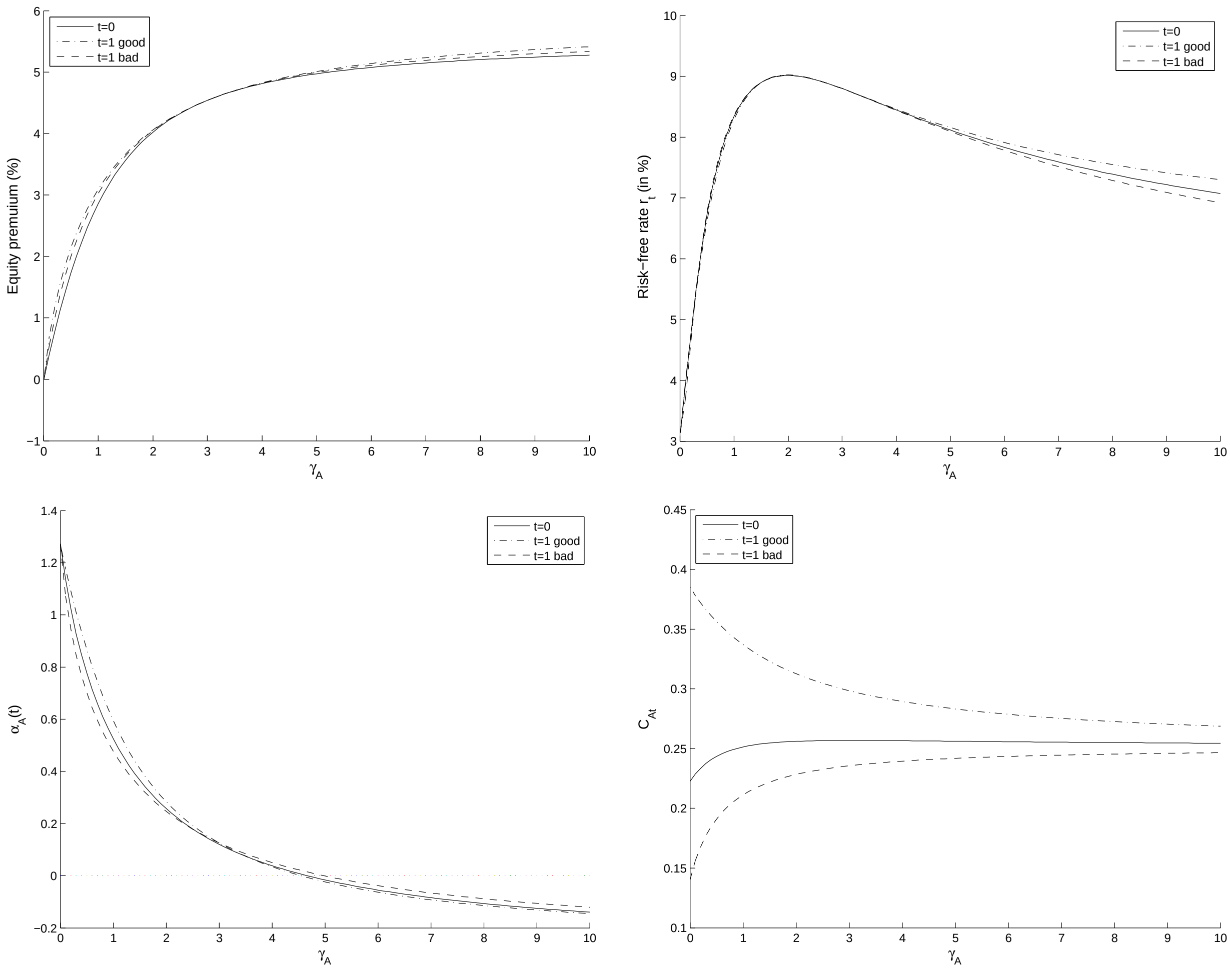

Figure 2: **Impact of risk-aversion:** This figure shows the impact of the risk-aversion γ_A of agent A on the equity premium (upper left graph), the risk-free rate (upper right graph), investor A's holdings of the risky stock from time t to $t+1$ (lower left graph) and his consumption (lower right graph).

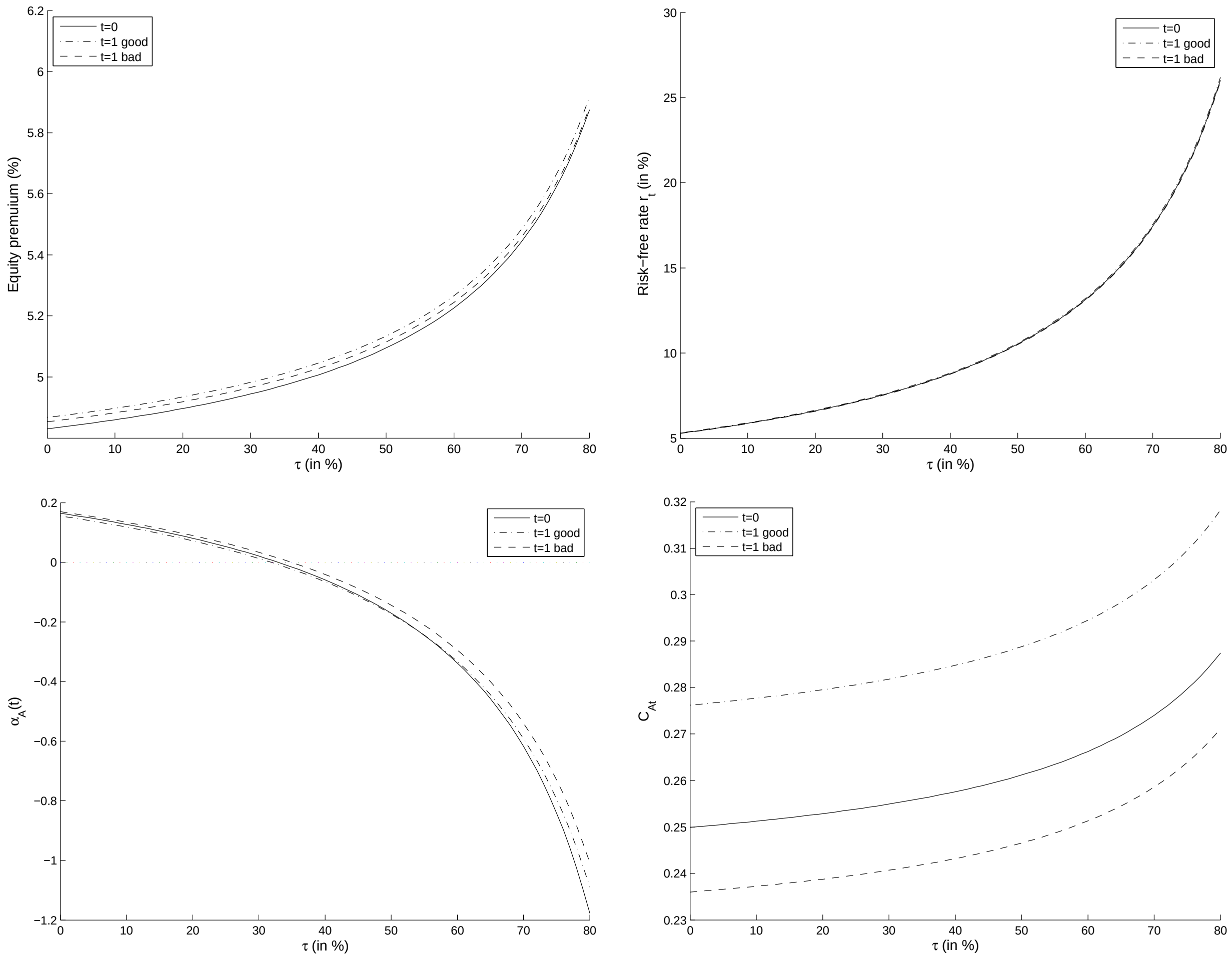

Figure 3: **Impact of tax-rate:** This figure shows the impact of the tax-rate τ on the equity premium (upper left graph), the risk-free rate (upper right graph), agent A's holdings of the risky stock from time t to $t+1$ (lower left graph) and his consumption (lower right graph).

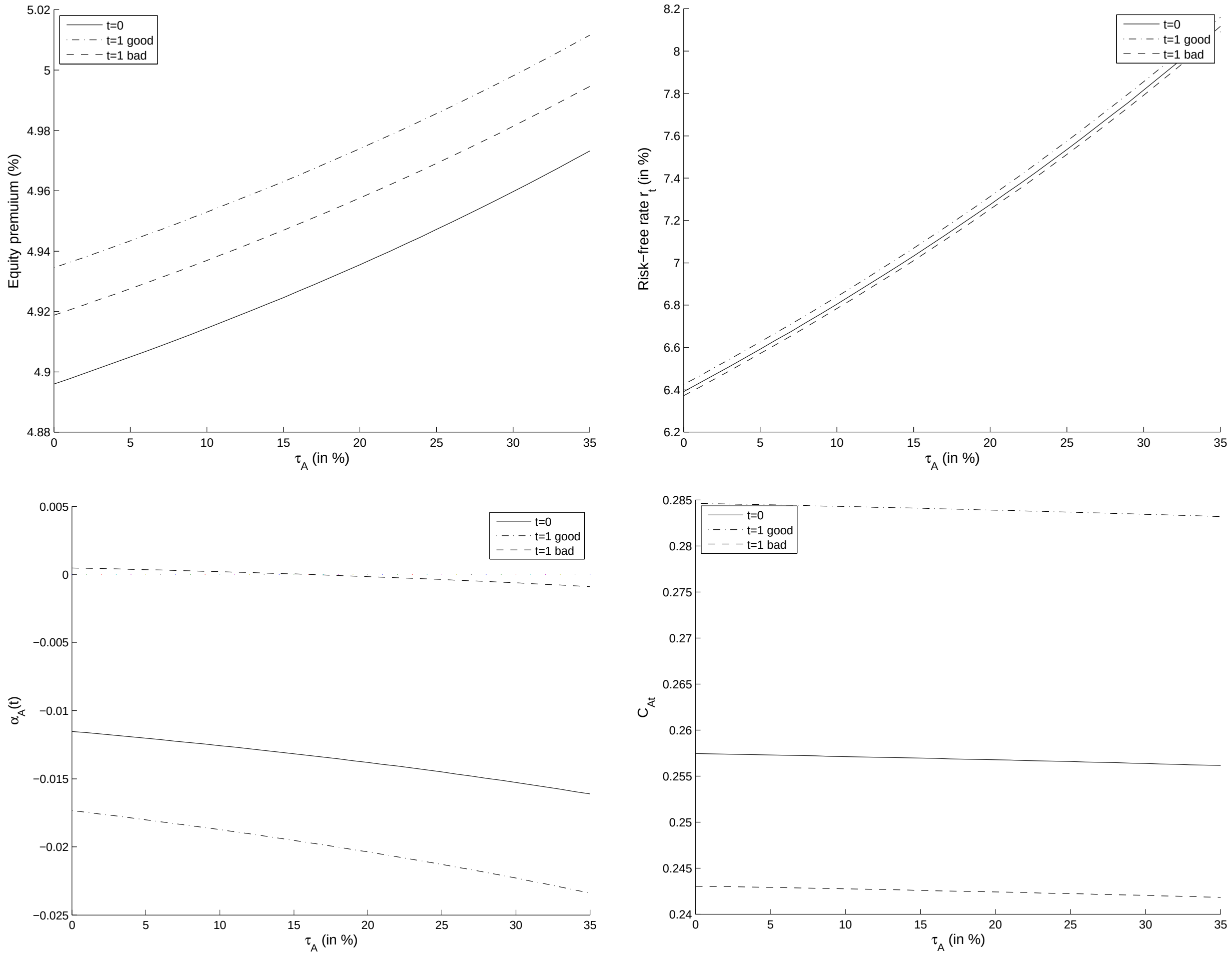

Figure 4: **Impact of different personal tax rates:** This figure shows the impact of different tax rates for agent A and agent B. Agent B is assumed to be taxed at $\tau_B = 35\%$, whereas agent A's tax rate τ_A is shown on the abscissa. This figure shows the impact of agent A's tax rate on the equity premium (upper left graph), the risk-free rate (upper right graph), agent A's holdings of the risky stock from time t to $t+1$ (lower left graph) and his consumption (lower right graph).

	$t = 0$	$t = 1$, high	$t = 1$, low
Equity premium	5.0%	5.0%	5.0%
r_t	8.1%	8.2%	8.1%
$\alpha_A(t)$	-0.016	-0.023	-0.001
C_{At}	0.256	0.283	0.242

Table 1: **Results base case parameter choice:** This table shows the equity premium, the risk-free rate r, the number α_A of units of the risky stock held by investor A and his optimal consumption C_A at time $t = 0$ and $t = 1$ in the state with the high and low dividend payment for our base case parameter choice.