FACULTY OF LAW UNIVERSITY OF TORONTO

THE JAMES HAUSMAN TAX LAW AND POLICY WORKSHOP SERIES 2009 - 2010

Terrence Chorvat
George Mason University School of Law

THE EFFECT OF THE TAXATION OF RISKY INCOME ON INVESTMENT BEHAVIOR

4:10 – 6:00 p.m.
Friday, September 29, 2009
Solarium (room FA2) – Falconer Hall
84 Queen's Park
Toronto Canada M5C 2C5

.

THE EFFECT OF THE TAXATION OF RISKY INCOME ON INVESTMENT BEHAVIOR

THE DATA FOR THIS EXPERIMENT ARE NOT COMPLETE. I AM PRESENTING IT AT THIS STAGE BOTH BECAUSE I THINK YOUR COMMENTS WOULD BE VERY HELPFUL IN FINISHING THE EXPERIMENT AND ALSO BECAUSE I THINK THERE MAY BE SOME INTEREST IN THE RESULTS EVEN AT THIS STAGE. THE DATA PRESENTED AT THE WORKSHOP MAY BE UPDATED FROM THE DATA IN THIS DRAFT OF THE PAPER.

ABSTRACT

Domar and Musgrave's article concerning the effects of a full-loss-offset income tax has been a staple of the public finance literature since 1944. Their model of investor behavior with a full-loss-offset income tax predicts that if a variety of conditions are met, investors should shift their portfolios to higher-risk assets since the government is sharing the risk. Their model assumes that taxpayers are capable of calculating their risk preference under a risk-altering tax structure. Despite the model's prominent role in the literature, the extent to which its predictions match actual economic behavior has yet to be directly empirically examined. In this paper, we use a laboratory experiment to test the hypothesis that individuals are willing to accept more risk when faced with a full-loss-offset income tax. Preliminary data in this experiment indicate that a symmetrical income tax has either no affect on portfolio allocation or might reduce an investor's willingness to take on risk. These results imply that the model's predictions may be reliant on unreasonable assumptions of human behavior.

I. THE MODEL

A standard model for the behavior of investors under taxation of risky income was developed by Domar and Musgrave in 1944[1]. It was further developed by Joseph Stiglitz in 1969[2] and is a staple of the literature about the effects of income taxes.[3] This model predicts that under a symmetrical income tax (discussed more fully below), and if a variety of standard conditions are met, investors will shift their portfolios so that they will be able to obtain the same after-tax returns on investments as if there was no tax on risky portion of the returns. Under the model, investors will increase the percentage of the portfolio allocated to risky securities as opposed to riskless securities, allowing them to effectively negate the effect of incomes taxes. As discussed below, a key limitation of this model is the strength of the conditions that have to be met in order for it to apply.

To illustrate how this model works, let us use a highly stylized model of investment behavior. Following many standard models of investment, suppose that each investor has a choice of two investments, one a safe, riskless investment and the other a risky investment with a higher expected value. The investors' problem is to allocate their portfolio between these two investments.[4] The investors' returns from a particular

---

[1] *Proportional Taxation and Risk-Taking* 58 Q. J. ECON. 388)
[2] (*The Effects of Income, Wealth, and Capital Gains Taxes on Risk-Taking* Q.J. E
[3] (*See* Myles, PUBLIC ECONOMICS, 1995, Ch.7)
[4] This model makes certain assumptions about investment behavior. It essentially adopts the "mean-variance" assumption. Under this assumption, the only two characteristics of an investment that matter are the investment's expected value (the higher the better) and the variance (the lower the better). It is possible that other facets of an investment matter to investors, or that these factors matter but it manner different that accounted for in standard portfolio models. To the extent that this is the case, the Domar-Musgrave model will not capture the effects of these aspects of investment decisions.

portfolio allocation will be $W_1 = (1-x)W_0 + xW_0r$, where W_0 is the level of wealth in period 0 and W_1 is the wealth in period 1, *x* is the percentage of the portfolio invested in the risky asset, and *r* is the stochastic return to the risky asset. Notice that under this simple version of this model, there is no return on the riskless investment. In addition, we assume that the distribution of *r* is known to the investor. It can be either a discrete distribution (e.g., 50% chance of a \$10 loss and a 50% chance of a \$15 gain) or a continuous distribution. Standard investment models assume that individual investors will select *x* so as to optimize their expected utility.

If we introduce taxation of income on the risky asset (with deduction allowed for losses) at the rate *t*, where 0 <t < 1, the final random wealth is

$$W_1 = (1-x)W_0 + xW_0(1+r(1-t)).$$ [5]

One can show that the first order condition for an interior optimum with no tax is

$$\int_{r-}^{r+} rU'(W_0 + W_0xr)\, f(r)dr = 0$$ [6]

[5] Notice that, because there is no return on the riskless asset, this is a tax on all of the investor's income.

[6] Proof:
If the final random wealth is $W = W_0 + W_0(1+r(1-t))x$, the individual (assuming they behave according to expected utility theory and are risk averse) will try to maximize their expected utility or E[U(W)] = $\int_{r-}^{r+} U(W_0(1+r(1-t))x)\, f(r)dr$ to $\max_x E[U(w)]$, we take the derivative with respect ot the choice variable x
, so we have if the tax rate is zero we have $\int_{r-}^{r+} W_0rU'(W_0 + W_0xr)\, f(r)dr = 0$ In the case, where there is a positive rate of taxation, we have

where f(r) is the probability density function, and r- and r + are the limits of the possible returns. While the optimum with a tax would be

$$\int_{r-}^{r+} rU'(W_0 + W_0 yr) f(r) dr = 0$$

Where $y = \frac{x}{1-t}$. We can see that these two integrals are the same and so in both cases we have the same solution to the portfolio problem *mutatis mutandis.*

One consequence of this model is that, if *t* changes, the optimum x changes to keep $\frac{x}{1-t}$ = y constant. This occurs because, in order to stay at a utility maximum, we must keep $E\left[\frac{\partial U(W)}{\partial x}\right]$ = 0 and therefore, if *t* changes, *x* has to change so that $x_0/(1-t) = y$, where x was the allocation to the risky asset without the tax, and y is allocation with the tax. If the tax rate on risky income increases, so too does the amount of wealth held in the risky asset. Taxing returns at a higher rate would encourage more investment in the taxed asset, rather than less. Furthermore, as pointed out by Agnar Sandmo,[7] if there are two risky assets whose returns are independent and identically distributed and the

---

$\int_{r-}^{r+} (1-t) rW_0 U'(W_0 + W_0(1-t)xr) f(r) dr = 0$.

If we substitute in $y = \frac{x}{1-t}$ we then have the integral

$\int_{r-}^{r+} W_0 rU'(W_0 + W_0 yr) f(r) dr = 0$, which is the same integral as before, so the solution is the same.

Therefore, the optimal portfolio allocation under income taxation is such that it is scaled up by $\frac{1}{1-t}$.

[7] *Differential Taxation and the Encouragement of Risk-Taking*, Economics Letters, 1989

incomes of each are taxed at two different rates, then the more highly taxed asset will have a greater allocation of the portfolio than the lower taxed asset.

The intuition here is that, by taxing the risky return, the government is effectively becoming a partner in the risky investment, with a percentage interest of (x/(1-t))-x. Because of this, by taking some of the return but reducing risk, taxpayers can get to the same risk return trade-off as before, by investing more in the risky asset.

This theory is central to a number of standard results in public finance. For example, it is the basis for arguing that the difference between consumption taxes and income taxes is a tax on riskless return on investment.[8]. It is also the basis for the argument about the economic effects of wealth taxes as compared to income and consumption taxes[9]. This model is also important in a number of recent articles on the effects of taxation on risk-taking. This model has also been important in discussions of the second layer of tax on corporate income[10] as well as the taxation of derivatives and other financial instruments[11]. Because of the growing interest in the use of the model to analyze investment decisions, understanding whether this is a reasonable representation of how investors in fact make their choices would be an important addition to the literature.

One of the key limitations of this model is that the analysis already discussed is only a partial equilibrium analysis. It assumes that the taxes themselves essentially

---

[8] Al Warren, *How Much Capital Income Taxed Under an Income Tax is Exempt Under a Cash Flow Tax,* Tax Law Review, 1996

[9] Stiglitz, QJE 1969 For a review of this literature, see Gareth Myles, PUBLIC ECONOMICS, 1995 Ch. 7.

[10] *See* Terrence Chorvat, *Apologia for the Double Taxation of Corporate Income*, 38 WAKE FOREST L. REV. 239 (2003)).

[11] David Schizer, Balance in the taxation of Derivative Securities 104 Colum. L.Rev. 1834 (2004) David Weisbach, Taxation and Risk-Taking with Multiple Tax Rates Nat. Tax J. (2004), Thomas Brennan Certainty and Uncertainty in Taxation of Risky Returns (2009)

perform no useful function.[12] However, if the taxes are used to fund public goods that the individuals values then they have not in fact reduced the risk they face, but rather they have simply transferred the risk from private goods into public goods.[13] This is one of the most serious problems of the application of the Domar-Musgrave theory. While it may be finessed by making some reasonable assumptions about the government's ability to run deficits,[14] the models do not give unambiguous predictions for investor behavior situations where not only the risk is transferred to a public good, but it is also the case that prices of the various investments will shift depending on the demand for the various investments.

II. Experiment

This experiment is designed to test the fundamental form of this model. This theory is very difficult to test with econometric data, in part because the real world is immensely more complicated than the world envisioned in the model. While there has been some econometric work which might be argued supports this model,[15] in any of this work there are too many confounding factors for any of them to be a reasonable test of the theory. Given the current tools we have for data analysis, it is highly unlikely that econometric data, will be able resolve the question of whether this model accurately

---

[12] Kai Konrad Risk Taking and Taxation in Complete Capital Markets 16 Geneva Papers on Risk and Insurance 167 (1991).

[13] Louis Kaplow, Taxation and Risk-Taking: A General Equilibrium Perspective 47 Nat'L Tax Jour. 789 (1994).

[14] See Chorvat, Apologia

[15] Martin Feldstein, Personal Taxation and Portfolio Composition: An Econometric Analysis 44 Econmetrica 631 (1976). Jonas Agell & Pers Anders Edin, Marginal Taxes and Asset Portfolios of Swedish Households 9 Scandinavian Journal of Economics 47 (1990), Stefan Hochguertel et al., *Saving Accounts Versus Stocks and Bonds in Household Portfolio Allocation,* 99 SCANDINAVIAN J. ECON. 81, 92 (1997).

describes investor behavior. One key problem with testing this model is that it assumes that the tax system allows for what are referred to as "full loss offsets". This means that if an investor earns income, he would pay a tax equal to his tax rate multiplied by his income (or *txr* in the model, yielding an after tax return of *(1-t)xr*) and if he loses money, he would get a check from the government equal to his losses multiplied by his tax rate (*txr* in the mode, yielding an after tax loss of (1-t)xr). This makes the income tax symmetrical in gains and losses. This is sometimes referred to as a perfect or normative income tax. Actual tax systems are almost never perfectly symmetrical, because there are significant restrictions on the use of losses. These are in place in large measure to prevent potential abuse of the tax system due to the realization doctrine.[16] As detailed in Stiglitz, the predictions of the model become more complicated as we move away from symmetrical taxation. Stiglitz showed that even without full loss offsets, it may be possible to still get some of this effect, but then it is an empirical question, because it depends on the risk aversion of the investors. Because tax legislation almost invariably contains many provisions which affect the tax rate and loss offset provisions is complicated ways, empirical testing of the model based on changes in the tax law is generally problematic at best.. This is important as a policy matter because if this effect does occur, it could mean that taxes could be structured to have lower deadweight losses (and actually lower losses over all)[17]. The purpose of this experiment is to test the model at a point when its predictions are unambiguous.

---

[16] Chorvat, Behavioral Economics and the Realization Doctrine

[17] (*See* Terrence Chorvat, *Apologia for the Double Taxation of Corporate Income*, 38 WAKE FOREST L. REV. 239 (2003))

In order for the model to yield unambiguous predictions, a number of important conditions have to be met.[18] As discussed, the tax system must be symmetrical between gains and losses. In addition, the rate of return on a riskless asset would have to be zero.[19] Furthermore, some of the predictions of the model only operate where the marginal rate of return on the risky investment is constant. If the rate of return declines with the amount invested in the risky investment, this can effect how the investor is willing to invest. Finally, the tax has to be proportional (i.e., a flat rate) in order for the predictions of the model to be simple and unambiguous.

A simple way to test this model is to give subjects a stake or portfolio and have them allocate their portfolio between two assets, a risky asset and a riskless asset. One would need to make the returns to risky assets random, in a way that they understand that these returns are random, and not predictable. In this experiment, we attempt to test the model with a continuous distribution of the returns by having it derived from a random number generator on a computer.

Experimental Model

To test the hypothesis, we first derive a version of the model that lends itself to empirical testing. We let the decision of a subject be a choice between two assets: one with risk (asset A) and the other without risk (asset B). Each subject has an endowment (E) that they can invest in the two assets. Any E not invested in the risky asset is by default invested in asset B.[this is changed for the rounds of the experiment currently

[18] These are discussed in Stiglitz (1969)
[19] However if utility functions are continuous, small rates of return on riskless investment still will yield the predictions that investors will likely shift more of their portfolios into risky assets.See Sandmo (1986)

being run] As such, we will define the amount invested in asset A as x and the amount invested in asset B as E-x.

Asset A's return on investment is a Bernoulli event with a high return outcome (H) and a low return outcome (L). If there is a high outcome, then the return is h. If there is a low outcome, then the return is l. For example, if the outcome is high (H), then the tax payer receives (1+h)x. The probability of H is p and the probability of L is 1-p. Therefore, the expected value of asset A is p(1+h)x + (1-p)(1+l)x.

Asset B's return on investment is a certain event with return r. In other words, the return from asset B is (1+r)(E-x). Therefore, the subject's payoff function is (1+r)(E-x) + (1+A)x and the expected payoff is (1+r)(E-x) + p(1+h)x + (1-p)(1+l)x.

For some time periods, we impose a capital gains tax to be levied on the return from the assets. We let the tax use full loss offsets (i.e., this is a symmetrical tax). We define *t* as the tax rate. The return on investment from asset A with a tax is (1-t)A and the return on asset B is (1-t)r. Therefore, the payoff function with taxes is (1+(1-t)r)(E-x) + (1+(1-t)A)x and the expected value is (1+(1-t)r)(E-x) + p(1+(1-t)h)x + (1-p)(1+(1-t)l)x.

Experimental Hypothesis:

Assume the utility function of the subjects are of the form y^a. In this case, the expected utility of a subject is

$p\left[\left((1+tr)(E-x)+(1+th)x\right)^a\right]+(1-p)\left[\left(1+(1-tr)(E-x)+\left(1+(1+th)\right)x\right)^a\right]$ We assume that subjects are rational and utility maximize and r =0. In this case, the optimal contribution to asset A is:

$$x^* = \frac{Eg}{(1-t)}$$

$$g = \frac{1-\left(\frac{l(p-1)}{h}\right)^{\frac{1}{a-1}}}{l\left(\frac{l(p-1)}{h}\right)^{\frac{1}{a-1}} - h}$$

To estimate g, use:

$$g = \frac{\hat{x}}{E}$$

Where $\hat{x}$ is the estimation of x from the experiment.

Since the tax rate is a modifier of the investors' preferences, the direction of the change can determine if the theory is accurate. In this case, the 1/(1-t) is the modifier. Therefore, we can hypothesize that an increase in the tax rate increases the amount invested in the risky asset (asset A).

Experimental Design

Because we assume that subjects do not know their utility function for risk, we designed the experiment as a repeated game to allow learning and discovery of preferences. Through repeated play, the subjects will reveal their preference for risk as the task provides outcomes and the subject response to their payoffs.

For each subject, a session is divided into 3 blocks. Each block has 12 rounds with the same tax rate: either 0, 20% or 40%. At the end of each block, a 12-sided die is rolled by the subject. The outcome of the die is the round that the subject is paid. Each subject makes decisions for 3 blocks with each of the 3 tax rates. The order of the blocks changes such that order effects cancel. For example, subject 1 makes decisions with block 1 having no tax rate, block 2 having 20% tax rate and block 3 having 40% tax rate (0,0.2,0.4). Subject 2 makes decision for blocks 0.4, 0.2, 0; subject 3 makes decisions for blocks 0.2, 0, 0.4 and so on.

Each round, subjects distribute money from asset B into asset A. The subjects had one minute per round to complete the decision. If the decision is completed before the end of the time, then the next round began immediately. If the time expires before the subject makes their decision, they will be forced to invest all endowment into asset B.

[The problem of the default asset allocation has been corrected in the most recent experimental method].

The parameters for l, h and p will provided a positive expected value for asset A and r =0 for asset B. For the purposes of this experiment, l = -1, h = 5 and p=0.5. This then provides an expected return on investment of e$2 per unit of endowment and total return of e$3 per unit of endowment for asset A, where e$ is experimental dollars. Asset B has a return on investment of e$0 per unit of endowment and a total return of e$1.0 per unit of endowment.

Each subject makes their decisions at a computer terminal. The interface was programmed in JAVA. All decisions were recorded electronically.

Here is a table for the overview of the experimental design:

Treatment	Repetition*	Block Placement	tax	rounds	E	h	l	p	r	time (sec)
1	6	1	0	12	100	5	-1	0.5	0	60
2	6	1	0.2	12	100	5	-1	0.5	0	60

3	6	1	0.4	12	100	5	-1	0.5	0	60
4	6	2	0	12	100	5	-1	0.5	0	60
5	6	2	0.2	12	100	5	-1	0.5	0	60
6	6	2	0.4	12	100	5	-1	0.5	0	60
7	6	3	0	12	100	5	-1	0.5	0	60
8	6	3	0.2	12	100	5	-1	0.5	0	60
9	6	3	0.4	12	100	5	-1	0.5	0	60

*Not completed

Experimental Analysis

We analyze the experiment three ways. First we test the hypothesis that an increase in the capital-gains* tax increases the amount invested in the risky asset using a non-parametric test. Second, we test the same hypothesis but with a parametric method that accounts for subjects' risk preferences, round effects and session effects. In the third, we test Domar and Musgrave's model specifically with a parametric model.

The Domar and Musgrave model predicts that an increase in the tax rate increases the amount invested in a risky asset. Using the data from the experiment, we can test if the amount invested in the risky asset when there is a low tax rate is less than when the tax rate is high. We formalize this in the following:

Ho: $d(0) = d(0.2) = d(0.4)$

Ha: $d(0) \neq d(0.2) \neq d(0.4)$

Where $d(t)$ is the population of decisions made with tax rate t.

To account for individual preferences, we estimate their preferred amount invested to the risky asset from the median of the blocks without taxes. The median removes variation from subject learning. We then calculate the deviation from the subject preferred investment by subtracting each observation from the estimate. This allows us to compare investment across subjects since it accounts for individual preferences.

The data exhibits strong round effects. These round effects can be confounded in the amount invested in the risky asset. To mitigate the influence of the rounds, we only analyze the last block of the experiment. By doing so, we also reduce the error from learning and becoming acquainted with the software.

We use Kruskal-Wallis rank sum test for multiple populations to test the hypothesis. We can reject the hypothesis that $d(0) = d(0.2) = d(0.4)$ with an adjusted $p < 0.01$, but we can not reject the hypothesis that $d(0) = d(0.2)$. All the other pairwise comparisons are rejected at $p < 0.01$.

Although the populations are not equal, the direction is the opposite of what Domar and Musgrave predicted. In this case, as the tax rate increases, the amount allocated to the risky asset decreased. The rank means fall as the tax rate increase, indicating that the prediction of the model is the opposite of how subjects behave. Note that limited data in the 20% tax treatment may reduce that accuracy of the model and the statistic for the preferred investment hides part of the standard errors.

This test seems to suggest that as the tax rate increases, the amount invested in the risk asset falls. To support these findings, we use a parametric test that accounts for both preferences and round effects.

We assume that each subject has a preference for risk that corresponds to a preferred amount invested in the risky asset. The preferences are consistent across the decisions of the subject and are randomly selected from the public. For this reason, a random effect model should be used with the dependent variable as the amount given to the risky asset (asset A) and the independent variable as the tax rate.

We include a round, session and a lagged risky-asset return variable to account for the particulars of the experiment. With these additional variables, we have the following model:

$$x_{sr} = \alpha + \beta_1 t_{sr} + \beta_2 r_{sr} + \beta_3 g_{sr} + \beta_4 o_{s,r-1} + v_s \phi_{sr} + e_{sr}$$

Where t is the tax rate, r is the round, g is group size in laboratory and o is dummy for the outcome of the risky asset.

The results are found in table 3. As the nonparametric test suggests, the coefficient of the tax rate is negative and significant to p = 0.05. This supports the finding that subjects are not acting according to the Domar and Musgrave predictions.

Finally, we can develop a statistical model directly from the Domar and Musgrave analytical theory. Our previous two models have been heuristics because they do not account for the nonlinearity of the predicted change in the model. If we linearize the model using log functions, then we can test the prediction of the model by using linear regression techniques. Recall that the Eg/(1-t) is the amount invested in the risky asset in the model. By taking the natural log of both sides we find:

$$\ln(x) = \ln E + \ln g + \ln\left(\frac{1}{1-t}\right)$$

Now we can set the ln(E) to the constant, since it is constant across subjects, and add an error term to form a linear regression model.

$$\ln(x_{sr}) = \alpha + \beta_1 \ln g_s + \beta_2 \ln\left(\frac{1}{1-t_{sr}}\right) + e_{sr}$$

where s is the subject and r is the round. Since g is the same for all observations of the same subject, we can substitute it for fixed effects across subject. This avoids hiding error within the statistic g when evaluating the model.

$$\ln(x_{sr}) = \alpha + \beta_1 \ln\left(\frac{1}{1-t_{sr}}\right) + v_s \phi_{sr} + e_{sr}$$

With the regression model, we can find the value of B1. If B1 is positive, significant and close to 1, we can conclude that the theory is correct. In table 3, we find that the coefficient of the tax rate is positive and significant to p = 0.05, but not close to 1. This would suggest that nonlinearity of the previous two tests may not be capturing the complete logic of the Domar and Musgrave's model, but this may be driven by round effect. When we add round as an additional regressor to this model, the B1 term is no longer significant. Using the exact model of Domar and Musgrave it is inconclusive, but the previous two tests, although heuristics, indicate that this model was not predictive of investment behavior in situation which was designed to be as close to the assumptions of the model as possible.

Table 2

Tax	**Obs**	**RankSum**	**RankMean**
0	132	17484	132.45
0.2	24	2860.5	119.19
0.4	72	5761.5	80.02
Adjusted			
p-value	0.008333		
	Diff	**Crit Value**	**Prob**
t(0) = t(0.2)	13.27	35.04	0.182
t(0) = t(0.4)	52.43	23.14	0.000
t(0.2) = t(0.4)	39.17	37.22	0.005

Table 3

Variables	OLS	Random Effects
Tax Rate	-14.00	-14.0*
	(8.54)	(6.99)
Round	-0.766***	-0.766***
	(0.134)	(0.110)

Number in Group	-1.15	-1.15
	(1.48)	(5.51)
Lagged Asset-A Outcome	-6.53*	-6.53**
	(2.78)	(2.27)
Constant	76.00***	76.00***
	(5.92)	(18.08)

*$p < 0.05$

**$p < 0.01$

***$p < 0.001$

Graph 1

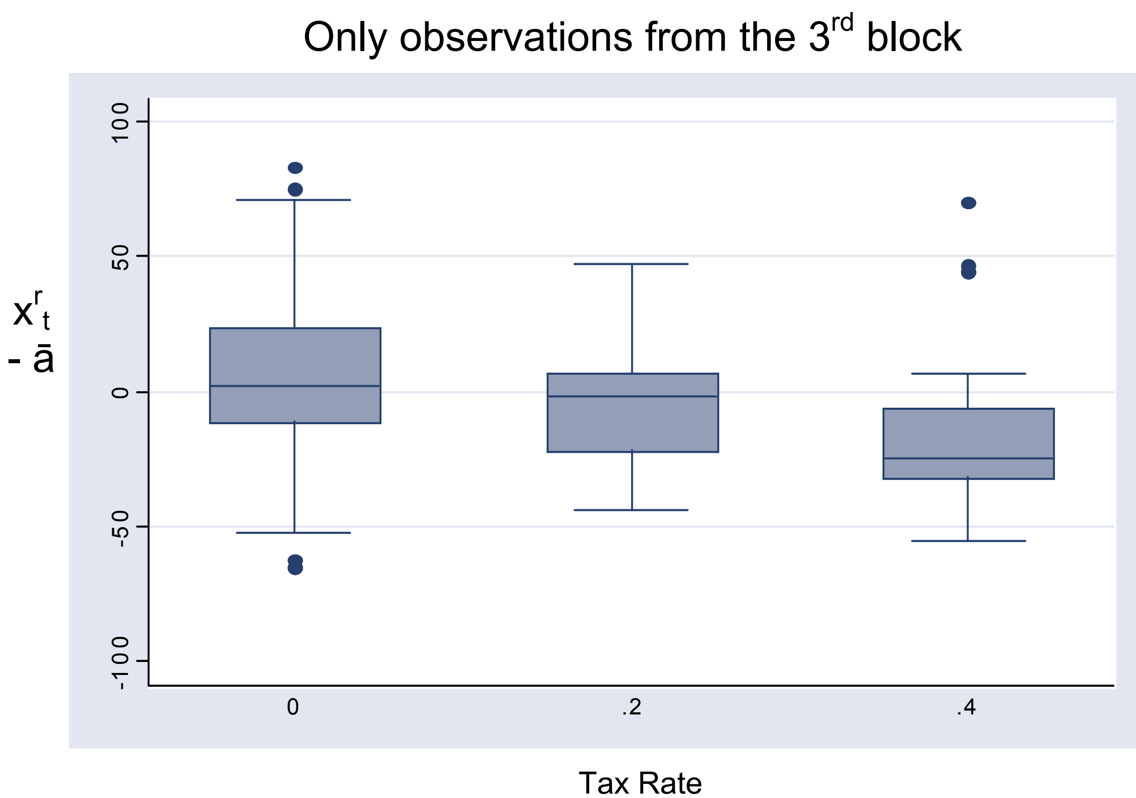

Table 4

Variables	Fixed Effects Model 1 (Stata xtreg)	Fixed Effects Model 2 (Stata xtreg)
$\frac{1}{1-t}$	0.291* (0.134)	0.086 (0.133)
Round		-0.017*** (0 .002)
Constant	3.74*** (0.124)	4.10*** (0.139)

*p < 0.05

**p < 0.01

***p < 0.001

III. Analysis

One of the key predictions of the Domar- Musgrave model is that imposing an income tax will result in an increase in the allocation to the risky assets. From the results we have obtained in this experiment, it is unlikely that the subjects follow the Domar-Musgrave paradigm in its most natural setting. It is important to note that individuals did appear to alter their preferences over the term of the experiment. This effect dominated whatever tax effects that existed.

What are the implications of this experiment on the effects of taxation on risk-taking? It would seem that even perfectly symmetrical taxes do not result in the scaling up of risk-taking. One might argue that this indicates the irrationality of investors, but this is not necessarily the case. Violation of the Domar-Musgrave model is only irrational if investors only care about the mean and variance or the return distribution. If there are other elements of their utility functions then the behaviors exhibited in this experiment are not necessarily irrational.

Importantly, we should note that there are a variety of ways in which this experiment departs from real investment choices. Here, there the subjects are confronted with investment decisions *in seriatum*, as opposed to being incorporated into all of the other decisions of one's life. However, most of the departures from actual investment problems in general make the problem faced by the subjects more like that envisioned by the model than that those faced in real life. It is hard to see that if the model cannot predict behavior in this simple situation how the model is of much use in the more complicated situations.

One potential additional limitation on the use of these results to generalize to market behavior is that the subjects were all students at George Mason University. It may be that investment professionals are more likely to be follow the model's predictions. If so, it may be that a substantial amount of investment capital still follows the models predictions. This question will be followed up in future research. At a minimum, this experiment indicates that we should take the model's results with a certain amount of caution, and this may decrease the value of conclusions drawn from the model.