Tithing and Asset Prices

Joe G. Baker
R. Kim Craft
David Tufte *

Southern Utah University

This paper is preliminary. Do not quote without permission. Research assistance on this project was provided by Cassie Hansen. Jeff Barnes, Rhead Bowman, Carl Templin, and Dan McMillen provided helpful comments.

* Corresponding author: College of Business, Southern Utah University, 351 West Center St., Cedar City, UT 84720, (435) 586-5407, tufte@suu.edu.

Tithing and Asset Prices

Abstract

Tithing, the formal practice of contributing a percentage of income to a church, is unevenly practiced in the United States. However, members or the Church of Jesus Christ of Latter Day Saints (CJCLDS) are very likely to tithe, and are concentrated in the intermountain west. Tithing amounts to a tax whose rate is advised, but which may be modified voluntarily. In particular, recent evidence suggests that CJCLDS members are likely to tithe at a much lower rate on capital gains on primary residential real estate (PRRE). This tax wedge will induce a preferential rate of return on that asset, potentially to the detriment of other assets. We present a theoretical model in which some – but not all – agents tithe, and use it to detail the relationship between tithing and asset prices.

1. Introduction

It is not a standard hypothesis in economics and finance that religious doctrine and practice can affect asset prices. This paper argues that the doctrinal stipulations for tithing in the CJCLDS lead to uneven practice which can influence the price behavior of assets.

Tithing is the biblically based practice of contributing a percentage of one's income to your church. In some sense, this amounts to a flat tax, and can be expected to generate marginal effects on economic decisions. This is distinct from the common practice of donating to a collection held at a church. That is a lump-sum tax, which would not be expected to generate marginal effects.

Literally, the percentage of income tithed is fixed at ten percent. However, Dahl and Ransom [1999] point out that the definition of what constitutes income is an individual and private decision. Well-meaning individuals may thus differ on what constitutes income. At some point, this probably didn't matter much, but the plethora of financial opportunities available today makes this issue more problematic. In practice, this implies for the faithful that well-defined sources of income (*e.g.* interest) will be tithed at an average rate across individuals which is higher than for less well-defined sources of income (*e.g.*, gifts).

This becomes a critical issue if communities are a mix of people who tithe and who do not. The presence of a flat tax that differs across groups does not generally have interesting economic implications. However, the presence of a flat tax whose rate differs across tax bases within a group may lead to arbitrage opportunities.

Tithing has been practiced for over 3,500 years, but is not widespread today. It is still practiced by some protestant denominations in the U.S. However, most of these groups developed as a rebellion against central organization of religious practice. It seems unlikely that

tithing practice in these communities is likely to be sufficiently focused to create observable economic implications. Further, it is arguable that without central control, that locally made tithes have a direct impact on local spiritual and material welfare. Alternatively, CJCLDS members tithe, and are concentrated in the intermountain west. Further, their tithes are submitted to a central authority for distribution; so that it is much more difficult to claim that a member will directly benefit from locally made tithes. In addition, it is common in the intermountain west to find predominantly CJCLDS communities near predominantly non-CJCLDS communities. This suggests that the marginal effects of different rates of tithing are most likely to be found in this region.

2. Theoretical Models

2.A. A Model Without Tithing

An overlapping generations model of an exchange economy is used for its straightforward handling of agent heterogeneity, and since the mechanics of production are not necessary to highlight the effects of exchanging income through tithing (see McCandless and Wallace [1991] for an accessible discussion). We limit the model to two assets, one of which is patterned after primary residential real estate (PRRE), and one which captures all other investment vehicles (for simplicity, we assume it acts like a loan).

The model features $m+n$ agents, each of whom lives for two periods. In each period, there are young agents in their first period of life, and old agents in their second. The decisions of the old and young affect prices faced by both types of agents. In addition, the young can make intertemporal trades with other young agents in that a good is transferred while they are young, and payed for when they are old.

We assume that each agent maximizes a utility function that is a special case of the constant relative risk aversion class:[1]

$$U_t^i = \ln c_t^i(t) + \ln c_t^i(t+1) \tag{1}$$

Here, utility is U, consumption is c, the superscript denotes an index number for each agent, time subscripts denote the generation of the agent, and the current time is noted in parentheses. Discounting is suppressed, although its presence would not substantially change the results below. While young, an agent maximizes over both periods with perfect foresight.

The budget constraint of young agent i is:

$$v_t^i(t) = c_t^i(t) + \ell^i(t) + p(t)a^i(t) \tag{2}$$

Here, the young agent does not produce income, but rather is endowed with v, which is spent on consumption to generate utility while young, c, and on two assets. We assume that the endowment completely depreciates between periods; so therefore, utility maximization implies the constraint is an equality. Young agents can only 'store' their endowment for use when old by trading with another young agent now, for repayment next period. The two assets are the vehicles for these trades. Agents can either buy one period loans, ℓ, or parcels of PRRE, a, at price p.[2]

The budget constraint of old agent i is given by:

$$v_t^i(t+1) + [1 + r(t)]\ell^i(t) + \{p(t) + [p(t+1) - p(t)] + d\}a^i(t) = c_t^i(t+1) \tag{3}$$

---

[1] See Blanchard and Fischer [1989] for a comparison of this family of utility function with others.

[2] There is no time subscript on loans because they are intragenerational, and therefore are only made at time t. There are no subscripts or superscripts on p, since there is only one price for a parcel of PRRE. This convention is followed as other variables are introduced.

We assume perfect foresight, in that a young agent knows the next period values of their endowment, the price of PRRE, and its dividend, d.[3] For simplicity, we assume that the latter is constant. The interest rate is r(t). The equation says that an old agent's consumption is funded by their endowment, the repayment of principal and interest on loans made when they were young, and the recovery of the purchase price, the capital gains, and the dividends earned on PRRE purchased when young and sold when old.

The model is assumed to be of the Samuelson class,[4] so the endowment of the young is greater than that of the old. In conjunction with the utility function, this implies that consumption smoothing is the motivation for intertemporal transfers through either loans or PRRE.

Solving (2) for loans, $\ell^i(t)$, and substituting them out of (3) yields the intertemporal budget constraint of agent i:

$$\begin{aligned} &v_t^i(t+1)+[1+r(t)]v_t^i(t)= \\ &c_t^i(t+1)+[1+r(t)]c_t^i(t)-a^i(t)\{p(t)+[p(t+1)-p(t)]+d-[1+r(t)]p(t)\} \end{aligned} \tag{4}$$

The last term on the right leads to an arbitrage condition. If the term in braces is positive, agents are best off holding no land at all. If it is negative, each agent is best off if they attempt to hold all the land in the economy. Neither condition is reasonable in equilibrium, leading to the aggregate arbitrage condition that the term in braces must be zero in equilibrium:

$$r(t)=\frac{p(t+1)-p(t)+d}{p(t)} \tag{5}$$

This says that the rate of return on a loan must equal the income earned on PRRE (capital gains and dividends) divided by the purchase price. In turn, this allows us to simplify the intertemporal budget constraint of agent i to:

---

[3] This is interpreted as the services that housing delivers, in contrast to the capital gains one can earn from housing.
[4] See Farmer [1993] for a discussion.

$$v_t^i(t+1)+[1+r(t)]v_t^i(t)=c_t^i(t+1)+[1+r(t)]c_t^i(t) \tag{6}$$

This says that the future value of endowments must equal the future value of consumption.

Loans in this model are net: positive values of $\ell^i(t)$ indicate loans, while negative values indicate borrowing. All loans are intertemporal and intragenerational; that is, the young loan to each other for repayment next period when the parties to the loan are old. Market clearing requires that the aggregate of loans must be zero, and since loans and PRRE are the only way to save, the aggregate of what is not consumed when young must equal the aggregate purchase price of land:

$$\sum_{i=1}^{i=m+n} v_t^i(t)-c_t^i(t)=p(t)\sum_{i=1}^{i=m+n} a^i(t) \tag{7}$$

This condition ties the individuals' decisions on consumption together so that at the aggregate level there is a price for PRRE which clears markets.

Maximizing (1) with respect to (6) yields the first order conditions:

$$\frac{1}{c_t^i(t)}-l^i(t)r(t)=0 \tag{8}$$

$$\frac{1}{c_t^i(t+1)}-l^i(t)=0 \tag{9}$$

Here, $l^i(t)$ is the Lagrangian multiplier. The model contains three variables for each of the $m+n$ agents, and three aggregate variables. There are $m+n+2$ equations: (5), (7), and $m+n$ versions of equations (6), (8), and (9). These cannot be solved uniquely for the $m+n+3$ endogenous variables $c_t^i(t)$, $c_t^i(t+1)$, $l^i(t)$, $r(t)$, $p(t)$, and $p(t+1)$. This is a standard result in

overlapping generations modeling.[5] The conventional approach to this situation is to eliminate the variables that exist at one point in time (in this model, $c_t^i(t)$, $c_t^i(t+1)$, $l^i(t)$, and $r(t)$), yielding a comparative dynamic relationship relating the variables that exist at more than one point in time (in this model $p(t)$, and $p(t+1)$). This permits us to make comparative dynamic statements about the evolution of the inflation rate, and how that interacts with the other variables in the model. This yields:

$$p(t+1) = \frac{p(t)\sum_{i=1}^{i=m+n} v_t^i(t+1)}{[-2p(t)\sum_{i=1}^{i=m+n} a^i(t) + \sum_{i=1}^{i=m+n} v_t^i(t)]} - d \qquad (10)$$

One (illustrative) strategy to simplify this is to assume that all agents are identical, and that all PRRE parcels are of size 1. This simplifies (10) to:

$$p(t+1) = \frac{p(t)v_t(t+1)}{[-2p(t) + v_t(t)]} - d \qquad (11')$$

The model is intrinsically dynamic, so this comparative dynamic relationship dictates all future prices as a recursion on current prices. This relationship indicates that prices have two steady states: a source in the positive space, and a sink which is in the negative space (if the dividend is positive) or the positive space (if the dividend is negative). Since prices are not explosive, we assert that observed behavior is divergence away from the source, towards either the sink or a price of zero. Figure 1 shows the behavior of this relationship (not yet available). The horizontal intercept (where $p(t) = 0$) is at the negative of the dividend, d. The vertical intercept (where $p(t+1) = 0$) is at $\frac{dv_t(t)}{w_t(t+1) + 2d}$. The source (where $p(t+1) = p(t)$) is above

[5] Overlapping generations models are more general than representative agent models precisely because they lack one equation, typically a transversality condition.

and to the right of this intercept. From there, prices decline monotonically to zero.[6] The behavior of the other variables can then be inferred by backwards induction: the decay of prices towards zero indicates that interest rates will rise through time, and that as lending becomes more profitable the consumption of the old will rise and that of the young will fall.

2.B. Introducing Tithing

Now, we divide the population of our model into m agents who tithe, and n agents who don't. The behavior of the latter follows that outlined in the previous section. In the spirit of typical microeconomic analysis, we assume that the utility functions of all $m+n$ agents remain identical to that in the previous section: the 'action' is in the constraints those agents face.

Tithing amounts to a voluntary tax on income. In principal, the rate of tithing should be identical across income types, but Dahl and Ransom [1999] point out that in practice it is not. To capture this, we allow four different tithing rates $[t_v, t_i, t_c, t_d]$ corresponding to the four sources of income: endowments, $v_t^i(t)$ or $v_t^i(t+1)$, interest, $r(t)\ell^i(t)$, capital gains, $p(t+1)-p(t)$, and dividends, d.[7]

For a member of a young generation, tithing occurs only out of one's endowment:

$$(1-t_v)v_t^i(t) = c_t^i(t) + \ell^i(t) + p(t)a^i(t) \tag{12}$$

The situation is more complex for a member of the old generation, who may have income from all four sources:

$$\begin{aligned}&(1-t_v)v_t^i(t+1)+(1-t_\ell)r(t)\ell^i(t)+\ell^i(t)+\\&\{(1-t_c)[p(t+1)-p(t)]+\ p(t)+(1-t_d)d(t+1)\}a^i(t) = c_t^i(t+1)\end{aligned} \tag{13}$$

---

[6] At first glance, this result may seem odd, but it follows because the price of an asset is the present value of its future dividends. Present value is calculated as the finite sum of an infinite number of finite and monotonically declining terms. Moving forward through time subtracts the largest value in that sequence from the sum, leaving a smaller sum.

[7] Dahl and Ransom [1999] show no evidence that the rate of tithing on dividends from PRRE is different from others. However, this stands to reason since most of these dividends are probably not paid in cash.

The intertemporal budget constraint is then:

$$\begin{aligned}&(1-t_v)v_t^i(t+1)+[1+r(t)-r(t)t_\ell](1-t_v)v_t^i(t)=\\&c_t^i(t+1)+[1+r(t)-r(t)t_\ell]c_t^i(t)-\\&\{(1-t_c)[p(t+1)-p(t)]-r(t)(1-t_\ell)p(t)+(1-t_d)d\}d^i(t)\end{aligned} \tag{14}$$

The term on land is the key to understanding the effects of tithing. Rearrangement of that term into a form analogous to the arbitrage condition of the previous section yields:

$$r(t)=\frac{(1-t_c)[p(t+1)-p(t)]+(1-t_d)d}{p(t)(1-t_l)} \tag{15}$$

Four implications can be inferred from this equation.

Proposition 1: if the rates of tithing are identical across the three income sources in (15), then the arbitrage condition is the same for tithers and non-tithers for all choices of tithing rate.

Proof: Setting $t_l = t_c = t_d$ makes all tithing terms cancel from (15), which is then identical to (5).

Proposition 2: even if the rates of tithing are identical across the three income sources in (15), the proportion of tithers in the economy affects the comparative dynamics of an economy.

Proof: the first clause indicates that Proposition 1 holds. This implies that the model will collapse to (5), (7)-(9), and (14). Collapse of this system will yield an equation analogous to (10), except in this case all of the endowments will be multiplied by the uniform tithing rate. Since those will not cancel, the quantitative behavior of the comparative dynamics will change.

Proposition 3: if any of the rates of tithing in (15) is not equal to the other two, then the arbitrage condition will fail for tithers.

Proof: if the first clause of the proposition is true, then the tithing rates will not cancel.

Proposition 4: if any of the income sources in (15) is partially or completely excluded from the tithe, then the arbitrage condition fails for tithers.

Proof: if the first clause of the proposition is true, then the tithing rates will not cancel.

Proposition 1 implies that uniform tithing behavior, in and of itself, does not raise any economically interesting modeling issues. Proposition 2 implies that even though uniform tithing doesn't make modeling anything other than less arithmetically tractable, it still is quantitatively important for describing economic outcomes. However, it isn't clear how empirically important this effect is likely to be: if endowments are large relative to prices, tithing is not likely to change equation (10) much. Propositions 3 and 4 are important because they imply that the subjective decision about what a reasonable tithing rate is, and the base upon which the tithe is applied are critical to understanding whether tithing has more serious implications for modeling, and therefore potentially unintuitive economic effects. To be precise, the religious doctrine of tithing is not (terribly) economically important in this model, but the personal choice of tithing rates and bases is important.

This last observation is particularly important because of the evidence in Dahl and Ransom [1999] that t_c is likely to be smaller when averaged across all CJCLDS members than the tithing rates on other assets. Imposing this empirical observation on our theoretical model implies that rates of return on primary residential real estate will be perceived to be higher by CJCLDS members *ex post*.

Within the confines of the model this implies, assuming that CJCLDS members are not widespread and organized enough to exert market power, that it is optimal for a CJCLDS member to invest all of their funds in PRRE. In fact, since income is potentially unbounded if the arbitrage condition doesn't hold, it would make sense for a CJCLDS member to borrow on margin to obtain additional PRRE. Further, there are clear opportunities for – what is in essence - short-selling to be profitable.[8]

Why is this not observed? One casual observation indicates that areas in which CJCLDS members predominate are not covered with sprawling mansions.[9] A second observation is that the higher rate of return accessible to the CJCLDS member who does not tithe on capital gains is not likely to be information an individual would wish to make public.

2.C. A Model With Tithing

The behavior of tithers within the model is – at this juncture – insufficiently constrained. Agents who tithe are not constrained by (5) which is *ex ante* for them – they are interested in the rates of return they get after tithing, which they only recognize *ex post*.

To constrain the behavior of tithing agents within the model, we assume that CJCLDS members are societally constrained from owning excessively large primary residences:

$$a^i(t) = \bar{a}, \text{ for all agents 1 through m} \qquad (16)$$

This is not an inequality in practice, but since there is no *ex post* arbitrage restriction in the model, we will proceed as if it is an equality.

The budget constraint of a young tither now becomes:

---

[8] For example, a tither could 1) take out a loan for a non-PRRE asset purchase, 2) sell that asset to obtain cash (and thereby avoid paying a tithe on any income generated from that asset), 3) invest the cash in PRRE, 4) cover the interest payments on the loan out of other income sources, and 5) ultimately sell the PRRE and realize capital gains which they have decided are not subject to a tithe.

[9] Anecdotal evidence indicates that this is beginning to change in the Utah county area (*i.e.*, Provo).

$$v_t^i(t) = c_t^i(t) + \ell^i(t) + p(t)\bar{a}(t) \tag{17}$$

The budget constraint of an old tither now becomes:

$$\begin{aligned}&(1-t_v)v_t^i(t+1) + (1-t_\ell)r(t)\ell^i(t) + \ell^i(t) + \\ &\{(1-t_c)[p(t+1)-p(t)] + p(t) + (1-t_d)d(t+1)\}\bar{a}(t) = c_t^i(t+1)\end{aligned} \tag{18}$$

Collapsing those two budget constraints yields the intertemporal budget constraint for a tither:

$$\begin{aligned}&(1-t_v)v_t^i(t+1) + [1+r(t)-r(t)t_\ell](1-t_v)v_t^i(t) = \\ &c_t^i(t+1) + [1+r(t)-r(t)t_\ell]c_t^i(t) - \\ &\{(1-t_c)[p(t+1)-p(t)] - r(t)(1-t_\ell)p(t) + (1-t_d)d\}\bar{a}(t)\end{aligned} \tag{19}$$

A non-tither still must obey (5) and maximize (1) with respect to (6) to obtain the first order conditions (6), (8), and (9). Alternatively, a tither must obey (16), and maximizes (1) with respect to (19) to obtain first order conditions (19) and those analogous to (8), and (9).

Solution of the model is not yet written up.

3. Empirical Results

While the CJCLDS has an international presence, the U.S. intermountain west is the only area in which its members commonly are a majority or significant plurality of the population. While widely associated with Utah, large population percentages of CJCLDS members are common from eastern Idaho, through Utah, southern Nevada, southwestern California, and northern Arizona.[10] Because of the history of emigration from the U.S., and implicit segregation within the U.S., it is common in this region to find pairs of contiguous and otherwise similar

[10] It is not commonly known that the CJCLDS is not predominant in much of eastern Utah.

communities,[11] one of which is predominantly CJCLDS, and one which is not.[12] Our intention is to form a matched pairs sample from these communities.

Data on membership in religious groups is available on a county by county basis. Further, we expect to be able to obtain data from the CJCLDS regarding the size of church wards in various localities.

Our model is not detailed enough to make predictions for tithing rates that differ across individuals, so it is not necessary for us to obtain data at this level of detail.

Currently, we are considering three methods for obtaining financial data to test our model. Our main stumbling block here is that Utah does not require that the financial details of real estate transactions be made public.

One possibility is to use county level assessment data. The advantage of this is that it is publicly accessible. The disadvantages are that it must be obtained county by county. Obviously, assessment data is not ideal because of its well known biases, however, our use of matched pairs will tend to mitigate this, since we can select pairs from the same county that will be subject to the same biases.

A second possibility it to conduct a survey. The advantage of this is that we will have a random sample. The disadvantages are the cost of putting the survey together, and the fact that biases in individual answers will need to be modeled.

A third possibility it to obtain proprietary real estate data detailing transactions. The advantage of this is accuracy, and the disadvantage is cost.

---

[11] An important determinant of our ability to find pairs is the fact that for much of its history the CJCLDS frowned upon members undertaking certain occupations (*e.g.*, mining). So, it is common to find a predominantly agrarian CJCLDS community nearby a predominantly non-CJCLDS railroad or mining community.

[12] Some examp les are Farmington and Roy in Utah, or Panaca and Caliente in Nevada. Their diversity may make analysis more problematic, but Provo and Ogden developed along these lines as well.

The current status of data collection is as follows. We have obtained some assessment data, and are cross-tabulating it with church membership data. We are also in the process of obtaining some proprietary real estate agent data, but we are unsure of its quality. Lastly, we have applied to the Provost's office at Southern Utah University for a research grant to fund a small pilot survey. We intend to use the results of that survey to justify a larger grant from a national funding agency.

4. Conclusions

This paper develops a dynamic general equilibrium model of an economy in which some agents may tithe. The model suggests that tithing, as a religious doctrine, has economically interesting effects only to the extent that it changes agent's marginal rates of substitution by changing the amount of disposable income they have. However, if the practice of tithing by agents deviates from the doctrine, then there may be more interesting economic implications. In particular, if agents tithe at different rates on different income sources, or if they exclude (even partially) some income sources from their tithe, then tithers will not be constrained by the same arbitrage condition as non-tithers. This is important because evidence already exists in the literature that tithing rates on capital gains on primary residential real estate differ substantially in practice from doctrine.

This modeling difficulty was addressed by assuming that tithers face a social constraint not to over-invest in primary residential real estate that is not shared by non-tithers. The implications of this assumption are still being explored.

5. References

Blanchard, Olivier Jean, and Fischer, Stanley, *Lectures on Macroeconomics*, 1989, MIT Press: Cambridge.

Dahl, Gordon B., and Ransom, Michael R., "Does Where You Stand Depend on Where You Sit? Tithing Donations and Self-Serving Beliefs," *American Economic Review*, 1999, 89, 703-27.

Farmer, Roger, E. A., *The Macroeconomics of Self-Fulfilling Prophecies*, 1993, MIT Press: Cambridge.

McCandless, George, T. Jr., and Wallace, Neil, *Introduction to Dynamic Macroeconomic Theory*, 1991, Harvard University Press: Cambridge.