Research Background Paper

Measuring Savings

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Abstract
Development depends on saving. But what exactly is saving, and how is it measured? This paper defines saving and describes several measures of financial savings. The measures account for the passage of time and for the three stages of saving: putting in (depositing), keeping in (maintaining a balance), and taking out (withdrawing). Together, the different measures capture how people move financial resources through time.

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MEASURING SAVINGS

1. INTRODUCTION

Production requires natural resources, tools, and human capital. These factors of production come from saving, the choice to move resources through time rather than to use them up now. Without saving, people are hunters and gatherers who live hand-to-mouth. With saving, people can build steadily on the past to improve the future. In short, saving drives development and progress.

Although saving is required for long-term improvement in well-being, measures of savings are rudimentary. For example, the most important form of savings is human capital (Schultz, 1979), but measures of the quantity of human capital such as age, education, or job experience are—at best—oblique proxies. Measures of quality are also imperfect and usually boil down to wages, a proxy available only for people who work for pay.

Measuring financial savings is more straightforward. Dollars are quantified, have uniform quality, and change forms at known times. Even if measuring financial savings is simple in relative terms, however, it is still complex in absolute terms.

How to measure saving? And what is saving in the first place? This paper proposes a definition—saving is the movement of resources through time—and a series of measures that account for the passage of time and for the three stages of saving: putting in (depositing), keeping in (maintaining a balance), and taking out (withdrawing). The specific context is measuring financial savings in the Children and Youth Savings Account Policy Demonstration (CYSAPD), but the concepts are general. Better measurement may help policymakers to design better savings incentives. This matters because savings incentives cost billions each year because savings is central to development (Sherraden, 1991).

The paper proceeds as follows. Section 2 defines saving and other basic concepts. Section 3 proposes a series of measures of financial savings in CYSAPD. Section 4 discusses issues in measuring changes in savings caused by the CYSAPD. Section 5 wraps up.

2. Basic concepts

This section defines saving, discusses the three stages of saving, and explains why measures of saving must account explicitly for time.

2.1 Income, assets, saving, and asset accumulation

Resources received in a given time period are income; resources controlled at a point in time are assets. Both income and assets refer to resources; they differ only in the frame of reference. If resources received as income are not immediately consumed, then they become assets.

Moving resources through time is saving. The definition includes both conscious and unconscious failure to consume. For example, people with cash might make bank deposits rather than buy hamburgers, fail to withdraw existing bank balances to buy hamburgers, or use so little petroleum that reserves are left unexploited. Most people would recognize only the first example as saving, but all three examples move resources through time.

The use of resources (consumption) is dissaving. If, in a long time frame, saving exceeds dissaving, then the result is asset accumulation.

Everyone saves, and everyone dissaves. For example, a person may use a paycheck to pay bills over time. The person first saves (even if the check is not immediately deposited or cashed) and then dissaves. From a high-frequency view (pay-day until the next day, for example), almost all income is saved, and almost all assets are soon dissaved.

Asset accumulation occurs if saving consistently exceeds dissaving. Slivers of differences in high-frequency behavior can produce large differences in asset accumulation. For example, suppose that two people each earn $100 per day but that one saves $2 more per day. With a 3 percent annual return, the difference in asset accumulation in 20 years is about $20,000.

Furthermore, accumulation gaps tend to grow because assets beget assets (Schreiner et al., 2001). That is, greater assets—be they physical, social, financial, or human—lead to greater production, greater income, and thus greater resources. Once assets put someone ahead, she tends to stay ahead.

2.2 Stages of financial saving

Moving dollars through time is financial saving. Financial saving has three stages. The first is "putting in". This changes non-financial resources into dollars or—when "putting in" means "depositing"—changes cash into account balances. Although many people equate "depositing" with "saving", saving is far broader.

The second stage of financial saving is maintaining balances, or "keeping in". Although not always recognized as saving, failure to consume assets does move resources through time.

The third stage is "taking out". Resources "taken out" may be consumed (dissaved) or kept in another form (saved). For account balances, "taking out" means making withdrawals.

Each stage is a distinct aspect of financial saving. Savings might be high in one stage but low in another, so measurement should look at all three stages. For example, savers with large deposits may have high savings in terms of "putting in", but, if they make quick withdrawals, they may have low savings in terms of "keeping in". Likewise, savers with low deposits might nonetheless maintain balances for a long time. Finally, savers with high savings in terms of "putting in" and/or "keeping in" might—if withdrawals are consumed rather than converted to other assets—have low savings in terms of "taking out".

Measurement should cover all three stages because a narrow focus on one or two stages would miss some facets of behavior. For example, when workers switch jobs, about half of the number of distributions from 401(k) plans are not rolled into other retirement plans (Samwick and Skinner, 1997; Poterba, Venti, and Wise, 1995). What does this mean for saving? For "taking out", about half the non-rollover is kept as assets in some form. For "putting in", people who do not make rollovers usually had smaller deposits. For "keeping in", most people who do not make rollovers are young and have small balances. Measures of savings that omit stages miss important parts of the story.

2.3 Saving and time

Saving moves resources through time, so measures of financial savings must refer explicitly to time. (For example, "deposits per month" refers to time, but "balance" does not.) Changes in resources in a period of time are flows, and resources at a point in time are stocks. Stocks and flows describe two stages of financial saving, "putting in" as flows of deposits and "taking out" as flows of withdrawals (or stocks of balances to be withdrawn later).

Stocks and flows, however, describe "keeping in" inadequately. Measuring the resources held through time requires a "flowified stock". With units of dollar-months, such a measure is the Average Balance.

For example, suppose a saver in the CYSAPD deposits $10 on the first of the month for a year and withdraws it all for consumption at year's end. What is CYSAPD savings? Deposits "put in" are $120; withdrawals "taken out" are zero. The average balance "kept in" is 65 dollar-months. That is, the saver moved resources through time equivalent to $65 per month.

3. Measures of financial savings

This section describes measuring savings with explicit reference to time and to all three stages of financial savings. The formulae are in terms of monthly deposits and withdrawals. They are framed in terms of CYSAPD accounts, but they would apply just as well to Individual Development Accounts (IDAs), Individual Retirement Accounts (IRAs), or 401(k) plans.

3.1 Savings measures

3.1.1 Sources of deposits

CYSAPD deposits have four sources. The first are participants, the second are interest payments, and the third are friends and family. In CYSAPD, deposits by family and friends are acknowledged and encouraged. While rarely discussed, friends and family also contribute to IDAs, IRAs, and 401(k) plans.

The fourth source of CYSAPD deposits are third parties beyond family or friends. Just as employers can contribute to 401(k) plans, third parties can contribute to CYSAPD accounts. Although participants do not own matches until they make a matched withdrawal, they do own third-party deposits from the moment of deposit.

Although third-party deposits may be rewards for participant tasks (such as completion of a year of school), from the point of view of the participant, their presence and size are arbitrary. For example, a CYSAPD program might reward attendance at financial education with a third-party deposit of $100 or $1,000. Thus, the size of third-party deposits in a CYSAPD account depends on program donors. In contrast, participants choose whether resources from third-party deposits are kept in the account and whether they are converted to other assets upon withdrawal. Thus, third-party deposits are not counted for measures of "putting in" but are counted for measures of "keeping in" and "taking out".

3.1.2 Gross deposits

Gross Deposits in a CYSAPD account by saver i in month t are denoted as g_{it}. (From now on, the subscript i is suppressed.) Gross Deposits include both Own Deposits o_t (from the participant, from interest, and from family and friends) and Third-Party Deposits q_t:

$$g_t = o_t + q_t.$$

The measure of saving as "putting in" excludes Third-Party Deposits. The sum of Own Deposits through month t is Cumulative Own Deposits O_t:

$$O_t = \sum_{j=1}^{t} o_j.$$

Cumulative Own Deposits O_t should not be compared across people at different stages in participation. To account for time as a participant, use Own Deposits per Month $\overline{O_t}$:

$$\overline{O_t} = \frac{O_t}{t}.$$

The principal measure of saving should not be the first step of "putting in". First, CYSAPD (like other saving incentives) matches deposits only up to the annual cap c. Excess deposits are still savings, but they are not CYSAPD savings. (To keep formulae simple, this paper ignores excess deposits.) Second, deposits may be withdrawn to finance consumption or other forms of assets. Third, people might treat CYSAPD like a checking account, making frequent deposits and withdrawals without plans for long-term accumulation. This churning leads to high "putting in" but low "keeping in" and low "taking out". The best measures look at deposits and withdrawals together.

3.1.3 Withdrawals

Gross Withdrawals w_t are Matched Withdrawals m_t (approved for incentives) plus Unmatched Withdrawals u_t (unapproved for incentives):

$$w_t = m_t + u_t.$$

CYSAPD has two types of withdrawals because—as in IDAs, IRAs, and 401(k) plans—only some uses of savings qualify for incentives. For purposes of measurement, a further assumption is that unmatched withdrawals are consumed but matched withdrawals are converted into other forms of assets.

Cumulative Unmatched Withdrawals U_t measure resources "taken out" of CYSAPD and assumed consumed:

$$U_t = \sum_{j=1}^{t} u_j .$$

Cumulative Matched Withdrawals M_t measures resources "taken out" of CYSAPD and assumed converted into other of forms of assets:

$$M_t = \sum_{j=1}^{t} m_j .$$

As a measure of saving, matched withdrawals "taken out" is useful but incomplete. First, at a given point in time, some matched withdrawals have yet to happen. Second, resources are fungible, so it is pure assumption that people save all matched withdrawals and consume all unmatched withdrawals.

3.1.4 Participant accumulation

Participants may accumulate three forms of resources through CYSAPD. The first are balances that may be "taken out" in future matched withdrawals. The second are resources already "taken out" in matched withdrawals and assumed converted to assets in another form. The third are matches.

Account balances and matched withdrawals are "kept in" by participants and so are included the measure of Participant Accumulation P_t. Matches are excluded because they do not come from the participant. Assuming that the match cap never binds, Participant Accumulation P_t is Cumulative Own Deposits O_t minus Cumulative Unmatched Withdrawals U_t:

$$\begin{aligned} P_t &= O_t - U_t , \\ &= \sum_{j=1}^{t} o_j - u_j . \end{aligned}$$

Accumulation depends on the length of participation. To control for this, divide Participant Accumulation by months to get Participant Accumulation per Month $\overline{P_t}$:

$$\overline{P_t} = \frac{O_t - U_t}{t} .$$

Participant Accumulation per Month shows how fast resources accumulate. (Schreiner et al. (2001) and Sherraden et al. (2000) call this measure "average monthly net deposits".) It is a better measure of savings than Own Deposits per Month because it accounts for unmatched withdrawals. It is better than Cumulative Matched Withdrawals because it counts both matched

withdrawals and balances that may yet be matched. And it is better than Participant Accumulation because it controls for the length of participation. Participant Accumulation per Month is the best summary measure of participant saving in the stages of "putting in" deposits and "taking out" withdrawals.

3.1.5 Total accumulation

For two reasons, participant accumulation does not include the match itself. First, participants do not own the match until after a matched withdrawal. Second, the match rate is determined not by the participant but by the program. If participant accumulation included the match, then arbitrary program choices would affect measures of participant behavior.

Although Participant Accumulation before matched withdrawals should not include the match, Total Accumulation A_t after matched withdrawals should. Participant Accumulation P_t, plus any matches at match rate Δ:

$$A_t = P_t + M_t \cdot (1 + \rho).$$

Total Accumulation is useful as a measure of assets built through CYSAPD after all stages of financial saving are completed. It includes deposits from third parties.

3.1.6 Dollar-months saved

Suppose two people join CYSAPD on January 1. The first deposits $10 on the first day of each month for a year, and the second makes a single deposit of $120 on December 1. Neither makes any withdrawals. Who saved more?

Although intuition suggests that the slow-and-steady person saved more, the savings measures described so far are identical for each saver. Each has Cumulative Own Deposits of $120, Own Deposits per Month of $10, Cumulative Unmatched Withdrawals of 0, Cumulative Matched Withdrawals of $0, Participant Accumulation of $120, Participant Accumulation per Month of $10, and Total Accumulation of $120.

The measures are the same because they look at only the "putting in" and "taking out" stages and ignore the "keeping in" stage. Measuring the movement of resources through time requires a "flowified stock" such as the sum of
Participant Accumulation P_t in all months, Dollar-Months Saved, D_t:

$$\begin{aligned} D_t &= \sum_{j=1}^{t} P_j, \\ &= \sum_{j=1}^{t} \sum_{k=1}^{j} o_k - u_k. \end{aligned}$$

In the example, the first person saved $780 dollar-months: 10 dollar-months in the first month, 20 dollar-months in the second month, and so on. The second person saved 120 dollar-months, all in December. Consistent with intuition, Dollar-Months Saved suggests that the first person saved more.

Dollar-Months Saved distinguishes between the two savers because it looks at both size and timing of deposits and withdrawals and thus accounts for "keeping in". Other measures look at only size via "putting in" and "taking out".

Dollar-Months Saved is especially useful for savers who make unmatched withdrawals. Drop-outs are the extreme; all their deposits become unmatched withdrawals. Savings measures that ignore "keeping in" show zero savings for resources once removed as unmatched withdrawals. Even drop-outs, however, moved some resources through time, and Dollar-Months Saved reflects this.

3.1.7 Dollar-months per month

Comparisons of Dollar-Months Saved between savers work best when both have participated for the same length of time. One approach is to divide by t by months of participation to get Dollar-Months per Month, $\overline{D_t}$:

$$\overline{D_t} = \frac{D_t}{t}.$$

This is just the average balance. The term Dollar-Months per Month is preferred because it shows better that the measure is a "flowified stock".

3.1.8 Dollar-months saved ratio

Dollar-Months per Month still depends on the length of participation. For example, saving $10 a month for one year gives an average balance of $65, but saving $10 a month for two years gives an average balance of $125. Another way to control for length of participation is to compare actual Dollar-Months Saved with Dollar-Months Saved if deposits were c/12 each month. (These equal-sized monthly deposits would just add up to the annual match cap c.) This is the Dollar-Months Saved Ratio, $\overline{D_t^r}$:

$$\overline{D_t^r} = \frac{D_t}{\sum_{j=1}^{t}\sum_{k=1}^{j}\frac{c}{12}},$$

$$= \frac{D_t \cdot 24}{c \cdot t \cdot (t+1)}.$$

In Figure 1, the Dollar-Months Saved Ratio is the area under line A (D_tA24) to the area under line B ($cAtA(t+1)$). In the figure, the ratio is 0.600. With no excess deposits, the maximum rate is 2.000 (a single deposit in the first month of (tAc)/12). The minimum rate of 0.000 obtains if there are never any deposits. The rate is 1.000 if the pattern of size and timing of cash flows

produces Dollar-Months Saved equal to what Dollar-Months Saved would be with deposits of c/12 each month. (A rate of 1.000 is possible even if deposits are not c/12 each month. For example, someone with a match cap of $120 might deposit 0 in month 1 and $30 on the first day of month 2.)

In the example with two savers, suppose the annual match rate c is $120. The slow-and-steady saver saved $10 a month, exactly the amount to reach the match cap at year-end. Accordingly, the Dollar-Months Saved Ratio is ($780A24) / ($120A12A13) = 1.000. The ratio for the saver who made only one deposit of $120 in December is much lower, ($120A24) / ($120A12A13) = 0.154.

3.1.9 Summary

Why bother with so many savings measures? First, the effects of asset use (such as a down payment on a house) depend on Total Accumulation. In turn, Total Accumulation depends on the match rate and on Participant Accumulation and thus on length of participation and Participant Accumulation per Month. This means measuring "putting in" and "taking out".

Second, the social/psychological/behavioral effects of asset ownership—what Sherraden (1990) calls "asset effects"—depend on moving resources through time. When people think about their assets and how they will use them—when they savor their savings—they may be happier and make better choices (Schreiner et al., 2001). A measure of asset ownership is months of participation t, and a measure of the amount of assets "kept in" is Dollar-Months Saved.

3.2 Accumulation comparisons

This section describes measures that compare Participant Accumulation with two benchmarks, income and the match cap.

3.2.1 Savings rate

Deposits as a share of income is the savings rate. This traditional term is a misnomer; most savings in a period come not from newly acquired resources but existing assets left unconsumed. Also, most participants have non-CYSAPD savings, so the measure here is really the CYSAPD savings rate.

Participant Accumulation per Month $\bar{P}_t$ (annualized) as a share of annual income y is the savings rate, $\bar{r}_t$:

$$\bar{r}_t = \frac{\bar{P}_t \cdot 12}{y}.$$

The difficulty is measuring income. As defined earlier, resources received in a period are income. Income is thus more than just financial resources; for example, the main form of income for most people is time to live. This paper, however, follows convention and counts as income only financial inflows.

Still, some issues remain. Should income include in-cash public assistance? What about in-kind public assistance? Although public assistance is indeed part of income, it is very difficult to measure. Thus, this research, like almost all other work, does not include it in the measure of income.

Should measures use gross income, adjusted gross income, or after-tax income? As new disposable resources, the best measure is after-tax income.

Should income be measured for the month prior to enrollment, for the 12 months prior to enrollment, or for the prior tax year? Because income fluctuates from month to month and because there are no official 12-month records of income, measurement should use tax returns for the year prior to enrollment.

3.2.2 Match use

Do participants save all the way up to the match cap? Participant Accumulation P_t divided by the pro-rated match cap is Match Use, $\overline{X_t}$:

$$\overline{X_t} = \frac{P_t}{(c \cdot t)/12}.$$

Match Use shows the pace of saving relative to potential matching. Someone on pace to use exactly all match eligibility has a ratio of 1.000. Someone behind (ahead) of this pace is below (above) 1.000.

3.3 Deposit consistency

Savings incentives like CYSAPD aim to promote asset accumulation and savings habits. Although there is little hard evidence, many people believe that consistent savers both become better savers and accumulate more. This section presents two measures of deposit consistency, one that focuses on the presence of monthly deposits and one that focuses on the size and timing of deposits.

3.3.1 Deposit frequency

The share of months with a deposit is Deposit Frequency, $\overline{f_t}$. (Interest is not counted; otherwise, all months would have a deposit.) If the function $I(o_t)$ is unity if Own Deposits o_t is positive and zero if o_t is zero, Deposit Frequency is:

$$\overline{f_t} = \frac{\sum_{j=1}^{t} I(o_j)}{t}.$$

Higher frequencies indicate greater consistency. If a saver makes a deposit in all months (maximum frequency), then Deposit Frequency is 1.000. The minimum (with no deposits) is 0.000.

The strength of Deposit Frequency is its simplicity. This is also its weakness; the measure is the same whether someone deposits $10 each month or $1, $19, $15, and then $4. This weakness may be unimportant if, for learning to save, what matters is not the size of the deposits but its mere presence.

3.3.1 Deposit entropy

A measure of the distribution of deposits—size and timing—is Deposit Entropy, $\bar{e}_t$. (As above, interest is excluded.) Based on the classic entropy measure (Golan, Judge, and Miller, 1996), Deposit Entropy is closer to zero as deposits are more concentrated (less consistent) and is closer to unity as deposits are more uniform (more consistent). The formula is:

$$\bar{e}_t = 1 + \left(\frac{1}{\ln t}\right) \cdot \sum_{j=1}^{t} \bar{o}_j \cdot \ln \bar{o}_j,$$

$$\text{where} \quad \bar{o}_j = \frac{o_j}{\sum_{k=1}^{t} o_k}.$$

The weaknesses of entropy is its newness and its difficult-to-interpret units. For example, 0.8 is a more-uniform deposit pattern than 0.6, but the precise meaning of the 0.2 difference is not clear.

The strength of entropy is that it summarizes the entire distribution of deposits. Unlike other summary measures of the uniformity of distributions (such as variance or coefficient of variation), entropy is bounded between zero and unity and depends only on the shape of the distribution, not the "height".

For example, suppose a saver deposits $10 and $20. The deposit shares are $\bar{o}_1 = 10/30 = 0.333$ and $\bar{o}_2 = 20/30 = 0.666$. Deposit Entropy is then:

$$\bar{e}_t = 1 + \left(\frac{1}{\ln 2}\right) \cdot (0.33 \cdot \ln 0.33 + 0.66 \cdot \ln 0.66) = 1 + 1.443 \cdot (-0.637) = 0.082.$$

For comparison, the variance is $[(10!15)^2+(20!15)^2] / 1 = 50$. With a mean of (10+20) / 2 = 15, the coefficient of variation is 50 / 15 = 3.33.

What if deposits were $1 and $2? Deposit Entropy is unchanged, as only "height" changes, not shape. The variance and coefficient of variation, however, are now 0.5 and 0.33. Unlike these two summary measures of distribution, entropy is invariant to units.

4. Measuring Impacts in CYSAPD

Measuring impact in CYSAPD is straightforward, the difference in average outcomes between treatment and control groups. But what outcomes to measure? In CYSAPD, the central outcomes are Participant Accumulation and Total Accumulation in the name of the child or youth. Dollar-Months Saved—because of its links with "asset effects"—is also an important outcome.

4.1 New savings and asset shifts

Deposits in CYSAPD come from two sources (Schreiner et al., 2001). The first is an increase in difference between income and consumption, or new saving. New saving comes from increased income (through increased time or effort in work) and/or from decreased consumption. The second source of deposits is a reshuffling of already-saved resources, or asset shifts. There are two types of asset shifts. In the first, already-saved resources (for example, existing balances in a checking account) are moved to CYSAPD. In the second, resources that would have been saved anyway are put in CYSAPD.

Savings programs—be they CYSAPD, IDAs, IRAs, or 401(k) plans—aim both to increase new saving and to increase asset accumulation. These two goals are sometimes conflicting, sometimes complementary. (CYSAPD also has non-financial goals, but reaching them presumably requires financial success.) Savings incentives—for example, matches—reward new saving and boost asset accumulation. These same incentives, however, also attract asset shifts. After all, it may be easier to convert resources saved in the past to CYSAPD balances than to increase current income and/or decrease current consumption.

4.2 Asset accumulation in CYSAPD

Impact measurement for asset accumulation in CYSAPD focuses on two outcomes, Participant Accumulation and Total Accumulation. As argued below, both take the point of view of the child or youth. Participant Accumulation tells how much resources were put in the CYSAPD account by participants, family, and friends and either kept in or taken out as matched withdrawals. Total Accumulation adds third-party deposits and matches and so measures all asset accumulation that occurs through the CYSAPD account. It is useful to measure accumulation both with and without third-party deposits and matches because they do not depend completely on participant behavior.

4.3 New Savings

What about new savings? Participant Accumulation is not likely all new savings, and Total Accumulation certainly is not. Measuring new savings requires measuring differences in net worth between treatments and controls. (With an experimental design, this requires not "before-and-after" measures, just "after" (Schreiner, 2000)).

Measuring net worth requires measuring total assets and liabilities. This is a tall order, and it may be even more difficult than usual in CYSAPD because a large share of deposits may come from beyond the household, for example, from uncles or grandparents. Thus, measuring new savings due to CYSAPD would require measuring net worth for all family and friends who might contribute.

This is probably impossible. What to do? One option is to assume that family or friends outside the immediate household do not make CYSAPD contributions. Then measuring net worth requires only measuring total assets and liabilities in the participant's household. This is the approach adopted in experimental component of the American Dream Demonstration (ADD) of IDAs.

A second option is to look only at impacts on assets kept in the name of the participant. That is, CYSAPD may be less interested in new savings by all potential contributors than in new savings for the child or youth. Then the question is whether family and friends shift to CYSAPD gifts that they would have made to the participant anyway. For example, grandparents who would buy educational savings bonds for their grandchildren anyway might instead put the resources in CYSAPD. Likewise, parents might spend less on books or computers to free up resources to put in CYSAPD.

This approach attempts to finesse the quagmire of measuring net worth for all possible contributors, substituting measuring only assets in the name of the CYSAPD participant. Granted, the approach does not measure impacts on total net savings caused by CYSAPD; it only measures impacts on net savings in the name of the participant. This assumes that CYSAPD does not care about asset shifts if they lead to greater assets in the name of the child or youth. Evaluators must judge whether this is an acceptable compromise.

4.5 Asset effects

Asset effects depend not on resource use but on resource ownership. If all CYSAPD did were help children and youth to consume more, then it would resemble traditional transfer programs. But CYSAPD aspires to much more; in any case, in the space of the demonstration, very few participants will reach an age when they can use CYSAPD resources.

Thus, CYSAPD will not increase resource use by participants during the demonstration; in fact, because CYSAPD encourages saving, resource use will probably decrease. Thus, any non-financial effects will depend on how ownership of financial resources—as opposed to use—changes behavior. Measuring non-financial impacts will require measuring how different levels of outcomes are associated with different levels of ownership.

How to measure ownership? Two key dimensions are presence and amount. The mere fact of accumulation, regardless of amount, may affect non-financial outcomes. A simple measure of the extent of the presence of ownership in CYSAPD is months of participation, t. (ADD suggests that few participants ever carry zero balances, so participation is a very good proxy for ownership.)

The amount of accumulation may also affect non-financial outcomes. A measure is Dollar-Months Saved, D_t. If one person has $100 in CYSAPD for one year and a second person has $50 for four years, Dollar-Months Saved reflects that the second person owned more resources through time.

Because greater resource ownership eventually leads to greater resource use, few (if any) studies untangle their distinct forces. Because CYSAPD participants will not use their accumulations until after the demonstration ends, CYSAPD presents a unique chance to measure the effects of ownership untainted by the effects of use that ownership eventually confers.

5. Conclusion

This paper defines saving as moving resources through time. Saving has three stages: putting in, keeping in, and taking out. Each stage matters because some participants save more in one stage than in another. For example, both participants and third parties put in deposits in CYSAPD, and measurement should distinguish among these two sources (both distinct from matches). Also, some participants (drop-outs in particular) keep resources in CYSAPD that are eventually consumed. Finally, CYSAPD aims to increase accumulation through converting resources taken out to assets in other forms.

The basic measure of resources put in by participants is Own Deposits per Month. The measure Participant Accumulation per Month recognizes that some deposits are consumed and that different people have different lengths of participation. To measure resources kept in CYSAPD through time, use Dollar-Months Saved or the Dollar-Months Saved Ratio. The Savings Rate compares Participant Accumulation with income, and Match Use compares Participant Accumulation with the match cap. Savings consistency is indicated by Deposit Frequency and Deposit Entropy.

Participants will not convert their CYSAPD resources to other forms of assets during the life of the demonstration. Thus, any non-financial effects must derive not from asset use but from asset ownership. A measure of the extent of the presence of ownership is the length of participation, and a measure of the amount of resources owned is Dollar-Months Saved.

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Figure 1: The Dollar-Months Saved Ratio