Feed-the-Dog Design Notes

June 15, 2012

Description

Introduction

Motivation: The purpose of the experiment is test the consumption-savings predictions of the exponential-growth bias (EGB) model. This is something that is difficult to directly identify in the field. In the lab we can isolate exponential perceptions from the confounds of risk and preferences. Although EGB can be identified more directly as was done in our previous studies, it is not necessarily true that EGB will manifest as the theory predicts in a consumption-savings decision. More specifically, there are three predictions that we wish to test: people will overconsume early in life (under the right conditions), overconsumption is exacerbated when income is received later.

Overview: To address these predictions we can run a three-armed experiment. The static arm is akin to the strategy method and will give the best data for estimating α. The dynamic arm is more akin to the action method and hence adds cognitive realism, and feedback that is not present in the static arm.

All three arms will begin with instructions, followed by several training rounds, and then commence with the main experiment. Within each arm, the main experiment will have three life-cycles, each of which with different income streams: $\vec{y} \in \{< y_0, 0, \ldots, 0 >, < y, \ldots, y >, < 0, \ldots, 0, y_T >\}$.

All experiments are meant to take place using a web interface but will be run in the lab summer 2012.

Static Arm

Subjects receive instructions. Let $T = 4$ and $i = 100\%$. Subjects receive an income vector and may borrow and save over time. They are paid based on the number of utils they generate for their dog. Let u^* be the maximum achievable utility from a decision problem. Prior to launching the study, we will simulate random answers to calibrate u^r, the utility achieved by random choice. Payment will then follow a quadratic loss rule, earning \$45 at u^* and \$5 at u^r. They must feed their dog in each period and decide how much to feed. The dog has a homothetic utility function: CRRA with $\gamma < 1$.

Subjects get a trial period in which $T = 4$ and income is $< y, \ldots, y >$. In period t' there is an interest rate $i' > 0$. In all other periods $i = 0$. In the first question they must allocate their wealth across the first four periods. Food is consumed sequentially, so if they allocate too much early on, consumption can potentially be zero in all later periods. In the last period T (the fifth period), the dog eats any remaining food. Subjects are told how much money they would have earned, how much was maximally possible, and what the optimal consumption path would have been. Then subjects face another $T = 4$ problem also with feedback.[1] The purpose of this is to make it clear that consumption smoothing is the way to go and that consumption should be higher in the periods $t > t'$.

The order of the lifecycles is random.

Lifecycle 1: In the first question, subjects face a $T = 5$ problem with $i = 100\%$ in $t = 2$ but not in any other period, and income is $< y_0, 0, \ldots, 0 >$. When they complete their answer they do not get feedback. They then move onto a $T = 4$ problem, then a $T = 3$ problem, then a $T = 2$ problem, and finally a $T = 1$ problem. We need not run these five questions in that particular order but this is at least the most intuitive. Explicitly speaking, the questions are

1. Consumption plan for six periods (0, 1, 2, 3, 4; 5)
2. Consumption plan for five periods (1, 2, 3, 4; 5)
3. Consumption plan for four periods (2, 3, 4; 5)
4. Consumption plan for three periods (3, 4; 5)
5. Consumption plan for two periods (4; 5)

where they are told in every case that period-5 consumption will be deterministically assigned the residual.

At the beginning of each of these questions a new income stream is given and so these questions are essentially independent from the subject's view. However since the dog's utility function is homothetic, the wealth from the income stream has no effect on the optimal consumption path in terms of the proportion of wealth. So theoretically, the behavior in the four conditions, fully predicts behavior in a $T = 5$ lifecycle.

Lifecycle 2: The second lifecycle is identical to the first except the interest rate is $i = 75\%$ in every period.[2] Comparing this to lifecycle 1 gives the effect of EGB. The prediction is that there will be more overconsumption in lifecycle 2. Overconsumption is defined as the consumption in excess of the optimum in early periods (e.g. $t = 0$ and maybe $t = 1, 2$).

[1] Brown, Chua, and Camerer (2012) give helpful but suboptimal advice and people get it about right on the fourth try. They use a different framework though with uncertainty.

[2] If a person has 40 years of labor before retirement, and they face an annual interest rate of 9% then $1.09^(40/6) \approx$ 1.78.

Lifecycle 3: Same as lifecycle 2 except income is $< 0, \ldots, 0, y_0 >$. Comparing this to lifecycle 2 gives the effect of delayed income. Lifecycle 3 has upfront income which should mitigate overconsumption; lifecycle 3 is predicted to have more overconsumption than lifecycle 2.

After the lifecycle questions, subjects answer three "domain 1" exponential questions to diagnose their α.

One lifecycle question is randomly selected to count for payment. Each of the three diagnostic questions receive payment based on accuracy. This design yields a total of 53 responses (8 training questions + 15 per lifecycle and 3 lifecycles).

This arm gives us a lot of data which we can use to estimate α. The homotheticity allows us to create a hypothetical lifecycle and project the magnitude of the financial error. This arm is the best for testing overconsumption and it also gives us a clear depiction of dynamic inconsistency via projected future consumption and actual. Furthermore, within and between comparisons of the effect of the income streams on overconsumption allow us to test the time sensitivity prediction.

Dynamic Arm

In the dynamic arm decisions are made sequentially. Preferences of the dog and the income vectors have the same structure as before.

Subjects get a trial period in which $T = 4$ and income is $< y, \ldots, y >$. In period t' there is an interest rate $i' > 0$. In all other periods $i = 0$. They solve sequentially. They state consumption in $t = 0$. Total assets and liabilities update and they see this on their screen. Then they state consumption in $t = 1$. So on and so forth. At the end of the lifecycle they are told what they would have earned, how much was maximally possible, and what the optimal consumption path would have been. They get to do one more $T = 4$ problems like this with a different interest rate.

The order of the lifecycles is random.

Lifecycle 1: subjects face a $T = 5$ with $i = 100\%$ in $t = 2$ but not in any other period, and income is $< y_0, 0, \ldots, 0 >$. There is no feedback at the end of the lifecycle but they do get an update on their total assets and liabilities over time as they go through the life.

Lifecycle 2: Same as lifecycle 1 except that $i = 75\%$ in every period.

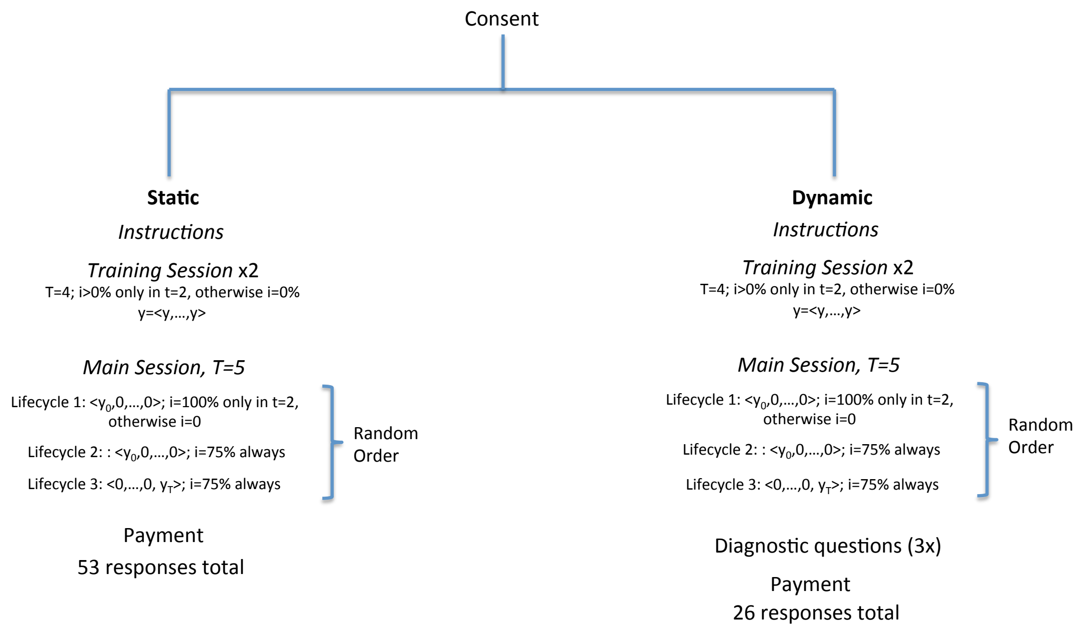
Lifecycle 3: Same as lifecycle 2 except income is $< 0, \ldots, y_T >$.

After the lifecycle questions, subjects answer three 10 diagnostic questions to for independent estimation α.

One lifecycle question is randomly selected to count for payment. Each of the ten diagnostic questions receive payment based on accuracy. This design yields a total of 33 responses (8 training questions + 5 per lifecycle and 3 lifecycles + 10 diagnostic questions).

People will complain that the static arm is too artificial and doesn't provide the dynamic feedback that people receive as they progress through life. The dynamic arm will address this concern. It is more cognitively similar to how people face these sorts of problems in real life.

Figure 1: Flowchart of the Experiment



Comparing the dynamic arm to the static arm reveals the role of feedback. The diagnostic questions will test for the diagnosticity of an alpha measure on lifecycle behavior in the experiment.

Instrument

Consent Form

You are being asked to participate in a research project conducted by Professor Joshua Tasoff in the School of Politics and Economics at Claremont Graduate University (CGU). This research is being conducted with Matthew R. Levy at the London School of Economics.

PURPOSE: The purpose of the study is to examine how individuals make various financial decisions in riskless environments for real monetary stakes.

PARTICIPATION: If you agree to take part, you will be asked to fill out a questionnaire. During the study, we will ask you to choose between receiving different sums of money. The experiment will last about 60 minutes.

SKS & BENEFITS: There are no known risks to you from taking part in this research. As with all research, there is a chance that confidentiality could be compromised; however, we are taking precautions to minimize this risk. There are also no direct benefits other than payment. It is our hope that the research will benefit the scientific community and lead to a greater understanding of individual decision making.

COMPENSATION: You will receive a minimum of $5 if you complete the entire experiment, and an additional payment of between $0 and $45 based on your choices and on chance. The expected combined payment is approximately $27. You will be paid by check made out in your name and mailed to an address of your choice.

PARTICIPATION: Please understand that participation is completely voluntary. Your decision whether or not to participate will in no way affect your current or future relationship with CGU or its faculty, students, or staff. You have the right to withdraw from the research at any time without penalty. You also have the right to refuse to answer any question(s) for any reason, without penalty.

NFIDENTIALITY: Your individual privacy will be maintained in all publications or presentations resulting form this study. All of the information that we obtain from you during the research will be kept confidential. The data will be stored in electronic form. Each person will have their own code number, and no one will posses a list matching codes to names. Your choices will be held confidential at all times and will not be shared with anyone outside of the research team.

If you have any questions or would like additional information about this research, please contact me at 909-621-8460; Professor Joshua Tasoff, Department of Economics, School of Politics & Economics, Claremont Graduate University, Harper E. 204, 170 E. Tenth Street, Claremont, CA 91711; joshua.tasoffcgu.edu. The CGU Institutional Review Board, which is administered through the Office of Research and Sponsored Programs (ORSP), has reviewed this project. You may also contact ORSP at (909) 607-9406 with any questions.

I understand the above information and have had all of my questions about participation on this research project answered. I voluntarily consent to participate in this research.

□ I certify that I am 18 years or older. I have read this consent form and I agree to take part in this research.

General Instructions

Thank you for participating in this experiment. Several foundations fund this research. Please read the instructions carefully. Please do **not** use your browser's "back" button while taking this survey.

Your decisions in this experiment will affect how much money you receive. Just for participating you will receive **$5**. You may earn up to an additional **$45**.

In this game[3] you are tasked with feeding a digital dog. The digital dog is under your care for a certain number of days. You will be allotted bucks at different points which you can use to purchase dog food.

Figure 2: An artist's conception of the digital dog you will be feeding.

Dog: The dog likes to eat. The more the dog eats, the happier the dog is. The dog's happiness is measured in terms of tail wags. Specifically, if the dog eats x units of dog food, the dog has $x^{\frac{1}{2}}$ wags. The table below gives some sample values for food and wags. The graph plots the number of wags as a function of food.

Table 1: How food affects wags

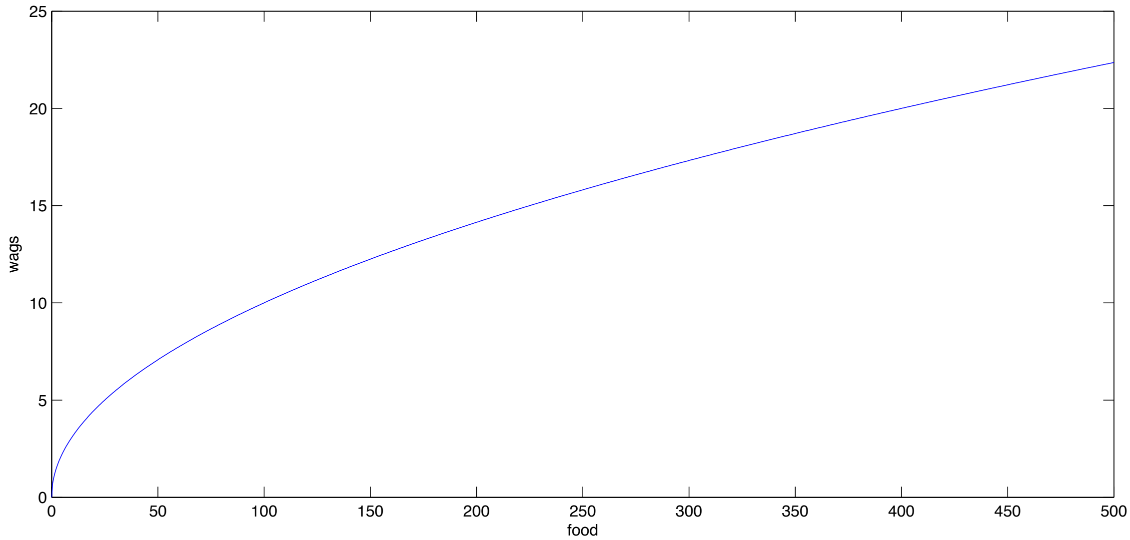
Food	0	5	10	25	50	100	150	200	300	500
Wags	0	2.24	3.16	5	7.1	10	12.2	14.1	17.3	22.4

Notice that each unit of food gives the dog more wags when the dog eats little than when the dog eats a lot. For example. If the dog eats 5 units then it is $\frac{5}{2.24} = 2.23$ units of food per wag. But if the dog eats 100 units, then it is $\frac{100}{10} = 10$ units of food per wag. So in other words, the first

[3]Hopefully framing this as a game will help to mitigate boredom.

units of food give the hungry dog lots of additional happiness but there are diminishing returns. The 100th unit of food provides incrementally less additional happiness.

Figure 3: Wags as a function of food



Savings & Loans: Each day you will receive a certain number of bucks. A single buck buys a single unit of food. All food purchased that day is eaten by the dog (you may not save food). However, you may save bucks for future days. Whenever you spend less in a day than you are allotted, the difference is automatically saved into the next day. Saved bucks accumulate interest at a rate of i that is specified for every day. So for example, if $i = 60\%$ then saving 1 buck will add 1.6 bucks to your allotment in the next day. If $i = 100\%$ then saving 1 buck adds 2 bucks in the next day.[4]

You may also take out loans to pay for food in early periods. Whenever you spend more in a period than you are allotted, the difference is automatically debited against the next period. Debts accumulate interest at a rate i that is specified for every period. So for example, if $i = 60\%$ then debiting 1 buck will decrease the allotment in the next period by 1.6 bucks. If $i = 100\%$ then debiting 1 buck will decrease the next period's allotment by 2 bucks. You may sometimes borrow so much that your allotment in the next period is negative, and you must then borrow again next period to cover the debt. However, you may not borrow so much that your allotment in the final period becomes negative. The computer will automatically limit your actual spending to the amount you could afford given your allotments – if you reach this amount before the final period, the computer will automatically set spending in all future periods to zero.

[4] I wanted to phrase it so that it's clear savings can be re-saved at current rates. Increasing a future day's allotment seems fairly easy to comprehend, and more importantly is precisely true.

You will automatically spend your full final-period allotment on dog food.

At the end of all the periods, the number of wags will be summed up. This is called a single round. You will have two practice rounds and three actual rounds. At the end of the three actual rounds, one actual round will be randomly chosen. You will be paid based on the sum of tail wags in that round. For every tail wag you earn X dollars.

Instructions: Static Arm

At the beginning of each round, you will choose how much the dog eats for each period. The food will be purchased in the order of the periods. If you specify a quantity that exceeds your overall ability to pay (even with loans), you will purchase the amount that you can afford and consumption in all subsequent periods will be zero.

Example 1: Suppose you have the dog for three days, $i = 0$, and you receive 10 bucks in $t = 0$ and 0 in all other periods. At this point, you specify how much food you wish to purchase for the dog in each of the three days. Suppose you list the following amounts of food:

- Monday: 6 units.
- Tuesday: 7 units.
- Wednesday: Any remaining money will be spent on food in Wednesday.

6 bucks were spent on Monday, which was less than your allotment of 10 bucks in that period. This means that (10-6)=4 bucks were automatically saved. The interest rate is zero, so your savings increased your Tuesday allotment by 4. Since the Tuesday allotment would have been zero otherwise, your new Tuesday allotment becomes 4 bucks.

Your plan asks to buy 7 units of dog food on Tuesday. Because your Tuesday allotment is only 4 bucks, and there are no positive allotments remaining to borrow against, the computer will only allow 4 bucks to be spent. You will therefore purchase 4 units of dog food on Tuesday. Since there is no money left over, the computer will also buy 0 units of dog food on Wednesday.

The total number of tail wags generated is XXX.

Example 2: Suppose you have the dog for two days, $i = 100\%$, and you receive 30 bucks on Tuesday and 0 on Monday. Suppose you list the following amounts of food:

- Monday: 10 units.
- Tuesday: The remaining money will be spent on food in period 1.

10 bucks were spent on Monday, which was more than your allotment of 0 bucks for that day. This means that (10-0)=10 bucks were automatically borrowed. The interest rate is 100%, so your borrowing decreased your Tuesday allotment by $(10 \times 2) = 20$ bucks. This means that there are (30-20)=10 bucks that are automatically spent on food on Tuesday.

The total number of tail wags generated is XXX.
Click to begin the training session.

Training Session: Static Arm

You are tasked with feeding the dog for five days. The table below gives your income and the interest rates in each of the five days.

Day	Monday	Tuesday	Wednesday	Thursday	Friday
Income	50	50	50	50	50
Interest Rate	0%	0%	100%	0%	-

Below, please specify how much dog food you wish to purchase in each period.

- Monday: ____________ units.
- Tuesday: ____________ units.
- Wednesday: ____________ units.
- Thursday: ____________ units.
- Friday: The remaining money will be spent on food on Friday.

[Graph and table should be on this page. Also good to have a food-input wags-output calculator.]

Click here to submit.

Day	You chose...	The dog ate...	The optimal allocation was...
Monday	XXX	XXX	XXX
Tuesday	XXX	XXX	XXX
Wednesday	XXX	XXX	XXX
Thursday	XXX	XXX	XXX
Friday	XXX	XXX	XXX
Wags earned	-	XXX	XXX

[A second practice problem is presented. This time $i = 75\%$.]

Main Session: Static Arm

Lifecycle 1 (Round 1) You are tasked with feeding the dog for six days. The table below gives your income and the interest rates in each of the six periods.

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Income	100	0	0	0	0	0
Interest Rate	0%	0%	100%	0%	0%	-

- Monday: ____________ units.
- Tuesday: ____________ units.
- Wednesday: ____________ units.
- Thursday: ____________ units.
- Friday: ____________ units.
- Saturday: The remaining money will be spent on food on Saturday.

[Graph and table should be on this page. Also good to have a food-input wags-output calculator.]

(Round 2) You are tasked with feeding the dog for four days. The table below gives your income and the interest rates in each of the six periods.

Day	Monday	Tuesday	Wednesday	Thursday	Friday
Income	Y_0	0	0	0	0
Interest Rate	0%	100%	0%	0%	-

[Y_0 is randomized]

- Monday: ____________ units.
- Tuesday: ____________ units.
- Wednesday: ____________ units.
- Thursday: ____________ units.

- Friday: The remaining money will be spent on food on Friday.

[Graph and table should be on this page. Also good to have a food-input wags-output calculator.]

(Round 3) You are tasked with feeding the dog for four days. The table below gives your income and the interest rates in each of the six periods.

Day	Monday	Tuesday	Wednesday	Thursday
Income	Y_0	0	0	0
Interest Rate	100%	0%	0%	-

[Y_0 is randomized]

- Monday: ____________ units.
- Tuesday: ____________ units.
- Wednesday: ____________ units.
- Thursday: The remaining money will be spent on food on Thursday.

[Graph and table should be on this page. Also good to have a food-input wags-output calculator.]

(Round 4) You are tasked with feeding the dog for three days. The table below gives your income and the interest rates in each of the six periods.

Day	Monday	Tuesday	Wednesday
Income	Y_0	0	0
Interest Rate	0%	0%	-

[Y_0 is randomized]

- Monday ____________ units.
- Tuesday: ____________ units.
- Wednesday: The remaining money will be spent on food in period 2.

[Graph and table should be on this page. Also good to have a food-input wags-output calculator.]

(Round 5) You are tasked with feeding the dog for two days. The table below gives your income and the interest rates in each of the six periods.

Day	Monday	Tuesday
Income	Y_0	0
Interest Rate	0%	-

[Y_0 is randomized]

- Monday: ____________ units.
- Tuesday: The remaining money will be spent on food in period 1.

[Graph and table should be on this page. Also good to have a food-input wags-output calculator.]

[Lifecycle 2 & 3 have the same structure except different initial interest and income vectors.]

Lifecycle 2 (Round 1)

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Income	100	0	0	0	0	0
Interest Rate	75%	75%	75%	75%	75%	-

Lifecycle 3 (Round 1)

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Income	0	0	0	0	0	500
Interest Rate	75%	75%	75%	75%	75%	-

In each round, at the beginning of the round, you will choose how much the dog eats on the first day. When you click to continue you will see how much money you have. You will then choose how much the dog eats on the second day. This process iterates until you complete the second to last day. Any remaining wealth is used to purchase dog food in the last day.

For example, suppose there are three days, $i = 0$, and you receive 10 bucks on Monday and 0 in all other periods. At this point, you specify how much food you wish to purchase for the dog on Monday. Suppose you type:

- Monday: 6 units.

The next screen will indicate that you have 4 bucks to spend. Since no income is received in future periods you cannot take a loan since you wouldn't be able to pay it off. Suppose you type:

- Tuesday: 4 units.

Since there are no bucks remaining, 0 units of dog food are eaten in Period 2.

The total number of tail wags generated is XXX.

Click to begin the training session.

Example 2: Suppose you have the dog for two days, $i = 100\%$, and you receive 30 bucks on Tuesday and 0 on Monday. Suppose you list the following amounts of food:

- Monday: 10 units.

10 bucks were spent on Monday, which was more than your allotment of 0 bucks for that day. This means that (10-0)=10 bucks were automatically borrowed. The interest rate is 100%, so your borrowing decreased your Tuesday allotment by $(10 \times 2) = 20$ bucks. This means that there are (30-20)=10 bucks that are automatically spent on food on Tuesday.

The total number of tail wags generated is XXX.

Training Session: Dynamic Arm

You are tasked with feeding the dog for five days. The table below gives your income and the interest rates in each of the five days.

Day	Monday	Tuesday	Wednesday	Thursday	Friday
Income	50	50	50	50	50
Interest Rate	0%	0%	100%	0%	-

Below, please specify how much dog food you wish to purchase.

- Monday: _____________ units.

[Graph and table should be on this page. Also good to have a food-input wags-output calculator.]

Click here to submit.

Day	Monday	Tuesday	Wednesday	Thursday	Friday
Income	50	50	50	50	50
Interest Rate	0%	0%	100%	0%	-

You have saved/borrowed XXX bucks. Thus today you have 50 + XXX= XXX bucks.

Below, please specify how much dog food you wish to purchase.

- Tuesday: _____________ units.

[Graph and table should be on this page. Also good to have a food-input wags-output calculator.]

Click here to submit.

[Iteration continues until the lifecycle is complete.]

Day	The dog ate...	The optimal allocation was...
Monday	XXX	XXX
Tuesday	XXX	XXX
Wednesday	XXX	XXX
Thursday	XXX	XXX
Friday	XXX	XXX
Wags earned	XXX	XXX

[A second practice problem is presented. This time $i = 75\%$.]

Lifecycle 1 You are tasked with feeding the dog for six days. The table below gives your income and the interest rates in each of the six periods.

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Income	100	0	0	0	0	0
Interest Rate	0%	0%	100%	0%	0%	-

Below, please specify how much dog food you wish to purchase.

- Monday: ______________ units.

[Graph and table should be on this page. Also good to have a food-input wags-output calculator.]

Click here to submit.

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Income	100	0	0	0	0	0
Interest Rate	0%	0%	100%	0%	0%	-

You have saved/borrowed XXX bucks. Thus today you have XXX= XXX bucks.

Below, please specify how much dog food you wish to purchase.

- Tuesday: ______________ units.

[Graph and table should be on this page. Also good to have a food-input wags-output calculator.]

Click here to submit.

[Iteration continues until the lifecycle is complete.]

[Lifecycle 2 & 3 have the same structure except different initial interest and income vectors.]

Lifecycle 2

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Income	100	0	0	0	0	0
Interest Rate	75%	75%	75%	75%	75%	-

Lifecycle 3

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Income	0	0	0	0	0	500
Interest Rate	75%	75%	75%	75%	75%	-

Diagnostic Session: Dynamic Arm

[Insert overconfidence lab experiment description here]

Diagnostic Questions

1. Asset A has an initial value of $100, and grows at an interest rate of 10% each period. Asset B has an initial value of $X, and does not grow. What value of X will cause the two assets to be of equal value after 20 periods?

2. Asset A has an initial value of $100, and grows at an interest rate of 5% each period. Asset B has an initial value of $X, and does not grow. What value of X will cause the two assets to be of equal value after 50 periods?

3. Asset A has an initial value of $100, and grows at an interest rate of 4% each period. Asset B has an initial value of $X, and does not grow. What value of X will cause the two assets to be of equal value after 1 periods?[5]

4. Asset A has an initial value of $500, and grows at an interest rate of -8% each period. Asset B has an initial value of $X, and does not grow. What value of X will cause the two assets to be of equal value after 10 periods?

[5] This question controls for numeracy.