

**Credit Cards, Excess Debt, and the Time Value of Money:  
The Parable of the Debt Banana**

November 16, 2012

Timothy Falcon Crack<sup>a\*</sup> and Helen Roberts<sup>b</sup>

Key words: time value of money, credit cards, debt, bankruptcy, moral hazard, ethics  
JEL codes: G12

<sup>a</sup> Department of Accountancy and Finance, University of Otago, P.O. Box 56, Dunedin 9054, New Zealand, tcrack@otago.ac.nz, telephone: (64) 3 479 8130, fax: (64) 3 479 8171

<sup>b</sup> Department of Accountancy and Finance, University of Otago, P.O. Box 56, Dunedin 9054, New Zealand, helen.roberts@otago.ac.nz, telephone: (64) 3 479 8072, fax: (64) 3 479 8171

\*corresponding author

We thank Scott Chaput and Reza Tajaddini. Any errors are ours.

## **Credit Cards, Excess Debt, and the Time Value of Money: The Parable of the Debt Banana**

*The Parable of the Debt Banana is an analogy between the accumulation of excess personal debt and the accumulation of excess body weight. We created this parable to grab student attention and to then serve as a springboard for discussion of personal debt, time value of money mathematics, the mechanics of credit cards, personal bankruptcy, moral hazard, ethics, and credit card reform. A follow up survey in a large class (453 students; 84% response rate) showed that 92% of students seeing the parable alongside the underlying finance principles said that it grabbed their attention more than if the underlying finance principles alone were presented, and 87% of students seeing the parable said it made an impression upon them that will make them more careful in their future credit card spending habits. An accompanying spreadsheet allows readers to explore our worked examples and perform sensitivity analysis.*

### **INTRODUCTION**

The parable of the debt banana is an analogy between the accumulation of excess personal debt and the accumulation of excess body weight. We created and presented our parable in a compulsory Finance 101 course taken by all business majors. Most students had little or no exposure to the world of finance and many had poor mathematical skills. Both their lack of financial sophistication and their natural body consciousness meant that our simple parable was very well received (see survey responses in Appendix 2).

In theory, young peoples' use of credit cards should be part of a plan to gain financial independence and to build a good credit score. The reality, however, is that there are altogether

too many stories of young people getting into financial difficulty via the use of credit cards (e.g., Peñaloza and Barnhart [2011]), and credit card debt relative to income is a major contributor to bankruptcy [Domowitz and Sartain, 1999, p. 404; Zhu, 2011, p. 24].

Zhu [2011, p. 5], when discussing personal bankruptcy, argues that it is important to launch educational programs focused on the consequences of poor financial planning and on ways to avoid consuming beyond one's means. Peñaloza and Barnhart [2011, p. 759] state that such educational programs should not focus solely on credit card fees and compound interest. Rather, they argue that consumers need to understand how they use credit/debt to gain independence, satisfy expectations of the middle class,<sup>1</sup> and as security during life transitions (e.g., college, marriage, children, illness, etc). Consumers' vulnerability in using credit/debt increases during these transitions [Peñaloza and Barnhart, 2011, p. 759], and those who spend beyond their means are vulnerable to the impact of adverse events and are more likely to file for bankruptcy as a result [Zhu, 2011, p. 35].<sup>2</sup>

Like Peñaloza and Barnhart [2011], we think that focusing on fees and interest rates is not sufficient. Unlike Peñaloza and Barnhart, who focus on understanding the drivers of the use of credit, one of our contributions is to provide a parable that relates financial health to more familiar and more easily understood physical health.

Xu and Zia [2012] and Hastings, Madrian and Skimmyhorn [2012] review between them well over 100 articles on financial literacy and financial education. Xu and Zia [2012] review international literature that says that financial literacy in high-income countries is quite low and that this can be associated with and cause adverse financial outcomes. They blame the global financial crisis, in part, on low levels of financial literacy in the U.S. One consequence of this

crisis is that the Dodd-Frank Act of 2010 has led to the creation of the Office of Financial Education as part of the Department of the Treasury [Hastings et al., 2012].

Disturbingly, Hastings et al. [2012] argue strongly that there is no real evidence of any causal relationship between financial education and either financial literacy or better financial outcomes. They cite serious endogeneity concerns and much mixed empirical evidence. They go on to discuss alternatives to financial education (e.g., regulation and simplified product disclosure) with the aim of improving financial outcomes. We think our survey and quiz questions are immune to the endogeneity concerns raised by Hastings et al. [2012] (their concerns are driven by sample selection issues).

Xu and Zia [2012] say that the goal of financial literacy in high-income countries may be consumer protection, whereas in low-income countries it may be access to and take up of financial services. They also distinguish between financial literacy for consumers and for entrepreneurs. Our parable is designed to help facilitate learning that protects consumers, but our work also overlaps slightly with the notion of responsible take up of financial services and with advice for entrepreneurs who may be using credit card debt to establish a small business.

Our survey responses show that our students have a very positive reaction to our parable (see responses in Appendix 2). They become immediately very attentive and this makes discussion of the related topics very easy. We think, therefore, that both the understanding of the time value of money (TVM) mathematics and life lessons in the use of credit will be enhanced when the TVM mathematics and associated topics are accompanied by our parable of the debt banana.

## **THE PARABLE OF THE DEBT BANANA**

Suppose you eat one extra average-sized banana a day over and above your daily energy requirements.<sup>3</sup> It would be difficult to call that overeating because it is, after all, just one healthy banana. What could be better for you? It is not as if anyone would point at you and say that you have a problem. If we do the mathematics, however, a different picture emerges. The average banana is 105 calories [CDC, 2011a]. There are nine calories in a gram of fat [CDC, 2008]. Thus, if you eat one extra banana over and above your daily energy needs, you will store 11.67 grams (equivalently, 0.41 ounces) of fat per day.<sup>4</sup> That seems tiny, but over 10 years this energy gap produces a weight gain of 93.9 pounds—enough to turn an underweight person into an obese person.<sup>5</sup> Ouch.

The small extra consumption of one banana per day is easy to overlook. The associated weight gain, however, accumulates slowly but surely. Not only that, but as you gain weight it becomes more difficult to exercise, and this compounds the problem by making it more difficult to get yourself back to a healthy weight. Although there is an obesity epidemic [Abelson and Kennedy, 2004; Ogden et al., 2006], this article is not about that, per se, but rather we wish to utilize the epidemic and students' natural body consciousness as background for teaching about debt, TVM mathematics, and financial responsibility.<sup>6</sup>

## **CREDIT CARDS AND DEBT**

Young students lacking in life experience do not recognize how easy it is to get into financial difficulty using credit cards. Like slow weight gain (e.g., Mozaffarian et al. [2011]), getting into financial difficulty does not happen overnight—and typically cannot be erased overnight. Financial difficulty is insidious and worsened, we think, by the easy availability of

credit cards.<sup>7</sup> A small extra consumption (food or credit) is easy to miss, but it adds up over time. Just as weight gain makes it more difficult to exercise and become healthy, indebtedness carries with it interest obligations that, literally, compound the problem and make it more difficult to get back to financial health.

There are other parallels between weight gain and financial difficulty. For example, some people who lose weight find that they regain it again [Sumithran et al., 2011; Parker-Pope, 2012].<sup>8</sup> Similarly, some people who declare bankruptcy and clear their debts, subsequently fall back into the same trap and have to declare bankruptcy again [Golmant and Ulrich, 2006].

We must look at worked examples to show how quickly debt can build up, and how slowly it may be erased.

### **Two Credit Card Examples**

We will now consider two credit card examples. The first uses only basic TVM mathematics; the second one requires a spreadsheet for the calculation.

Case 1 (simple TVM math): John is 21 years old and gets a new credit card in the mail. He spends \$1,000 using his new credit card. He immediately regrets this and cuts the card in half and never uses it again. The card charges an annual percentage rate (APR) of 20% with monthly compounding. Suppose that the minimum payment required is simply \$20 per month and John pays only the minimum. How long until John is debt free? Using annuity formulae, we quickly find that the answer is 108 months (i.e., nine years)—see the TVM mathematics in Appendix 1. So, John will be 30 years old when he extinguishes this one debt. He will have made 108 payments of \$20 for a total of \$2,160 (\$1,160 in interest and \$1,000 in principal). Note that interest payments account for more than half the total payments.

Case 2 (spreadsheet): Suppose Mary is 21 years old and decides that from now on she will purchase a \$10 lunch and also a \$10 dinner 28 days per month using a new credit card. Suppose that the card has an APR of 20% with monthly compounding. Suppose the credit card company requires a more realistic minimum payment than in Case 1 (see Appendix 1 for details), and that interest begins to accrue on new purchases at the end of each month. Assume that Mary's first payment is made at the end of the first month, before any interest has accrued, and that she makes monthly payments from then on.

The TVM mathematics is complicated enough that a spreadsheet must be used—see Appendix 1 for details regarding the spreadsheet. If Mary pays only the minimum balance, then after one year she will owe \$6,278 on her credit card, her minimum payment due will be \$161, and she will have already paid out \$1,028 (\$587 in interest and \$442 in principal)—see Table 1. After five years, Mary will owe \$24,985 on her credit card, her minimum payment will be \$668, and she will have already paid out a total of \$22,160 (\$13,545 in interest and \$8,615 in principal). If Mary gets to the 10-year mark without declaring bankruptcy or having her credit card ripped away from her by the issuer, she will be 31 years old, and will owe \$38,527 on her credit card. Her minimum payment will then be \$1,035, and she will have already paid out a total of \$74,549 (\$45,876 in interest and \$28,673 in principal). Like weight gain, the accumulation of debt is steady and insidious.<sup>9</sup>

If, at the 10-year mark, Mary decides to pay off her balance in full as a lump sum, she will end up having paid out a total of \$113,076 to extinguish her debt (\$45,876 in interest and \$67,200 in principal). Like weight gain, however, it is more likely that Mary will have to work the excess off slowly over time. So, instead of paying off her balance in full at the 10-year mark, let us assume that Mary decides to make no new purchases and that she makes only the

minimum payment from then on. In that case, it will take an additional 445 payments, over 37 years, to extinguish the debt. By the time Mary has cleared this debt she will be 68 years one month old, and she will have paid out a total of \$175,442 (\$108,242 in interest and \$67,200 in principal).

**Table 1. Accumulation of credit card debt making only the minimum payment**

Assuming a monthly expenditure of \$560, and an APR of 20% with monthly compounding, we show the growing balance and minimum payment due, and the cumulative repayments of interest and principal. All amounts are rounded to the nearest dollar.

End of year	Balance on card	Minimum monthly payment just paid	Cumulative interest paid out	Cumulative principal paid off	Cumulative total paid out
1	\$ 6,278	\$ 161	\$ 587	\$ 442	\$ 1,028
5	\$ 24,985	\$ 668	\$ 13,545	\$ 8,615	\$ 22,160
10	\$ 38,527	\$ 1,035	\$ 45,876	\$ 28,673	\$ 74,549

Mary's accumulated debt at the 10-year mark, and the time it takes her to pay it off when paying only the minimum payment each month are both stubbornly insensitive to the interest rate. For example, halving the interest rate, to 10% per annum, only reduces the accumulated debt at the 10-year mark from \$38,527 to \$35,260, and only reduces the age at which she clears her debt from 68 years one month to 61 years five months. It is the paying of the minimum, per se, that creates the insensitivity, not the functional form of the minimum payment formula.<sup>10</sup>

### **The More You Pay, the Less You Pay**

When repaying debt (mortgages, credit cards, etc.), the more you pay off each month, the shorter the time until you extinguish the debt, and the less you end up paying in interest. Conversely, the less you pay off each month, the longer it takes to repay the debt and the more you pay out in interest.

For example, if John had paid \$37.16 per month, instead of only \$20, then he would have paid off his debt in only 36 months, at age 24, and would have ended up paying a total of only \$1,337 (\$337 in interest and \$1,000 in principal), instead of paying roughly three times this in



interest and not extinguishing the debt until age 30. See Appendix 1 for the TVM mathematics that gives the \$37.16 figure.

Similarly, if Mary had paid *twice* the minimum payment every month, then at the 10-year mark, she would owe only \$14,671 on her credit card. Her minimum payment would be \$798, and she would have paid out a total of \$75,570 (\$23,041 in interest and \$52,529 in principal). Comparing this result with the last row in Table 1, we see that although Mary's total payments would have been roughly the same as when paying only the minimum balance each month, paying twice the minimum means that the proportions of the total payout appearing in the forms of interest and principal are now roughly reversed. Paying twice the minimum balance each month means that she avoids \$22,835 in interest payments and ends up owing, at the 10-year mark, less than half what she owed when paying only the minimum balance.

Of course, if Mary paid her balance due in full each month, she would pay only the principal, and never any interest, and her balance due at the 10-year mark would be zero.<sup>11</sup> Compared with only ever paying the minimum payment until the debt is cleared, Mary saves \$108,242 in interest. She cannot do better than paying all principal and no interest.

The bottom line is that paying only the *minimum* each month means that you pay off your debt via the *maximum* allowable time horizon, while simultaneously paying the *maximum* cumulative interest payments allowable under the contract with the card issuer.

### **Personal Bankruptcy, Moral Hazard, and Ethics**

Credit card issuers face a moral hazard problem: Once a consumer is issued with a credit card he or she may behave badly and spend beyond his or her means, default on the debt, and ultimately extinguish the debt via bankruptcy rather than via repayment.<sup>12</sup> Zhu [2011, p. 3] acknowledges that this moral hazard problem is at play in the strategic/opportunistic filing of at

least some bankrupt households. This is one reason why, in the U.S., the Bankruptcy Abuse Prevention and Consumer Protection Act of 2005, hereafter BAPCPA [GPO, 2005] introduced more stringent means testing to make it more difficult for abusive bankruptcy filing [Zhu, 2011, p. 2]. Simkovic [2009] shows that after BAPCPA went into effect, personal bankruptcy filings declined sharply.

Young people need to recognize that personal bankruptcy is a bad choice for at least two reasons. First of all, if a young person views bankruptcy as a safety net that provides a moral license to overspend, then bankruptcy, in that case, is clearly unethical. Second, we think that declaring personal bankruptcy carries a social stigma akin to a criminal conviction for assault and that this can significantly harm future employment possibilities. For most jobs, neither a bankruptcy nor a conviction for assault would actually make a difference to the performance of the job, but that is not the point. The point is that the social stigma of bankruptcy is so great that you significantly reduce the likelihood that you will be hired in the first place.<sup>13</sup> That is why when applying for a bank account, brokerage account, new job, insurance, credit card, home loan, foreign travel visa, etc., you are typically asked whether you have ever declared bankruptcy—it is an indication of your morals.<sup>14</sup>

### **Credit Cards and Credit Card Reform**

In the U.S., the Credit Card Accountability Responsibility and Disclosure Act of 2009 [GPO, 2009], or “Credit CARD Act of 2009,” introduced changes to the Truth in Lending Act to make the risks of credit card debt clearer. For example, credit card companies must now provide “enhanced consumer disclosures” (Title II of the Act) and “protection of young customers” (Title III of the Act).

The *enhanced consumer disclosures* require that the billing statement now include words to the effect that “Making only the minimum payment increases the amount of interest you pay and the time it takes to replay your balance.” The statement must now also tell you how long it will take to pay off the debt making only the minimum payment, assuming no new purchases are made, and also how much you would have to pay off each month as an annuity to extinguish the debt in 36 months, assuming no new purchases are made (see Sec. 201 of the Act [GPO, 2009], and also OCC [2010, p. 25 and p. 182]). See the worked example (where John pays \$37.16 per month) in Appendix 1.

With regard to the *protection of young customers*, it is now more difficult for a young person to obtain a credit card. A person under the age of 21 can now apply for a credit card only with a parent’s co-signature or with proof of an ability to repay (see Sec. 301 of the Act [GPO, 2009]).

Even with these protections in place, recent statistics on use of credit cards by young persons reveals that 41 percent of cardholders from the ages of 18 to 29 made only the minimum required payment on a credit card in some of the past 12 months [FINRA, 2009].

## **CONCLUSION**

We present a cautionary example of seemingly “healthy overeating” (one extra banana per day), as a parable to illustrate that indebtedness, like weight gain, creeps up slowly and can have long-lasting effects. We used the parable in a compulsory Finance 101 course taken by students in all business majors and survey responses indicate that it grabs their attention (and is forecast to affect their future actions) more than if we presenting the underlying finance principles alone. Having grabbed student attention, it then allows for an easy discussion of excess debt, TVM

mathematics, mechanics of credit cards, personal bankruptcy, moral hazard, ethics, and credit card reform. We have included here a brief discussion of each of these topics.

### **Final Note**

We were mindful, while presenting our debt banana parable, that some persons in the class likely had eating disorders. So, we made it very scientific and presented it in a sensitive manner so as not to compound any self-image problems anyone might have. We simply laid out the numbers and did the mathematics and used the parable to emphasize the finance. The survey results indicate that we were successful in our aims.

## REFERENCES

- Abelson, Philip, and Donald Kennedy, 2004, The Obesity Epidemic, *Science*, 304(4), p. 1413.
- CDC, 2008, [http://www.cdc.gov/nccdphp/dnpa/nutrition/pdf/r2p\\_energy\\_density.pdf](http://www.cdc.gov/nccdphp/dnpa/nutrition/pdf/r2p_energy_density.pdf)
- CDC, 2011a, [http://www.cdc.gov/healthyweight/healthy\\_eating/fruits\\_vegetables.html](http://www.cdc.gov/healthyweight/healthy_eating/fruits_vegetables.html)
- CDC, 2011b, Online Body Mass Index Calculator, Accessed at:  
[http://www.cdc.gov/healthyweight/assessing/bmi/adult\\_bmi/english\\_bmi\\_calculator/bmi\\_calculator.html](http://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/english_bmi_calculator/bmi_calculator.html)
- Domowitz, Ian and Robert L. Sartin, 1999, Determinants of the Consumer Bankruptcy Decision, *The Journal of Finance*, 54(1), (Feb., 1999), pp. 403-420.
- FINRA, 2009, Financial Capability in the United States: Initial Report of Research Findings from the 2009 National Survey (A Component of the National Financial Capability Study), December 1, Accessed at: <http://www.finrafoundation.org/programs/p123306>
- FRB, 2011, Federal Reserve's G.19 report, December, 7. Accessed at:  
<http://www.federalreserve.gov/releases/g19/Current/>
- Golmant, John, and Tom Ulrich, 2006, Bankruptcy Repeat Filings, *American Bankruptcy Institute Law Review*, 14(1), 169-199.
- GPO, 2005, <http://www.gpo.gov/fdsys/pkg/PLAW-109publ8/pdf/PLAW-109publ8.pdf>
- GPO, 2009, <http://www.gpo.gov/fdsys/pkg/PLAW-111publ24/pdf/PLAW-111publ24.pdf>
- GPO, 2010, <http://www.gpo.gov/fdsys/pkg/USCODE-2010-title11/pdf/USCODE-2010-title11-chap5-subchapII-sec523.pdf>
- Gross, David B., and Nicholas S. Souleles, 2002, An Empirical Analysis of Personal Bankruptcy and Delinquency, *Review of Financial Studies*, 15(1), pp. 319-347.

Guiso, Luigi, Paola Sapienza, and Luigi Zingales, 2011, The Determinants of Attitudes towards Strategic Default on Mortgages (March 1). Fama-Miller Working Paper Forthcoming; Chicago Booth Research Paper No. 11-14. Accessed at: <http://ssrn.com/abstract=1573328>.

Guthrie, Katherine and Jan Sokolowsky, 2010, Obesity and Mortgage Delinquencies. Available at <http://ssrn.com/abstract=1617484>

Hastings, Justine, Brigitte C. Madrian, and Bill Skimmyhorn, 2012, Financial Literacy, Financial Education and Economic Outcomes (September). NBER Working Paper No. w18412. Accessed at: <http://ssrn.com/abstract=2150543>

Mayo Clinic, 2011, Metabolism and weight loss: How you burn calories, <http://www.mayoclinic.com/health/metabolism/WT00006>

Mozaffarian, Dariush, Tao Hao, Eric B. Rimm, Walter C. Willett, and Frank B. Hu, 2011, Changes in Diet and Lifestyle and Long-Term Weight Gain in Women and Men, New England Journal of Medicine, 364(25), 2392-2404.

Nazareno, Analisa, 2011, Understanding how credit card minimum payments are set: Issuers vary in how they calculate minimums, December 17, 2008. Accessed at: <http://www.creditcards.com/credit-card-news/minimum-credit-card-payments-1267.php>

OCC, 2010, Truth in Lending Act: Comptroller's Handbook, December 2010. Accessed at: <http://www.occ.gov/publications/publications-by-type/comptrollers-handbook/truth-in-lending-handbook.pdf>

Ogden, Cynthia, L., Margaret D. Carroll, Lester R. Curtin, Margaret A. McDowell, Carolyn J. Tabak, Katherine M. Flegal, 2006, Prevalence of Overweight and Obesity in the United States, 1999-2004, The Journal of the American Medical Association, 295,1549-1555.

- Parker-Pope, Tara, 2012, The Fat Trap, The Sunday Magazine Section of the New York Times, January 1, page MM22. Also available online at:  
<http://www.nytimes.com/2012/01/01/magazine/tara-parker-pope-fat-trap.html?pagewanted=all>
- Peñaloza, Lisa and Michelle Barnhart, 2011, Living U.S. Capitalism: The Normalization of Credit/Debt, *Journal of Consumer Research*, 38(4), 743-762.
- Plachta-Danielzik, Sandra, Beate Landsberg, Anja Bosy-Westphal, Maiké Johannsen, Dominique Lange and Manfred J. Müller, 2008, Energy Gain and Energy Gap in Normal-weight Children: Longitudinal Data of the KOPS, *Obesity*, 16 (4), 777-783.
- Sumithran, Priya, Luke A. Prendergast, Elizabeth Delbridge, Katrina Purcell, Arthur Shulkes, Adamandia Kriketos, and Joseph Proietto, 2011, Long-Term Persistence of Hormonal Adaptations to Weight Loss, *New England Journal of Medicine*, 365(17), 1597-1604.
- Simkovic, Michael, 2009, The Effect of BAPCPA on Credit Card Industry Profits and Prices, *American Bankruptcy Law Journal*, 83(1), Winter, 1-26.
- U.S. Census Bureau, 2010, Accessed at: <http://quickfacts.census.gov/qfd/states/00000.html>
- Xu, Lisa and Bilal Zia, 2012, Financial Literacy Around the World: An Overview of the Evidence with Practical Suggestions for the Way Forward (June 1). World Bank Policy Research Working Paper No. 6107. Accessed at: <http://ssrn.com/abstract=2094887>
- Zhu, Ning, 2011, Household Consumption and Personal Bankruptcy, *The Journal of Legal Studies*, Vol. 40, No. 1 (January 2011), pp. 1-37.

## APPENDIX 1

**Case 1:** How many months  $t$  until John's debt of  $PV=\$1000$  is extinguished if a payment of  $C=\$20$  is made at the end of every month, and assuming the monthly interest rate is  $r = 0.20/12$ ?

We simply rearrange the TVM formula for the PV of an annuity to find that

$$t = \frac{\ln\left[\frac{C}{(C-r \times PV)}\right]}{\ln(1+r)} = \frac{\ln\left[\frac{20}{\left(20 - 0.20/12 \times 1000\right)}\right]}{\ln\left(1 + 0.20/12\right)} \approx \frac{\ln(6)}{\ln(1.016667)} \approx 108.40 \text{ months.}$$

Similarly, to find the level payment needed for John to extinguish his debt in 36 months, we rearrange the TVM formula for the PV of an annuity to find that

$$C = \frac{PV}{\frac{1}{r} \left[ 1 - \frac{1}{(1+r)^{36}} \right]} = \frac{1000}{\frac{1}{0.20/12} \left[ 1 - \frac{1}{\left(1 + 0.20/12\right)^{36}} \right]} \approx \frac{1000}{26.908} \approx \$37.16 \text{ per month.}$$

**Case 2:** A typical minimum payment might be the balance due if less than \$20, or otherwise the maximum of (a) \$20, or (b) 2% of the outstanding balance or (c) 1% of the outstanding balance, plus all interest charged that month [Nazareno, 2008]. So, we assume a minimum payment equal to  $\min[\text{amount due}, \max(\$20, 2\% \text{ of balance}, 1\% \text{ of balance plus that month's interest})]$ . In this case, the TVM mathematics is complicated enough that a spreadsheet needs to be used to calculate the cash flows. A spreadsheet showing all calculations in this article is available here: [www.ToBeAnnounced.edu/DebtBanana.xls](http://www.ToBeAnnounced.edu/DebtBanana.xls). To allow for sensitivity analysis, we have inserted “spinners” into the spreadsheet so that the reader can simply point and click to vary the inputs and then see the effect on the outputs.



## APPENDIX 2

### Survey of Student Reaction to the Parable of the Debt Banana

After teaching a class using the parable, we conducted a follow up online BlackBoard survey of student reaction. Technical limitations (we wanted all responses to all questions recorded) meant that the survey had to be conducted as two separate online surveys each of four questions. So, survey questions 5-8 were not necessarily answered at the same time as survey questions 1-4. This may explain why the response to the “Not applicable; I have not seen the analogy yet” question drops from 15 students to only 10 in going from survey question 4 to survey question 5.

There were 453 students in the class and we got 379 students (84%) to complete the survey. This high response rate was driven by several factors: we discussed our AACSB accreditation and the importance of assurance of learning just before the survey was released, we advertised the surveys very widely (verbally in class, by email, on BlackBoard), we used BlackBoard’s “Adaptive Release” software to cause the subsequent assessed quiz to appear only if a student first sat our surveys; we made sure each survey could be completed online in less than one minute; and we offered a token cash prize to be awarded randomly but chosen only from the names of those students who completed the survey.

We had not planned to ask Question 8, about eating habits, but our survey format had room for one more question, so we included this one out of curiosity (and we were surprised at the strength of the response, but not the gender differences discussed below). We show below the eight questions we asked, followed by a count of students giving each answer, and the percent giving each answer. The bold font appeared in the surveys.

**1. Did you attend the “Debt Banana” lecture on Monday October 1st where we gave the analogy between slow weight gain and the slow accumulation of personal credit card debt, and also discussed TVM math and credit card minimum payments?**

- Yes. [334; 88%]
- No. [ 45; 12%]

**2. If you missed the “Debt Banana” lecture on Monday October 1st, did you at least spend some time reviewing the lecture notes on that topic?**

- Not Applicable; I attended the lecture. [309; 82%]
- Yes, I did that already. [ 49; 13%]
- No, but I plan to. [ 19; 5%]
- No, and I do NOT plan to. [ 2; 1%]

**3. Did you download the DebtBanana.xls EXCEL spreadsheet and vary the inputs to see how paying more than the credit card minimum payment can reduce your interest costs?**

- Yes, I did that already. [170; 45%]
- No, not yet, but I will. [177; 47%]
- No, not yet, and I will NOT. [ 32; 8%]

**4. Regarding the analogy we gave between weight gain and the accumulation of personal credit card debt, did this analogy grab your attention?**

- Yes, very much. [194; 51%]
- Yes, but only a little. [147; 39%]
- No. [ 23; 6%]
- Not applicable; I have not seen the analogy yet. [ 15; 4%]

**5. Regarding the analogy we gave between weight gain and the accumulation of personal credit card debt, did this analogy grab your attention more than if we had just done the TVM mathematics alone regarding the slow accumulation of personal debt if you overspend using a credit card?**

- Yes, very much. [199; 53%]
- Yes, but only a little. [139; 37%]
- No. [ 31; 8%]
- Not applicable; I have not seen the analogy yet. [ 10; 3%]

**6. Regarding the analogy we gave between weight gain and the accumulation of personal credit card debt, did you find this analogy personally offensive?**

- Yes, very much. [ 25; 7%]
- Yes, but only a little. [ 31; 8%]
- No. [313; 83%]
- Not applicable; I have not seen the analogy yet. [ 10; 3%]

7. Do you think the analogy between weight gain and the accumulation of personal debt has made an impression upon you that will **make you more careful in your credit card spending habits in the future** than if you had not seen this analogy?

- Yes, very much. [194; 51%]
- Yes, but only a little. [128; 34%]
- No. [ 49; 13%]
- Not applicable; I have not seen the analogy yet. [ 8; 2%]

8. Do you think the analogy between weight gain and the accumulation of personal debt has made an impression upon you that will **make you more careful in your eating habits in the future** than if you had not seen this analogy?

- Yes, very much. [ 82; 22%]
- Yes, but only a little. [106; 28%]
- No. [181; 48%]
- Not applicable; I have not seen the analogy yet. [ 10; 3%]

### **Graded Quiz on TVM and Ethics**

After completing the surveys, students were encouraged to sit a graded quiz that tested them on TVM material and ethics. Of the 453 students in the class, 379 (84%) completed the surveys and then 375 of those 379 students sat the graded quiz.

The quiz was composed of seven multiple choice questions each having between five and 10 similar answers to choose from. To reduce the likelihood of student-to-student cheating, there were five different versions of each question (using different numbers, words, or order of answers) and the BlackBoard software selected randomly. So, there were, potentially, 78,125 different versions of the online quiz. Students were given a single 30 minute attempt only.

We show below one of the possible versions of the quiz, but in the interests of space we show only the correct answer in each case and we have suppressed dozens of wrong answers that were similar in style to or on the same topic as the correct answer. We also show the count of persons answering correctly and incorrectly and give a percentage of correct and incorrect answers.

1. You spend \$1,000 using a new credit card. Your bank asks you to repay your debt via an annuity of 60 monthly payments, each of \$40. What is the total cost (i.e., ignoring time value of money) of repaying the loan?

a. \$2,400 made up of \$1,400 in interest, and \$1,000 in principal.

[correct 279; 74%]

[incorrect 96; 26%]

2. Which ONE of the following statements is FALSE?

g. Paying only the minimum payment each month means that you minimize the interest that you pay and the time it takes to pay off your debt.

[correct 287; 77%]

[incorrect 88; 23%]

3. We said that credit card issuers face a moral hazard problem. Which ONE of the following is the moral hazard problem we discussed?

b. Once a consumer is issued with a credit card, he or she may behave badly and purposely spend beyond his or her means, default of the debt, and subsequently extinguish the debt via bankruptcy, rather than repayment.

[correct 284; 76%]

[incorrect 91; 24%]

4. We gave an example in class of 21-year old Mary spending \$20 per day with her credit card, but paying only the minimum payment due each month. The interest rate was 20% per annum with monthly compounding. At the 10-year mark (i.e., age 31) she had accumulated \$38,527 debt on her credit card. If she stopped spending then and paid only the minimum amount due each month from then on, she would extinguish her debt by age 68 years and one month. We asked the following question in class: What happens to that accumulated balance, and the time taken to pay it off if we halve the interest rate to 10% per annum? Which of the following best describes what happens in that case and why?

c. The accumulated card balance at the 10-year mark is only slightly reduced, to \$35,260, while the time taken to pay it off is still lengthy (paying off at age 61 years five months). The reason is that the accumulated balance and the time to pay it off are stubbornly insensitive to the interest rate when you are paying only the minimum each month.

[correct 317; 85%]

[incorrect 58; 15%]

5. You get a new credit card from your bank. You immediately use it to buy \$1,500 worth of new clothes. The interest rate on the credit card is 12% per annum with monthly compounding. How

long until you pay off the debt if you pay only the minimum payment of \$20.00 at the end of each month? Please give your answer in months and round to two decimal places. Note that this is an ordinary annuity of repayments, not an annuity due.

✔ e. 139.32 months

[correct 316; 84%]

[incorrect 59; 16%]

6. You get a new credit card from your bank. You immediately use it to buy \$1,000 worth of new clothes. The interest rate on the credit card is 24% per annum with monthly compounding. What monthly payment will extinguish the debt in 36 months? Please round your answer to the nearest penny. Note that this is an ordinary annuity of repayments, not an annuity due.

✔ b. \$39.23

[correct 310; 83%]

[incorrect 65; 17%]

7. We gave an example in class of Mary spending \$20 per day with her credit card, but paying only the minimum payment due each month. At the 10-year mark she had accumulated \$38,527 debt on her credit card, having already paid out \$74,549 (\$45,876 in interest and \$28,673 in principal). Suppose instead that Mary had been paying twice the minimum payment each month over that initial 10-year period. In that case, which one of the following looks like her position at the ten-year mark? (Note that no calculation is expected here because it is too complicated; you are supposed to have a rough idea from class or from exploring the DebtBanana.xls spreadsheet).

✔ c. Accumulated debt of \$14,671, having already paid out \$75,570 (\$23,041 in interest and \$52,529 in principal). That is, much lower accumulated debt, much less interest expense incurred, and much more original principal paid off, as compared with the case where she pays only the minimum payment each month.

[correct 222; 59%]

[incorrect 153; 41%]

### Analysis and Cross-Examination of the Survey and Quiz Results

Here are some highlights from examination of the above results.

- We had a large sample of students in our class: 453 students.
- We got a very high response rate to the survey: 379 students (84%).
- We got a very high response rate to the graded quiz: 375 students (83%).
- Of the students who sat the survey, 92% who said they had seen the parable said that it grabbed their attention more than if the TVM mathematics alone had been presented (i.e., 338/369 from survey question 5, dropping the 10 students saying they had not seen it).

- Of the students who sat the survey, 87% who said they had seen the parable said that it made an impression that will make them more careful in their future credit card spending habits (i.e., 322/371 from survey question 7).
- Of the students who sat the survey, 7% (25 students) who said they had seen the parable answered “yes, very much” when asked whether it was personally offensive (survey question 6), but when asked whether it will make them more careful in their future credit card spending habits, 19 answered “yes, very much,” four answered “yes, but only a little,” and the other 2 answered “yes, very much” when asked whether it will make them more careful in their future *eating* habits. So, only a very few students said they found it personally very offensive, but every single one of those students also said that it will have an impact on their future habits, with most saying “very much” so.
- Further cross examination reveals that the students who answered “yes, very much” when asked whether the parable grabbed their attention more than the TVM math alone were more likely to get the answers correct on quiz questions 2, 3, 4, 5, 6, and 7, than students who answered “yes, but only a little” or “no” (aggregating those two responses). A t-test of a difference of proportions reveals, however, that those differences are significant at the 5% level only for quiz questions 4 and 6.
- We also have data on the gender of all survey and quiz respondents. There are some interesting and statistically significant gender differences in responses to the survey. Of the 379 students who completed the surveys, 209 were male and 170 were female. The following differences were significant at the 5% level.
  - Survey question 1: 93% of females (84% of males) attended the class.
  - Survey question 7: 89% of females (81% of males) answered yes (either “very much” or “only a little”) when asked whether the parable will make them more careful in their spending habits in the future. This result could be consistent with education helping to close the gender gap discussed by Xu and Zia [2012, p. 10]. When combined with the response to survey question 1, this result could also be consistent with more motivated individuals being more likely to respond to advice [Xu and Zia, 2012, p. 24].
  - Survey question 8: 58% of females (43% of males) answered yes (either “very much” or “only a little”) when asked whether the parable will make them more careful in their eating habits in the future.
  - There were no notable gender differences in performance on the graded quiz.
- Our prior had been that females would find the parable more offensive than males, but in fact, on survey question 5, 11% of females (18% of males) answered yes (either “very much” or “only a little”) when asked whether they found the parable personally offensive. This difference was in the opposite direction to our prior and was not significant.
- The students performed well on the graded quiz. The average correct response rate on quiz questions 1-6 was 80%; Question 7 was more difficult but even so, 59% of students still got it correct. We note students who said in survey question 3 that they had already downloaded the EXCEL sheet were more likely to get the correct answer in quiz question 7 than those who had not (62% versus 56%), but the difference was not statistically significant. We think this is very good given that only one in 10 of these students will major in finance.

- There are some inconsistent results in our survey responses. For example, eight students say “I have not seen the analogy” in response to survey question 7, but 10 students say this in response to survey question 8. We did not delete any inconsistent responses, but had we done so, the final results would have been almost indistinguishable from those presented.

## APPENDIX 3

### Teaching Plan

We used the Debt Banana parable as a tool to aid the teaching of a module on credit cards, excess debt, personal bankruptcy and moral hazard/ethics. Prior to teaching this module we had already discussed the mechanics of the TVM mathematics for single payments, multiple payments and annuities. So, the purpose of the parable was not to reinforce the TVM mathematics per se, but to reinforce the use of the TVM mathematics in the discussion of excess personal debt and credit cards (see, for example, survey question 5 that asks about exactly this application). Our teaching plan was as follows.

Introductory material earlier in the semester:

- Teach about single cash flows and the PV and FV of a lump sum.
- Teach about multiple irregular cash flows and how to find their PV and FV using a series of single cash flows.
- Teach about regular cash flows including PV and FV of ordinary annuities and annuities due.

Credit cards, excess debt, personal bankruptcy and moral hazard/ethics:

- Discuss the benefits of credit cards in building credit scores.
- Define insolvency and personal bankruptcy.
- Discuss the consequences of personal bankruptcy (career, travel, banking, etc).
- Present the Debt Banana mathematics to show that one extra banana per day over and above your daily energy needs creates an energy gap that over 10 years leads to a weight gain of 93.9 pounds.
- Draw analogies between slow weight gain and slow accumulation of excess personal debt (they do not appear overnight; they cannot be erased overnight; once accumulated, returning to financial/physical health is difficult).
- Discuss the enhanced consumer disclosures of the Credit CARD Act of 2009.
- Do a simple credit card numerical example where there is only a single purchase and the minimum payment stream is an annuity. Solve for total repayment, and time to pay off, and level payment needed to extinguish the debt in 36 months (see questions 1, 5 and 6 in the graded quiz in Appendix 2 for examples), just as in the Sec. 201 disclosures in the Credit CARD Act of 2009.



- Do a more realistic credit card numerical example where there are multiple purchases and a realistic minimum payment. The simple TVM math is no longer sufficient and we must use our DebtBanana.xls spreadsheet.
- Perform sensitivity analysis in the DebtBanana.xls spreadsheet in class, and invite students to explore the sheet outside of class time.
  - What happens to accumulated debt and time to repay (paying the minimum) if we halve the interest rate? (see question 4 in the graded quiz in Appendix 2) Note that the answer to this question (both accumulated debt and time to repay are stubbornly insensitive to the interest rate) is a direct consequence of paying only the minimum. The longer it takes to pay off the debt, the more interest you pay, so this hidden insensitivity is clearly in the banks' interest.
  - What happens to accumulated debt and interest paid so far if the customer pays twice the minimum each month instead of the minimum? (see question 7 in the graded quiz in Appendix 2)
  - What happens to accumulated debt and interest paid if the customer always pays the full amount each month? They never pay any interest.
- Discuss the relationship between level of payment each month and time it takes to pay off the debt ("the more you pay, the less you pay;" see question 2 in the graded quiz in Appendix 2).
- Define moral hazard and discuss the moral hazard problem faced by credit card issuers. (see question 3 in the graded quiz in Appendix 2) Mention BAPCA 2005. Discuss purposeful/fraudulent accumulation of excess debt versus unintentional business failure.
  - Ask whether a good business idea that subsequently fails and leads to bankruptcy and credit card default is a case of moral hazard. We argue no, because it is unintentional and the card user's morals are not in question.
  - Discuss adverse selection as well as moral hazard. The bank's inability to identify your type in advance is an adverse selection problem. Contrast this with the case where you purposely behave badly after the card is issued; this is a moral hazard problem.
- Conclude with a summary:
  - A small extra consumption (food or credit) may go unnoticed. It adds up slowly but surely over time.
  - Even if the interest rate is low, the level of debt and the time needed to pay it off can quickly reach unhealthy levels if you pay only the minimum each month. Higher interest rates just make it worse.
  - Making only the minimum debt payment each month maximizes both the interest you pay and the time until you are debt free.
  - Paying your credit card bill in full each month means you never pay any interest. This habit can easily save you a hundred thousand dollars over your lifetime.
  - It is unethical to view personal bankruptcy as a safety net providing a moral license to overspend.
  - Declaring bankruptcy is a very public event; everyone knows.
  - Personal bankruptcy carries a social stigma that can cost you dearly in the future (career, travel, banking, etc).

## ENDNOTES

---

<sup>1</sup> Zhu finds that bankrupt and control group households have very similar levels of consumption and debt, even though bankrupt households have less than one-half the income of a control group [Zhu, 2011, p. 4]. The bankrupt households thus seem guilty of trying to “keep up with the Joneses.”

<sup>2</sup> Chapter 7 filers can completely discharge most debts but lose any collateral on secured loans, whereas Chapter 13 filers (who are usually much better off in terms of income and assets) work out a repayment plan on some of their debt and keep the collateral [Zhu, 2011, p. 31]. Zhu suggests that Chapter 7 filers are more likely to be filing as a result of an adverse event (e.g., job loss, illness), whereas Chapter 13 filers are more likely to be filing because of poor consumption/spending habits [Zhu, 2011, p. 18].

<sup>3</sup> Biological and genetic factors [Parker-Pope, 2012] along with lifestyle factors [Mozaffarian et al., 2011] play a role in determining how much food is too much for any given individual, and thus we state this consumption relative to *your* daily energy requirements.

<sup>4</sup> We acknowledge, but ignore, scientific studies that say that 10% of these calories are used up in digestion, leaving only 90% to add weight. See, for example, Mayo Clinic [2011].

<sup>5</sup> A male who is 5 feet 9 inches tall and weighs 124 pounds has a body mass index (BMI) of 18.3 (underweight); add 93.9 pounds and his BMI rockets to 32.2 (obese). See CDC [2011b] for BMI index calculations and Plachta-Danielzik et al. [2008] for discussion of the “energy gap.”

<sup>6</sup> Guthrie and Sokolowsky (2010) go so far as to link obesity and loan delinquencies, arguing that obesity-induced medical expenses compete with other loan repayments.

<sup>7</sup> Total U.S. consumer revolving debt was \$792 billion in October 2011 [FRB, 2011]. Much of this is credit card debt. There was an additional \$1,665 in total U.S. non-revolving debt [FRB, 2011]. With 112.6 million households in the U.S. [U.S. Census Bureau, 2010], this averages out to \$7 thousand in revolving debt and an additional \$14.8 thousand in non-revolving debt per household.

<sup>8</sup> Even after diet-induced weight loss, hormonal changes may explain the high incidence of subsequent weight gain [Sumithran et al., 2011; Parker-Pope, 2012].

<sup>9</sup> Note that at the four-year mark, Mary has accumulated so much debt that her minimum payment from then on exceeds what she outlays for her lunches and dinners—a sure signal that something is wrong with her spending.

---

<sup>10</sup> The Comptroller of the Currency (within the United States Department of the Treasury) requires that a reasonable minimum payment be used in the U.S. [OCC, 2010, p. 27 and p. 190], but does not specify exactly what that should be. Even if a simpler minimum payment is adopted (e.g., just 4% of the balance due) this insensitivity remains largely intact.

<sup>11</sup> It is important to note that in some countries the notion of a minimum monthly payment on a credit card is a foreign concept. For example, in Germany credit card users pay their bill in full every month by direct debit, never incurring interest. In this case, an overdraft facility normally exists on their current account and the interest rate is quite high [personal communication with German banker, January 27, 2012]. So, the end result is similar.

<sup>12</sup> Note that recent credit card debt might not be discharged in either a Chapter 7 or a Chapter 13 bankruptcy if the card issuer challenges the discharge on the grounds that the application for the card was fraudulent or that the card user had no intention of repaying the debt (see Title 11 Sec. 523 a(2) [GPO, 2010]).

<sup>13</sup> Gross and Souleles [2002] note that this social stigma includes both pecuniary costs (e.g., the consequences of a bad reputation) and non-pecuniary costs (e.g., disgrace). Interestingly, they find that the social stigma of default (both bankruptcy and delinquency), declined in the 1990s as default became more commonplace.

<sup>14</sup> For example, Guiso et al. [2011] find that over 80% of survey respondents think it is morally wrong to strategically default on a mortgage when one can afford to pay. Even so, like Gross and Souleles [2002], they find a social contagion in strategic defaults on mortgages in the recent financial crisis.