

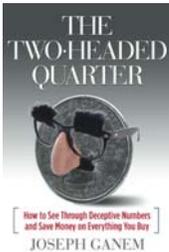
Integrating Quantitative and Financial Literacy

Joint Statistical Meetings
August 1, 2011
Miami Beach, Florida

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The Baltimore Sun: Education, math, science, personal finance
<http://www.BaltimoreSun.com>

The Daily Riff: Education Issues
<http://www.TheDailyRiff.com>

Two Headed Quarters: Personal blog on how to see through deceptive numbers
<http://twoheadedquarters.blogspot.com>

Themes: Use of numbers for misdirection. Use of numbers in place of judgment. Cost to consumers of quantitative illiteracy.

Purpose

Present instructional resources I've developed to teach "obvious benefit/hidden cost" problems.

- Resources are intended to integrate financial and quantitative literacy instruction
- Provide motivation for students/educators/policy makers to emphasize quantitative literacy

Calls for Financial Literacy Education

"Thus, in far too many instances, we entered into financial commitments that we couldn't afford, with terms and conditions that we didn't truly understand, in order to buy things that we really didn't need. If more Marylanders had the benefit of sound financial literacy education, fewer of our friends and family members would be facing the loss of homes and life savings today."

- Maryland Comptroller Peter Franchot
Baltimore Sun, Op-Ed, February 10, 2010

Education has Limits

Reminders of the obvious:

Knowledge is of no use without motivation

Education cannot substitute for trust and good judgment

All parties must act in good faith for our financial system to work

Remedial Education

Even with the NCLB law, the need for remedial college courses is not changing.

34.7% of first-year undergraduate in 2003-2004 needed at least one remedial course

36.2% of first-year undergraduate in 2007-2008 needed at least one remedial course

In many instances math is one of the remedial courses needed.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 2003-04 and 2007-08 National Postsecondary Student Aid Study (NPSAS:04 and NPSAS:08).

Quantitative Literacy

Mathematics proficiency:

32% proficient at grade 8

23% proficient at grade 12

“Consistent with these findings is the vast and growing demand for remedial mathematics education among arriving students in four-year colleges and community colleges across the nation.”

SOURCE: Foundations for Success: The final report of the national mathematics advisory panel, U. S. Department of Education (2008).

Recommendation

Students should master arithmetic before they take an Algebra I course.

“It is possible that the Accuplacer Arithmetic Test is the first rigorous arithmetic test that many students have ever encountered.”

“Algebra can be described as a generalization of arithmetic and it should not be formally studied without a thorough knowledge of arithmetic.”

SOURCE: Gabrielle Martino and W. Stephen Wilson, Doing the Math: Are Maryland’s high school math standards adding up to college success? (Abell Foundation, Baltimore, MD, 2009)

Behavioral Finance

Consumers:

•Are not rational

•Decisions often determined by “framing”

A decision frame is “the decision maker’s conception of the acts, outcomes, and contingencies associated with a particular choice.”

Often decision frames use a quantitative comparison.

SOURCE: Amos Tversky and Daniel Kahneman, “The framing of decisions and the psychology of choice,” Science, 211, pp. 453-458 (1981).

Car ad for 0% financing



Finance Charge

Use 0% financing from ad:

\$6452 = \$27,340 — \$20,888

If we use the monthly payment formula with 11% APR:

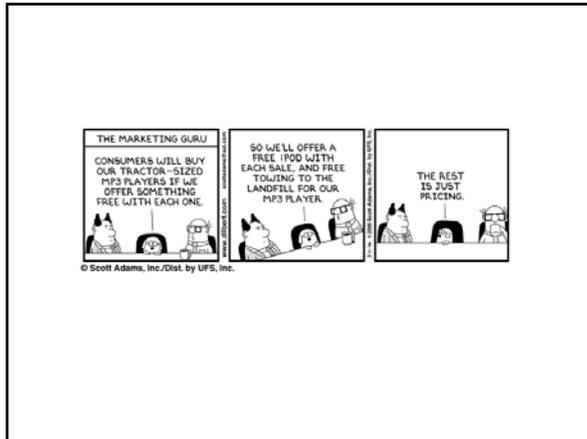
\$6360 = \$27,250 — \$20,888

Equivalent Ad



Price— \$20,888

Financing available for 5 years at 11% APR.



Loan Comparison

Auto Financing Savings

Cost without rebate (dollars):

Cost with rebate (dollars):

Loan term (years):

Reduced financing (APR*):

Alternate financing (APR*):

Monthly Payment: (reduced APR)

Monthly Payment: (alternate APR)

Difference:

* APR = annual percentage rate

Cost without rebate: \$27,340

Cost with rebate: \$20,888

Loan term (years): 5

Reduced APR: 0%

Alternate APR: 9%

Monthly payment (reduced): \$456

Monthly Payment (alternate): \$434

Difference: — \$22

Source: www.ComputeGasSavings.com

Obvious Benefit/Hidden Cost Problems

Consider these obvious benefit propositions:

- I have a coupon to save \$5 on any size purchase at a store 20 miles away. I need to buy a \$15 calculator. Should I make the trip?
- On my street gas sells for \$3.95 per gallon. If I drive to the next town 15 miles away it sells for \$3.85 per gallon. Should I make the trip?
- At a neighborhood cash-for-gold party, I've been offered \$600 for a gold chain that I no longer wear. Should I sell it?

The problem in each case is to determine the cost.

Driving to Save on a Purchase

Total Savings

Miles per gallon:

Cost per gallon (dollars):

Discount (dollars):

Distance (miles):

Total Savings:

Miles per gallon: 25

Cost per gallon: \$3.50

Discount: \$5

Distance: 20 miles

Total Savings: — \$0.60

Source: www.ComputeGasSavings.com

Driving to Save on Gas

Gas Savings

Tank Size (gallons):

Miles per gallon:

Cost local (dollars):

Cost away (dollars):

Distance (miles):

Savings per Gallon:

Tank Size (gallons): 16

Miles per gallon: 30

Cost per gallon (local): \$3.95

Cost per gallon (away): \$3.85

Distance: 15 miles

Savings per gallon: — \$0.14

Source: www.ComputeGasSavings.com

Cash for Gold

Gold Jewelry Pricing

Weight (oz):

Purity (carats):

Gold (dollars/oz troy):

Gold value

Weight (ounces): 1.2

Purity (carats): 14

Gold price (\$/troy ounce): \$1600

Gold value: \$1021

Complex Scenarios

The cost of going to work in a two-income family:

- Commuting costs
- Daycare costs
- Work-related expenses
- Taxes

A Solution for the Two-Income Family

Real Earnings Per Day

Distance to work (miles):

Miles per gallon:

Cost per gallon (dollars):

Cost of daycare (dollars):

Work-related costs (dollars):

Federal tax rate (%):

State tax rate (%):

Social Security/Medicare (%):

Daily pay:

Cost of gas per day:

After tax earnings per day:

Real earnings per day:

Distance: 10 miles

Miles per gallon: 20

Cost per gallon: \$3.75

Day care cost: \$35

Work-related costs: \$10

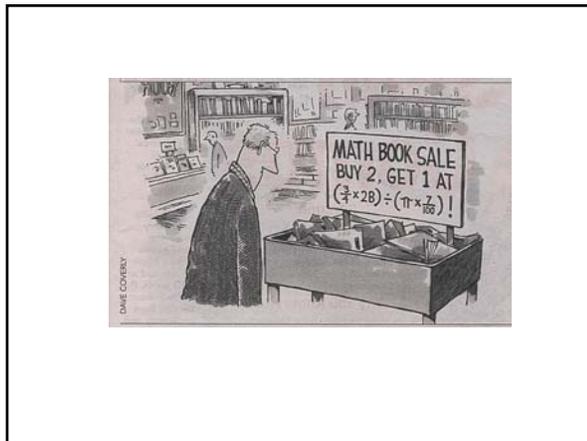
Federal Tax rate: 15%

State Tax rate: 5%

Daily Pay: \$96

Real earnings per day: \$20.70

Source: www.ComputeGasSavings.com



Generalizing with Algebra

Consumers:

Finance charge = Total cost — Cash price

Marketers:

Finance charge = Fraction of the cost determined by the interest rate in the monthly payment formula

$$v \cdot \left(\frac{100}{1}\right)(1-s) P = -SF$$

where $s = \left(1 + \frac{1}{100}\right)^{-N}$

Conclusion

- All resources available at www.ComputeGasSavings.com
- Consumers cannot act rationally if they don't understand the choices
- Learning quantitative reasoning can help consumers make better decisions
- Integrating financial and quantitative education could provide the motivation for real learning of both