THE SPENDING EXPLOSION: POSITIONAL EXTERNALITIES AND EXPONENTIAL CONSUMPTION GROWTH[1]

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Abstract:

Since the 1960s, The United States has experienced increased income inequality. Economist Robert Frank has argued that this increase in inequality has resulted in an expenditure cascade as people have tried to maintain their relative socioeconomic statuses by imitating the spending patterns of those in their reference groups. Although some researchers have tried to empirically determine the extent to which Frank's assessment is correct, none have focused on the implications of Frank's argument for the dynamics of consumption. That is, none have focused on how time series of measures of consumption should look, assuming Frank is right. This paper does exactly that. Drawing on a mathematical model from population biology, it is argued that if Frank is correct, measures of consumption should exhibit exponential growth. It was found that the exponential growth models provided excellent fits to available data on United States consumption measures.

Key words: Spending Explosion; indicators; Positional Externalities; Exponential Consumption Growth

In 1967, the lowest quintile of United States (U.S.) households had 4.0% of household income, the next fifth 10.8%, the fifth above that one 17.3%, the next fifth 24.2%, and the highest fifth 43.6% of household income. By 2009, these percentages had changed to 3.4%, 8.6% 14.6%, 23.2%, and 50.3%. That is, the top fifth of households went from having about 11 times more income to 15 times more than the bottom fifth (U.S. Census Bureau, 2010). U.S. economist Robert Frank has argued that this growth in income inequality has led to what he calls expenditure cascades resulting from positional externalities. Positional externalities result when the consumption patterns of some people influences what others desire to consume. That is, A may consume something and, because B judges how well off he[1] is by comparing what he has to what A has, B decides to consume it too. As will be seen below, this can lead to a cascade of "imitative spending" where A buys something which leads B to buy it because B compares herself to A. But because B buys it, this lads C to buy it because C compares their status to B's, etc. (Frank, 2010a and Frank 2010b).

[1] In an effort to be gender equitable, I'll sometimes use "he," sometimes "she," and sometimes "their"(out of respect for transgendered persons).

A number of researchers have taken an interest in Frank's work on positional externalities and conducted empirical work in an effort to assess the degree to which it they exist (Vendrik and Hirata, 2010; Fischer and Torgler, 2010; Torhler, Schmidt, and Frey, 2010, Rablem, 2008; Brown, Bulte, and Zhang, 2010; Schaffner and Torgler, 2010; Solnick and Hemenway, 1998). There has been little work, however, on the implications of the existence of such externalities, and associated expenditure cascades, for trajectories of consumption. This paper focuses on such implications. It will argue that expenditure cascades can result in spending patterns similar to what is found in "runaway" population growth, and that, therefore, a mathematical model often used in population biology is applicable to modeling the dynamics of several measures of consumption in the U.S.

Positional Externalities and Expenditure Cascades

Frank (2010a and Frank 2010b) provides an extensive discussion of the concepts of positional externalities and expenditure cascades. Externalities, in general, exist when market transactions affect others whom are not parties to these exchanges. For example, a firm may buy someone's labor to use in production of some consumption good. The firm benefits from having access to labor, the worker benefits from having access to a job, and consumers benefit from having access to the good. But suppose a by-product of production of the good is some kind of pollution. Those who are not owners of the firm, employees at the firm, or consumers of the product, but in the vicinity of the firm, suffer from this pollution, the resulting externality.

Frank relates this notion of externality to the increase in income inequality referred to above. Similar to many sociologists, he tells us that people often judge how well they are doing by comparing their state to those in their reference group. Members of one's reference group may be in the same socioeconomic class one is in or in a class slightly above it. Given that this is the case, if a member of one's reference group, say A, consumes a good, this may lead others in that group to consume the good as well. This is because if A consumes the good and B does not, A may now be relatively better off than B, with, of course, B being relatively worse off than A. In other words, A's consumption has altered the relative standing of B, and this is the sense in which there is a positional externality. As suggested above, Frank's key insight comes from considering how increasing inequality can affect this process. As the rich come to possess more of a nation's total household income, their expenditures tend to increase. This may lead others, even those of slightly less socioeconomic means, to increase their spending in order to regain a loss in their relative position. This may, in turn, lead others, even lower on the socioeconomic ladder, to increase their spending for the same reason. This process may cascade all the way down the socioeconomic ladder, at least well into the middle class, as people try to maintain their relative position by comparing what they have to what others have.

Frank's focus seems to be on how this process gets started by a change in spending on the part of the rich. But if people judge how well they're doing by comparing what they have to what those slightly above them have, it's also the case that the better off may judge how they're doing by comparing themselves to what others slightly below them have. If all of these upward and downward comparisons obtain, there may end up a situation where we have a perpetual expenditure cascade. Increased spending generates more spending, which generates more spending, etc. This description of an expenditure cascade has the "markings" of a "runaway" or "out of control" growth process. One of the more common of such processes, discussed in the scientific literature, is exponential population growth, such as that associated with bacteria and other organisms when there are no constraints on such growth or those constraints are not yet binding. In the biological literature (Gotelli, 2001) such growth is modeled with the following differential equation:

$$dN/dt = rN \tag{1}$$

Here N is the number of individuals in the population at time t, t is time, and r is a constant called the instantaneous rate of increase. In more detail, r = b – d, where b is the instantaneous birth rate and d the instantaneous death rate. When b = d, it can be seen from equation 1 that the population is constant over time, when d exceeds b the population is declining, and when b exceeds d, it is growing. Thus, runaway growth implies that b must exceed d.

Equation 1 is an ordinary differential equation that can be solved analytically by the separation of variables method. If we divide both sides of the equation by dt and N and integrate, we get:

$$N_t = N_0e^{rt} \tag{2}$$

where N_0 is the population size at time 0 or the initial population size. Equation 2 is the mathematical representation of exponential growth. This equation is used to model growth in many areas of science but the use that's most relevant to this paper is its use in modeling population dynamics.

According to biologists, the exponential model of population growth applies when there are no density-independent or density-dependent checks on growth or when these checks are not yet binding. Examples of density-independent checks would be droughts, hurricanes, and other weather related and climatic phenomena. Examples of density-dependent checks would be the presence of other organisms whether members or one's own species or not.

The expenditure cascade described above can lead to dynamics represented by equations 1 and 2. If we replace N with C we end up with:

$$dC/dt = rC \tag{3}$$

and

$$C_t = C_0e^{rt} \tag{4}$$

Here C is a measure of real (inflation adjusted) consumption and C_0 is real consumption at time 0 or initial consumption.

Many people, of course, have incomes that are too constrained for them to be able to engage in the expenditure cascade without access to borrowed money. Thus, if the exponential model holds, we should see exponential growth in measures of debt as consumers try to maintain their relative socioeconomic statuses. That is we would expect:

$$dC_{debt}/dt = rC_{debt} \tag{5}$$

$$C_{tdebt} = C_{0debt}e^{rt} \tag{6}$$

$$dM/dt = rM \tag{7}$$

$$M_t = M_0e^{rt} \tag{8}$$

Here C_{debt} is a measure of real consumer debt, C_0 is real consumer debt at time 0, M is a measure of residential mortgage debt, and M_0 is residential mortgage debt at time 0.

From a qualitative point of view, equations 3-8 represent a system of runaway spending financed by runaway debt all in an effort to "keep up with" and "stay ahead of the joneses." The question to ask, of course, is whether available data are consistent with such a representation.

Data

The Economic Report of the President (2010) is a yearly document written by the Chairman of the Council of Economic Advisers in an effort to highlight the nation's economic progress. The report contains tables of all kinds of data that purports to measure important economic variables (Government Printing Office, 2010). Four of these tables (Tables B-16, B-60, B-76, and B-77) provided the data for this paper. B-16 contains data on personal consumption expenditures ($billion/year), B77-on consumer debt ($million/year), B-76 on mortgage debt ($billion/year), B-60 on the consumer price index (a pure number). The time periods covered by these data differed so in order to conduct the analysis, I used the years 1965 to 2008 because these were the years for which data were available for all four variables.

The first three tables mentioned above contained nominal data. If I had simply based my analysis on these nominal time series, it would have been misleading. I suspect that Frank's concern regarding expenditure cascades is about real expenditures. That is, he's not just interested in spending increases that result merely from higher prices or inflation. He's concerned about how people are really increasing their spending not because they face higher prices but because they want to maintain their relative statuses by keeping up with and (I added) staying ahead of the joneses. An analysis based on an adjustment to these nominal variables seemed to be the better way to proceed.

To adjust personal consumption, consumer debt, and mortgage debt for inflation, I followed the standard method of dividing them by the decimal form of the consumer price index. These adjusted variables are the focus of the analysis discussed below.

Analysis and Results

With equations 3-8 in mind, I fit three exponential models to the Economic Report of the President data displayed in Figures 1, 2, and 3.

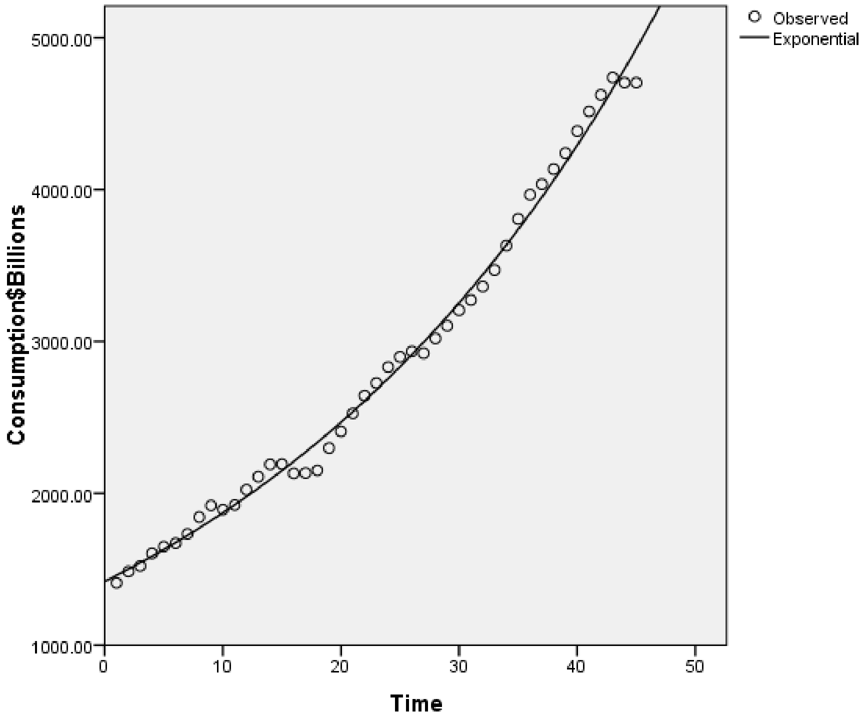

Figure 1 Time Series of Inflation Adjusted Personal Consumption Spending

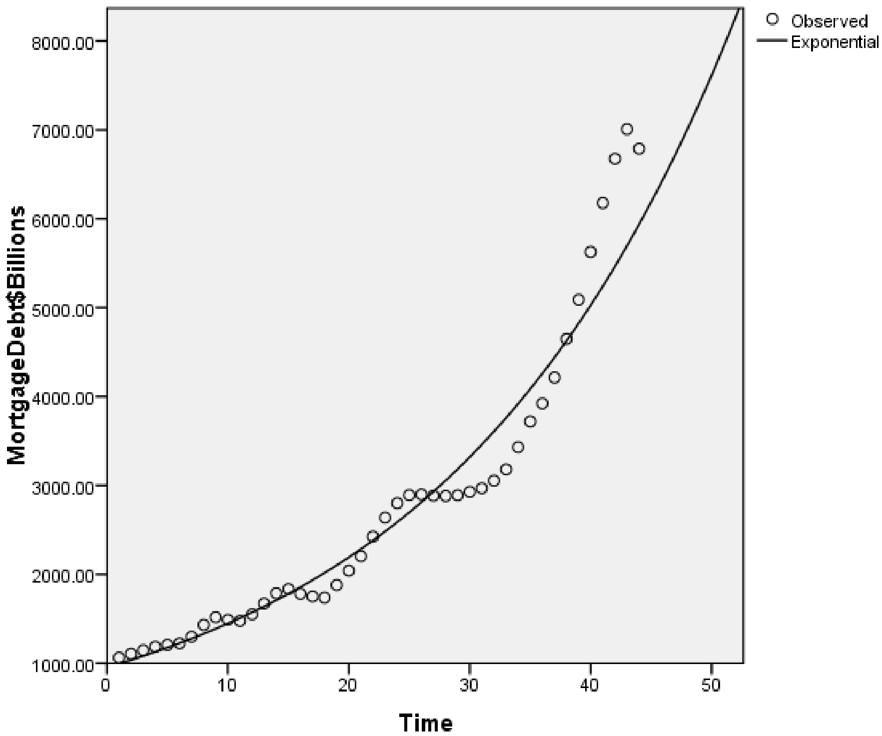

Figure 2 Time Series of Inflation Adjusted Mortgage Debt

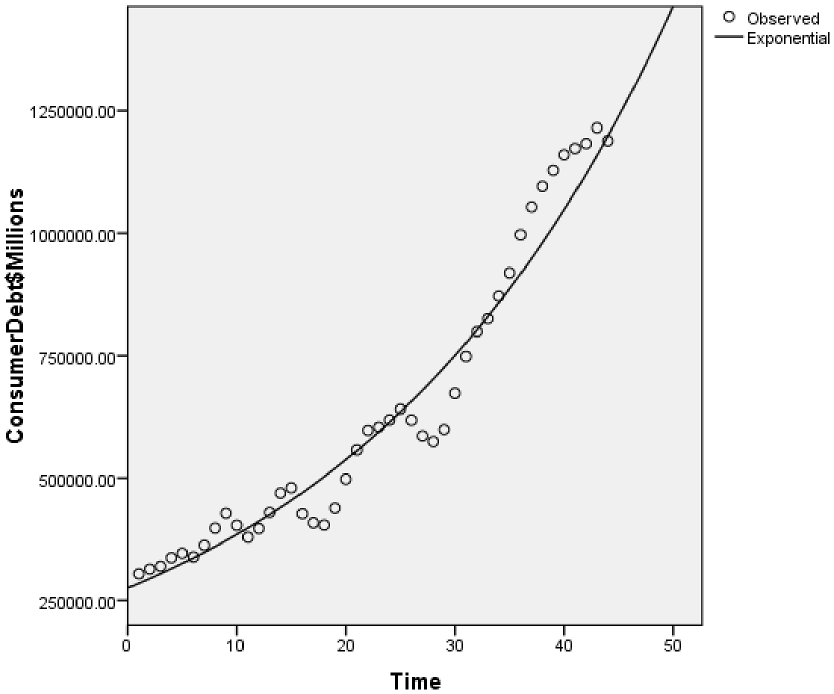

Figure 3 Time Series of Inflation Adjusted Consumer Debt

Figure 1 displays the time series data on inflation adjusted personal consumption and the exponential model fitted to these data. The equation for this model is:

$$C_t = 1419e^{.03t} \quad (9)$$

The adjusted r^2, a measure of goodness of fit, for this model was .99, about as good as it gets for models of social processes.

Figure 2 shows the time series for inflation adjusted mortgage debt. The equation fitted to these data was:

$$M_t = 955e^{.04t} \quad (10)$$

The adjusted r^2 for this model was .97, also an excellent fit.

Lastly, Figure 3 displays the series for inflation adjusted consumer debt with the following fitted model:

$$C_{tdebt} = 275681e^{.03t} \quad (11)$$

The fit of this model was .96, a slightly worse fit than the first two models but still excellent by social science standards.

All of these models were fitted to relatively short available time series. Ideally, one would want to use them to make predictions and then test these against real data that were not used to construct the model. Such data are not yet available, however, so this use of the models will have to await future work.

Discussion

Economist Robert Frank has insightfully connected increasing income inequality to a cascade of competitive spending, as people try to maintain their relative standing or status. Although there has been a good deal of work to assess Frank's idea, there has been little on what should be expected of the dynamics of consumption measures, assuming he is right. It was argued that the expenditure cascade he describes sounds a lot like descriptions of runaway population growth and that the same exponential model used to describe population explosion might also be relevant to what might be called expenditure explosion. Time series data on inflation adjusted personal consumption, consumer debt, and mortgage debt seemed to be well fit by exponential models, although the fit for consumer debt was slightly worse than for the other two models.

I stated earlier in this paper that the exponential model of population growth applies when there are no constraints on such growth or they are not yet binding. Frank (2010a) and Frank (2010b) propose a policy induced constraint on exponential consumption growth. He argues that an increased marginal tax rate on the rich may constrain their consumption enough that their role as the engine of the expenditure cascade will be disrupted. Of course, other economic changes may curtail exponential expenditure growth too. In fact, this may already be happening. The U.S. (and much of the rest of the world) has just gone through and are still feeling the effects of the worse economic downturn since the Great Depression. High unemployment, high mortgage foreclosure rates, and increased savings have resulted from this increase (Mui, 2010; Nance, 2010; and U. S. Department of Labor, 2010). It remains to be seen whether these will check exponential consumption growth, as increased population density or bad weather might check such growth in a biological population.

References

1. Alpizar, Francisco; Carlsson, Fredrik; Johansson-Stenman, Olof., **How Much do we Care About Absolute Versus Relative Income and Consumption**. Journal of Economic Behavior and Organization, 56, 2005, 405-421.

2. Brown, Philip H.; Bulte, Erwin; and Zhang, Xiaobo, **Positional Spending and Status Seeking in rural China** www.colby.edu/economics/faculty/phbrown/papers/BrownBulteZhangJDE2010.pdf (retrieved on September 20, 2010)

3. Fischer, Justina A. V. and Torgler, Benno, **Does Envy Destroy Social Fundamentals? The Impact of Relative Position on Social Capital.** www.yak.edu/leitner/resources/docs/ycias_relative_income_position_social_capital_rev.pdf (retrieved on May 20. 2010).

4. Frank Robert, **Are Positional Externalities Different from Other Externalities?** www.nd.edu/~adult/activities/documents/FrankArePositionalExternalitiesDifferent.pdf (retrieved on May 20, 2010).

5. Frank, Robert, **Luxury Fever: Money and Happiness in an Era of Excess.** New Jersey: Princeton University Press, 2010

6. Gotelli, Nicholas J., **A Primer of Ecology.** Massechusetts: Sinauer Associates, Inc., 2010

7. Government Printing Office, **Economic Report of the President Table B-16**. http://www.gpoaccess.gov/eop/tables10.html (retrieved on September 20, 2010).

8. Government Printing Office, **Economic Report of the President Table B-60.** http://www.gpoaccess.gov/eop/tables10.html (retrieved on September 20, 2010).

9. Government Printing Office, **Economic Report of the President Table B-76.** http://www.gpoaccess.gov/eop/tables10.html (retrieved on September 20, 2010).

10. Government Printing Office, **Economic Report of the President Table B-76.** http://www.gpoaccess.gov/eop/tables10.html (retrieved on September 20, 2010).

11. Mui, Ylan Q., **U.S. Savings Rate at Highest Level inYear Data Show.** Washington Post Online Edition, http://www.washingtonpost.com/wp-dyn/content/article/2010/08/03/AR2010080305317.html (retrieved on September 1, 1010).

12. Nance, Scott, **The Crisis Continues: U.S. Foreclosure Rates to Double This Year Analyst Predicts.** The Democratic Daily, http://thedemocraticdaily.com/2010/02/17/the-crisis-continues-u-s-foreclosure-rates-to-double-this-year-analyst-predicts/ (retrieved on September 1, 2010).

13. Rablen, Matthew D. Rablen. **Relativity, Rank, and the Utility of Income.** The Economic Journal, 118, 528, 2008, 801-821.

14. Schaffner, Markus and Torgler, Benno, **Meet the Joneses: An Empirical Investigation of Reference Groups** in Relative Income Position Comparisons. www.crema-research.ch/paper/2009_13.pdr (retrieved on May 1, 2010).

15. Solnick, Sara J., **Is More Always Better? A Survey of Positional Concerns**. Journal of Behavior and Organization, 37, 3, 1998, 373-383.

16. Tongler, Benno, Schmidt, Sascha L.; and Frey Brunno S., **Relative Income Position and Performance: An Empirical Panel Analysis**. http://time.dufe.edu.cn/wencong/freyliewwp268.pdf (retrieved on May 20, 2010).

17. U.S. Census Bureau, **Table A-2.** www.census.gov/hhhes/www?income?data/historical/inequality/taba2.pdf (retrieved on May 20, 2010).

18. U.S. Department of Labor, **Unemployment Rate**. http://www.bls.gov/ (retrieved on September 10, 2010).

19. Vendrik, Maarten and Hirata, **Experienced Versus Decision Utility of Income: Relative or Absolute Happiness**. http://arno.unimass.nl/show.cgi?fid=396 (retrieved on May 20, 2010).

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