HOUSEHOLD CONSUMPTION AND LIQUIDITY CONSTRAINTS:

THE IMPACT OF CONSTRAINT RELAXATION

By

RAYMOND J. QUINLAN

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Professor Thom Thurston

Date — Chair of Examining Committee

Professor Thom Thurston

Date — Executive Officer

Professor Thom Thurston

Professor Harvey Gram

Professor John Devereux

Supervisory Committee

THE CITY UNIVERSITY OF NEW YORK

Abstract

Household Consumption and Liquidity Constraints:
The Impact of Constraint Relaxation

By

Raymond Quinlan

Advisor: Professor Thom Thurston

This paper utilizes a rich data set of credit card customers in order to analyze how people respond to an unsolicited granting of credit. The data set consists of tens of thousands of credit card customers that were granted the available credit in December, 1999. Their activity is tracked over the course of the next thirty-three months, until August, 2002. The activity variables that are tracked include new purchases, change in outstanding debt on the offered product as well as for the household debt as a whole, and payment and delinquency behavior. The data set also includes the zip code of residence, estimates of household income based on census tract data, and age.

The study finds that many of the households make heavy use of the new liquidity in contrast to what would have been predicted by the permanent income hypothesis. Consumption for the period greatly exceeded the growth in average household income. Evidence of liquidity constraints is evaluated and the study concludes that there is strong evidence of a liquidity constraint existing. Households that made higher use of new liquidity were more likely to have riskier credit profiles indicating that the current credit granting policies of lenders may

constrain the higher risk households disproportionately. The study was able to examine this subset as the data set included the granting of credit to households that would not normally pass credit policy score cutoffs. The payment behavior of these higher risk accounts indicated that their credit risk is still within acceptable risk ranges during the period. The study concludes that there may be a market imperfection of a material amount, given the high proportion of GDP that is accounted for by consumer consumption and the high use of the granted credit by the analyzed group.

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INTRODUCTION

The study of household consumption is typically based upon an approximation of permanent income and divided into discrete time periods by constraints imposed, due to future income uncertainty and consumption constraints. It has been theorized that these liquidity constraints are a function of consumer assets and credit availability. The effect of the liquidity constraints has largely been untested, due to the lack of sufficient empirical data. This study illustrates the impact on consumer activity of an unsolicited relaxation of consumption constraints for several thousand consumers in the United States. The activity resulting from this relaxation has been tracked over a thirty-three month period. The timeframe is from December, 1999 until August, 2002. In order to perform this evaluation, a national credit card solicitation of pre-approved credit has been used in this study. The granting of credit was performed and potential users were notified starting in December, 1999. Activity in relation to this relaxation of the constraint was observed over the next thirty-three months.

The data set available, and how it came to be so, deserves some explanation. Citibank, a subsidiary of Citigroup, is in many consumer-banking businesses. Amongst them is their U.S. credit card division. The card division acquires many of their new customers via direct mail solicitation. In developing a model for successful new customer solicitations, many variables are taken into account. The primary purpose of analyzing these variables is to be able to optimize solicitation expenditures in relationship to consumer response to the credit card offer, and to be able to predict the consumer usage of the products offered. A key activity in this realm is the prediction of consumer default risk, as credit performance is key to profitable results.

In order to develop predictive models, sampling is done in test mailings over a wide spectrum of consumer profiles, and a large number of variables. One of these tests was executed in December, 1999. The resulting test base consisted of 55,445 individuals, and the goal was to track their behavior over many months, with the idea of obtaining enough behavioral data to develop a new response "score".

While the original intent of the program was to develop response and behavior scores, the sampling methodology, with its wide net, provided a very good household sample of the U.S. population. Further, as the offer was widely distributed in regard to age, location, income, credit worthiness, and several other variables, the data allow us to observe the response of this wide sample to a credit offer. This offer is, in fact, an offer of liquidity available for consuming by the household. The Citibank sample provides a great deal of information. I have attempted to use this information in order to gain insights into the impact of the relaxation of liquidity constraints. It is fortunate that the information is available for this use. Naturally there are constraints on the analysis, as it was not the original intent to analyze the liquidity constraint relaxation area. To elaborate on the data available, I will list some key attributes.

The database for this study is a thirty-three month view of 55,445 individuals that responded to an unsolicited offer of credit in December, 1999.

- While the data track and analyze the individual records of each respondent, all identifying information has been removed and aggregated into segments in order to protect privacy. In regard to the activity in the sample, we have available the following data:
    - Credit limit utilization for all products reported to the credit bureau. This is the amount of actual use the household has had of each approved credit line, expressed as a percent of the total.
    - Inquiries. The number of inquiries posted to the credit bureau for this record in the last six months. This is the actual count of inquiries posted to the household record by creditors, as the household requests new credit.
    - Bankcard inquiries. The number of bankcard inquiries posted to this record in the last six months. This is the number of times that the household has requested a new bank credit card loan.
    - Age of oldest trade line. The age in months of the record's oldest line.
    - Satisfactory trade lines. The count of satisfactory trade lines for this record. A satisfactory trade line, is an account that has been used by the household, and on which sufficient payments have been made to prevent the account from becoming delinquent. This is the listing of all credit accounts being paid on time.
    - Total trade lines. This is the total number of open credit accounts.

- Total balance outstanding. This is the total amount owed to all creditors.
- Total credit limit for all credit cards.
- Total revolving balance for all revolving accounts, aggregating total owed.
- The total bankcard balance.
- The total bankcard limit.
- The total time in days since the most recent bank or national trade account was opened. This is the length of time since the last major credit account was opened. This information has been used in this study as a screen before the solicitation was executed that blocked out households that had recently obtained additional credit.
- The total amount of revolving balance on bank, oil company or national trade line total.
- The revolving balances of bank, oil and national trade accounts. The total of these balances and their change has been used in evaluating the overall household use of credit.
- The number of revolving bank credit lines. This, a subset of the above, has been used to evaluate bankcard use of credit as a part of one household's overall use of credit.
- The number of trade lines opened in the last twenty-four months excluding mortgages. This is the number of new credit accounts opened in the last two years. This was used in evaluating

differences between accounts with no additional accounts versus the activity of those households which had opened new accounts.

- The number of trade lines opened in the last six months. This is the number of new credit accounts opened in the last six months.
- The total bank revolving balances, excluding the offer in this study. This is the total, in dollars, of balances owed to banks on revolving balances prior to the granting of credit for this study.
- The number of bank revolving lines, excluding the line offered in this study. This is the number of bank accounts opened with revolving credit lines, prior to the lines opened for this study.
- The highest credit line, excluding the line extended in this study. This is the highest line of credit the household had prior to this study.
- The highest revolving credit balance, excluding the balance for the product offered in this study.
- The total balance owed, excluding the product offered in this study. This is the total in dollars owed by the household, with the exception of the offer for this study.
- The total number of bank revolving trade lines, excluding the balance for the product offered in this study.
- The highest present debt burden for revolving bank on national trade line. This is an estimate of the household income divided by

the minimum payout required each month by the largest bank or national trade line.

- Retail credit card information. This is information regarding retail cards, such as inquiries for new accounts, turn down of applications, new accounts opened, size of line, etc.
- Installment loan information. Same as above for installment loans.
- Total balance of mortgage loan. This is the dollar amount of any mortgage owed by the household.
- Delinquency usage behavior:
  - Number of significant charge-offs. This is the number of accounts the household has that were written off by a lender as bad debts.
  - Number of significantly delinquent accounts. This is the number of accounts owned by the household that have gone more than 90 days delinquent.
  - Total increase of delinquent accounts. This is the number of accounts owned by the household that have become delinquent in the last year.
  - Highest delinquency in the last twelve months. This is the greatest number of days past due that any account owned by the household has become in the last year.

- The number of public records. This is the number of court records the household has experienced (bankruptcy, divorce, etc.).

The above data contain information in regard to the subjects' credit bureau. These data include information from all reports to the bureau. In addition to this set, we also have more detailed information regarding the particular product offered in December, 1999.

That information includes:

- The credit limit offered by the bank.
- The dollar total of purchases by the individual over the thirty-three months.
- The cash advance balance outstanding on each monthly statement.
- The number of purchases over the thirty-three months.
- The number of cash advances over the thirty-three months.
- The account payment history for each month in the period observed.
- Bankruptcy indicator which designates all households that have filed for bankruptcy over the period.
- Write-off indicator which records any account which was written off as a bad debt during the period.
- Risk score. The relative risk ranking of the account during each month.
- Interest charged on the account. The total interest that the bank charged to each account.

The records have been grouped into several segments to analyze behavior.

The segmentation scheme was designed to allow a view of respondents that varied over a creditworthiness spectrum with the idea of isolating differences in behavior that have occurred, due to the variance in liquidity options for accounts spread over a credit risk spectrum. The groups were established based upon a "risk score" that ranked the respondents on a scale of 1-100. The risk score ranked households from lowest risk to higher risk, depending upon their likelihood of becoming delinquent in the next twelve months. It is a standard score used in the banking industry, developed by the FICO ("Fair Isaacs Corporation") organization, and utilized by all major providers of credit in the United States. Within this scale, deciles were established to group the data. In addition, the population was divided into behavioral segments. The group that increased borrowing over the period ("the increasing balance population") was compared to the group that did not display a record of increasing balances ("the decreasing balance population"). The segments were tracked over the time period in regard to several actions:

- The use of incremental credit made available to them over time
- The overall use of credit
- Credit Performance
- Income based on censor tract
- Home value based on censor tract
- Age of head of household
- State of Residence

In each case, the primary focus has been the change in the use of credit from December, 1999 until August, 2002. Differences in performance by credit segment, income, home value age and state of residence were all documented and evaluated. In particular, the difference in growth rates between inferred consumption and income changes were estimated an analyzed. Income for the sample is known at the census block level as of December, 1999 and regional changes in income were used to approximate overall income changes during the period. The actual change in credit use was then compared with the income change, in order to evaluate the approximate incremental change in consumption, during the period of observation. In this way, we could estimate change in consumption relative to both the change in income and in regard to the prior state. This change in consumption, coincident with the change in the relaxation of the credit constraint, yields a clue as to how binding that constraint was in the prior period. The activity tracked most closely was the relationship to consumption once the constraint has been alleviated.

The consumer consumption expenditure just prior to the credit granting is at a given level of expenditure, which has been used as the base for each household. As the average credit line granted was approximately $3,000 and the average household income in the sample was $40,000, the credit granting that we are viewing is significant in relationship to household income. As a result, this credit granting can have a material effect on consumption options. We tracked the use of this new credit. The overall use of total credit by the household was also followed.

In the United States, there is a well-developed system of tracking consumer credit at the individual level. All major private concerns provide information to a joint database used by financial institutions and others that have an interest in consumer behavior, relative to credit and the patterns of household use in handling credit. Operating in a cooperative union, these grantors of credit report consumer behavior to the "utility" at no cost, so that each may benefit from the pooled data in evaluating consumer "creditworthiness." We will discuss the methods used for evaluating creditworthiness and the effect that varying levels of riskiness has on consumption in this study. These data represent a complete credit picture for millions of Americans. As part of our evaluation, we will be able to track not only the use of the new consumption capability, but also the use of all available credit by the household. This is a fuller picture of credit availability than has been available in most research done to date.

Initially, we have a group of households in some form of consumption equilibrium given their household income, assets, a view of future income variance and their credit constraints. They are not seeking additional credit that would support a higher level of consumption. As a result, these households have not been applying for new credit lines. In order to be eligible for the offer, the tested population could not have been actively seeking additional credit in the several months prior to the study. As above, all households that have been seeking new credit lines from any institution would have on their credit bureau reports an "inquiry". All such recent inquiries have been screened out of the sample. The new credit granted as a result of this solicitation is, therefore, clearly exogenous to the households. This type of activity was pre-screened out by reviewing credit bureau data for inquiries regarding new loans.

As a new offer of credit is made available to the households, we have a relaxation of the consumption constraint that allows us to view their reaction to changes in regard to that relaxation. The granting of the unsolicited credit noted above, gives the household "found" financial reserves. In regard to the household, this is clearly an exogenous event. We are able to follow the impact of the new consumption and its impact on the overall household use of credit, via the ongoing view of the household's total credit bureau report. As the study is thirty-three months in length, we can also observe what occurs, as the new credit availability becomes a more sustained part of the household financial picture. As a result of this lengthy review, we can observe the change in other household borrowings over almost three years. This is important, as it is the case that the households rapidly use the available credit over the first five months, and then level off their use thereafter.

Important in this analysis, is the fact that the data are nationwide for the United States. Because of this widespread data survey, we are able to approximate the overall changes in the populations' household income during the period. The population can be segmented and tracked at the census block level, for a finer view of income changes. In the United States, during the December, 1999 to August, 2002 interval, nominal household income rose approximately 4% per annum. This setting is important in isolating the income change for the sample. In addition, the widespread sample allows us to gauge the results against the backdrop of U.S. overall consumption during the almost three year total period. Household consumption in the United States during this period, defined as the growth in Personal Consumption Expenditures (PCE), rose at an annual level of approximately 5%. Using this macroeconomic indicator, we are able to view the sample household changes against this more general backdrop. As many of the segments' consumption increased multiples of the aggregate income increases, we can intuit the presence of a consumption constraint against which the relaxation of the constraint matters. We also tested for regional variations and found very little variance in use patterns.

This setting gives us the potential to discuss the major quantitative variables that are typically thought to affect consumption. The diversity and size of our sample allows us to isolate overall income and consumption change effects. We can view the household's use of credit via the tracking of the new offer and the change in credit bureau balances. By tracking the increase in consumption, we can measure the magnitude of the consumption constraint. Having established this base, we will move on to two key areas:

Initially, all of the households have been categorized based on risk profile, age, home value, annual income, and wealth. We will be able to examine the impact of the consumption constraint relaxation as it impacts households on a range of each of these variables.

Secondly, we will be able to examine the use of the new credit in relationship to the household's overall availability of credit, as we have the household's entire credit bureau available to us.

Risk analysis for consumers using FICO scores and the setting of a cutoff or approval optimization point for loan processing is a household parallel to the framework developed by Stiglitz & Weiss (1981). In their study regarding credit rating in markets with imperfect information, they develop a model for commercial lending in which a market equilibrium can be established for a market in which credit rationing exists. In discussing credit rationing, Stiglitz & Jaffee (1990) point out the importance of a proper mechanism for these decisions:

"When credit is allocated poorly, poor investment projects are undertaken, and the nation's resources are squandered."

In particular, in regard to the data we will be examining, they go on to discuss the unique nature of credit markets:

"The special nature of credit markets is most evident in the case of credit rationing, where borrowers are denied credit even though they are willing to pay the market rate (or more), while apparently similar borrowers do obtain credit."

In their study of credit rationing, they note that the literature search goes back as far as 1776 (Smith), and that the subject is referenced by Keynes in his "Treatise on Money" (1930, I: pp 212-212; II: pp: 364-367): "So far, however, as bank loans are concerned, lending does not - in Great Britain at least - take place according to the principles of a perfect market. There is apt to be an unsatisfied fringe of borrowers, the size of which can be expanding or contracting the volume of their loans, without there being any change in the level of bank-rate, in the demand schedule of borrowers, or in the volume of lending otherwise than through the banks. This phenomenon is capable, when it exists, of having great practical importance."

This thinking, as Stiglitz & Jaffee go on to comment, leads to the underpinnings of credit rationing standards reflected in the Stiglitz & Weiss paper, and reflected in the data examined in this paper. The Stiglitz & Weiss contribution of modeling a framework in which credit rationing exists, is a relevant background for the empirical data examined in this paper. Their work implies that creditworthy consumers desire credit at the current market rate (or above) and that they will not currently have all their credit needs satisfied. Further, that amongst those not being able to satisfy their credit needs are many that are creditworthy. In our tracking of our test data, we will see that both of these propositions appear to be verified; firstly, that many households will make use of additional credit when made available, indicating that the household is moving to a more desired level of spending and second, that they will act in a creditworthy manner. This is relevant, as our sample contains the activity of households that would normally be declined by banks, due to weak credit profits.

Previous empirical studies such as work done by Zeldes (1989) and Rumkle (1991) have tried to incorporate some aspects of consumption by using some proxies for these consumption expenditures such as PSID to examine food consumption, which is quite limited in relationship to total household consumption. Zeldes (1989A) goes on to split his sample into higher and lower wealth segments based on total assets, in order to track balances. These approximations - based on total assets - are usually very rough and do not necessarily represent the household's true options for consumption. Following the actual use of credit will allow us to be significantly more accurate in following consumption activity. This study examines credit use directly and not through the filtered approximation of asset movement. In this way, we can avoid the problem of consumption versus asset accumulation of assets on the consumer's overall balance sheet.

A possible use of the data set includes trying to approximate household conservatism in relationship to consumption. This would be consistent with Deaton's notion of a buffer stock created by households in order to smooth consumption. This is the self-restraint that a household places on itself in order to restrict consumption, even though it has credit lines available that would allow the household to increase consumption in the current period. One possibility is that by tracking "unused lines" of consumer credit, we can approximate this behavior. This area of investigation is especially pertinent, as estimates of U.S. consumer behavior frequently stimulate discussion regarding the real or perceived debt burden of U. S. households.

One hypothesis in this area of credit use is that the population will react in two very different ways, as economic conditions deteriorate in regard to the buffer stock theory. For those households that have uninterrupted income streams, but for whom the environment appears more risky, we may expect to see less use of available credit, as a cautionary cushion will be accumulated to buffer perceived "hard times" ahead - but not currently experienced. In this way, the non-use of available credit is a form of "liquidity", that could be used if income is interrupted. By constraining consumption now, the household will have the credit line available when the income for the household is negatively affected. For those households that have actually experienced an income interruption, however, the picture is quite different. These households will be more likely to use some portion of available credit contained in the household's current credit lines to maintain household consumption, at a rate approximating the rate of consumption that was extant prior to the interruption. This also would be consistent with Deaton's buffer stock theory. Such activity is consistent with a long-term consumption view. It is a key point in observing behavior. If income is interrupted and a household seeks to maintain its long-term consumption expenditures, it will clearly use all the credit available, in order to keep functioning at this longer-term consumption level. On the other hand, if a household is worried about future income interruption, it will conserve available credit in anticipation of the bad days to come. This is, in fact, the experience of the aggregate U.S. population. We are able to use this aggregated data as context for an analysis. Both of these observations are consistent with a permanent income hypothesis. In both cases, the household is smoothing out consumption and using credit as negative savings, in order to obtain a more stable consumption level over time.

So far, we have introduced risk ranking, credit limit setting, the availability of credit limit data, the utilization rate of the credit limit as an important concept, and the theory that this use will vary widely by household in times of economic downturn, depending upon the household experience and outlook.

In the sample, we were able to track the level of major delinquencies on all credit accounts held by the households. One area of interest is whether the households that are experiencing increases in delinquencies are more likely to have been consumption constrained. The sample was tracked and segmented by both delinquency behavior and balance growth. Those households that had an increase in delinquency had a consistently higher use of credit than those that did not have an increase in delinquency, during the period. The results are quite striking. The population that exercised an increased use of credit over the period, had an increase in "major delinquencies" of 49%, while the flat to decreasing credit balance group experienced a decline in delinquent behavior. A “major delinquency” is defined to be any time during which the household becomes more than sixty days past due on any loan reported to the credit bureau.

Major Delinquencies Per Household

	Initial	Terminal	Δ%
Increasing Balance Group	.57	.85	+49.1%
Decreasing Balance Group	.56	.51	-8.9%

The results are quite consistent over the period viewed. This evidence tends to support expectations in regard to lending to riskier households. The group that made use of the new credit, in order to increase their present consumption expenditures have raised these expenditures in relationship to current income. This is consistent with the possibility that they are raising these consumption expenditures to be more in line with their estimated longer-term expenditure level. In this effort, the household's ability to successfully stay at this higher level is dependent on the ability to finance the current period debt. As many households are subject to income interruption, or an inability to finance this debt, some increase in delinquency will be experienced for a portion of the households. These data are consistent with this hypothesis. The phenomenon will be most obvious in the segment of households that increase their current borrowing. The data are consistent with this hypothesis as well.

Clearly, we have some *prima facie* evidence of differences in response to the consumption constraint relaxation, depending on the household's situation. Given the difference in activity between the two groups, we can tentatively say that those with a higher risk of delinquency may have been more consumption constrained than those with a lower propensity to become delinquent. As this conclusion appears to be borne out by the data, the smoothing effect on consumption, consistent with a lifetime income hypothesis, would appear to be in evidence over the three year period.

Having this information regarding new consumption activity, overall credit use, overall credit availability and differences in balance growth and use of risk scoring, we can now start to review trend data, in order to gain an understanding of the activities by the households over time. The primary objectives are to track the use of the new credit, to follow the use of this consumption in relationship to overall credit availability, to segment this behavior by risk segment in order to approximate credit demand and to approximate the impact of this consumption change in relationship to the household's overall change in income. We have focused on the self-monitoring aspect of the behavior, at the household level. As we see patterns of behavior that imply that a liquidity constraint does exist and that consumption responds to a relaxation in that constraint, we will attempt to extrapolate the macroeconomic implications of these facts.

The linkage we are observing - from pre-existing constraint, to risk scoring, to credit limit granting, to increased consumption, to self monitoring, to varied patterns depending on the impact of the economic environment – has important policy implications. The mechanism of the credit granting and the use of this credit can be an important tool in the management of household consumption both at the margin, and in aggregate. The control of this credit granting is decentralized and not crisply linked to any policy institution, as the credit grantors are both regulated financial institutions as well as a compilation of unregulated entities, such as retail stores. As a result of this situation, it is possible to have an increase, or a decrease, in consumption expenditures for some segments of the U.S. household population, which is unrelated to the regulatory framework in the U.S. As we have seen, some segments of the U.S. household population respond to an increase in available credit by changing their consumption expenditure level. If these changes in credit availability hold in the U.S., the entities that control that credit availability can, in aggregate, have a significant impact on overall U.S. consumption, as the use of credit cards is extremely widespread in the U.S. Because many of these entities are unregulated, there can be activity which may conflict with government policies to raise, or lower, consumer consumption expenditures. If retailers, oil companies, and finance companies are executing credit policies different from the government, these policies could act in such a way as to make success of the government entities more difficult.

Studies done elsewhere have documented the use of financial innovations, such as securitization of the bank receivables and mortgages and their transfer to bondholders, as a means to disconnect the availability of credit to households from regulators. This has become established practice in the consumer credit industry. This study adds to this the evidence of this disconnect by focusing on the significant impact that credit limit granting has on segments of the U.S. population, especially in regard to consumption changes. It is important to emphasize in this regard, that much of the credit availability provided to households, is done so by non-regulated grantors such as major retailers and oil companies, and not by financial institutions. This further de-links this important stimulus to consumption from the monetary authorities.

In summary, this study illustrates that the relaxation of the credit constraint for some segments of the U.S. population significantly affects their consumption behavior. Their behavior can be tracked by developing an estimate for the household populations' income and consumption and by tracking the use of new credit provided exogenously to the household. We will track the use of the new credit by several variables including risk ranking, age, census block income, and others, over a thirty-three month period. The use will vary with economic conditions and their effect on individual households. The result of this analysis has the potential to have macroeconomic policy implications, regarding the linkage of individual credit granting to overall consumer consumption at the margin. Consumer consumption in the United States is approximately 70% of GDP. A 1% variance in this amount is a significant change in absolute terms. The analysis will show that credit constrained households may increase their consumption by amounts significantly higher than this amount if unconstrained, causing this linkage to be relevant.

CURRENT LITERATURE

In reviewing the literature regarding this topic, the two areas of most activity appear to be the following:

1) Consumption and Investment framework. The generalized life-cycle model is the relevant frame for developing household consumption patterns and whether there are constraints on desired consumption. Within this frame, there is a set of activity that addresses borrowing restrictions. We shall explore how those restrictions are thought about and the work that has been done regarding them.
2) The second area of focus is found in micro-data and equilibrium models. Within this frame, I will focus on incomplete markets and the literature that has been generated regarding micro-evidence and its relevance to the topic.

By pursuing the literature review in this way, we will cover both the model-frame aspect of the subject as well as the empirical work that has been done regarding the topic. Addressing the consumption and investment frame first, the topic appears relevant as a subset of the life-cycle consumption frame. As noted by Attanasio in addressing consumption:

"I consider the life-cycle model as a model in which consumption decisions are determined within an intertemporal optimization framework. What elements of this model turn out to be more important is largely an empirical matter. Indeed, even the presence of liquidity constraints or borrowing restrictions, can and should be incorporated within this framework."[1]

While most of the modeling that is used in the general literature assumes no liquidity or borrowing constraints, some efforts have been made to accommodate this reality. Attanasio, in surveying the literature, goes on to both note the constraint and to discuss how it is generally incorporated.

"Related to the issue of precautionary savings is that of the presence of borrowing constraints. The standard model assumes that individuals can borrow against future labor income to finance current consumption at the same rate at which they can lend. Of course, if this is not the case, the basic model has to take into account the additional constraint."[2]

While he notes that the borrowing rate, that is, the cost of the borrowing, may not be identical with the rate at which lending could be conducted by the consumer, he does not address a lack of availability of funds, at any price. The notion here regards price, not the absolute scarcity of credit. This distinction is important, as consumer response to availability constraints may be quite different from response to (especially small) movements in the cost of funding. This is important for segments of consumers that do not have access to credit as a routine matter. The U.S. credit industry approval rate on unsecured applications for credit is normally below 50%. The total unavailability of credit is a reality for significant portions of the U.S. population. This absolute lack of credit availability is addressed in Stiglitz & Weiss as discussed earlier in this study.

Continuing to approach the area of keenest concern for this study, Attanasio addresses the phenomenon of responses to a change in income.

"It has now become customary to interpret evidence of 'excess sensitivity' of consumption growth to labor income as an indication of 'liquidity constraints'; by which it is usually meant the presence of some imperfection in financial markets that prevents people from borrowing."[(3)]

This "excess sensitivity", which is usually seen as an increase in the marginal propensity to consume for a change at a given level of income, will be key to the topic being discussed. In fact, the implied increase in consumption that is being funded by increases in borrowings is a core observation in the data. Moving further in the analysis, Attanasio continues to focus his comments.

"However, there is no reason to believe that liquidity constrained individuals consume their disposable income. Only when the constraints are actually binding will this occur. Therefore, excess sensitivity tests and more generally Euler equations are not the best way to identify liquidity constraints. With these considerations, I do not want to dismiss the possibility of liquidity constraints as unimportant or unrealistic."[(4)]

This point of view is carried into several articles on the subject. Fleming (1973) discusses the imperfection of capital markets and the impact on the permanent income hypothesis. Tobin and Dolde (1971) discuss policy implications of liquidity as an imperfection in the framework. These studies both address the model adjustments that might be implied from the constraint. There are no empirical data used. The discussions in all three of these studies focus on the constraints associated with liquidity and the imperfection in the constraints that is a result of the current level of technology in transferring liquidity from savers to desiring borrowers. Liquidity constraints here are pricing inequalities that are appropriately or inappropriately set. As we go further, it is possible that an absolute constraint may be relevant for the consumer:

"An alternative to the consideration of interest rates varying with the amount borrowed (or saved) is the assumption that individuals face a limit to the amount they can borrow (which can be zero). Obviously, this can be interpreted as a case of the previous situation, with the borrowing rate being infinite at the limit. Even in this case, however, there are certain alternatives. It is possible, for instance, that the limit an individual can borrow is not fixed, but a function of some variables which, in turn, can be endogenous. Finally, it is possible to consider the existence of collateralizable loans."(5)

The effort here is to circumvent the absolute borrowing constraint via price setting, attaching the restriction to a variable such as income, or to change the characteristics of the borrowing (to collateralization, for instance) so that borrowing could, nonetheless, occur. Work has been done along these lines. Alessie, Devereux and Weber (1997) discuss the linkage between liquidity and earnings. In the end, however, there may be a real constraint that must be recognized.

"When liquidity constraints take the form of a limit to borrowing, it is still possible to write the Euler Equation for consumption, as long as the constraint is not binding. When it is binding, instead, the Euler equation will hold as an inequality, or as an equality with the addition of a slack-variable."(6)

The generalized Euler equation then becomes:

$$E_t\left[\frac{C^{1}_{t+1}}{C_t}\left(1-R^{t}_{t+1}\right)B\right] = 1+ u_t$$

When u_t is "an unobservable Kuhn-Tucker multiplier associated to the borrowing restriction."

In discussing the effect that this constraint may have, Hayeshi (1987) makes an interesting observation. As liquidity and borrowing relate to the intertemporal transfer of funding, the presence of a borrowing limit has the effect of changing the optimization horizon from multiple periods to matching income and consumption in the current period, in a manner that is as consistent as possible with the household’s permanent income projection. Therefore, consumption must be optimized using the liquidity at hand.

The importance of liquidity constraints has been highlighted by both the general business press and by economists. In order to help predict this important activity, the level of consumer borrowing is tracked closely. Comments about consumption are frequently tied quite closely to analysis of overall borrowing. The discussion varies among several areas including; consumer willingness to undertake debt, the carrying cost of such debt and the availability of the loans.

Indeed, as noted in current literature by Attanasio, "From a Policy Perspective, liquidity constraints are important because of their effect on the level of consumption rather than on its changes. In other words, what matters is how consumption reacts to unexpected changes in the economic environment (including policy changes). Euler equations are not informative about this." This comment leads immediately to the work of this paper. It is exactly the area we explore.

In reviewing the relationship between consumption and credit, several tactics have been taken. Ludvigson (1999) reviews the interaction between the two for aggregate U.S. consumption over the period from 1953 to 1993. He notes that “despite the growing attention paid to ballooning consumer indebtedness, little formal research has been devoted to investigating the impact of credit aggregate on aggregate consumption.”(7) He explores this relationship, along with an analysis of the theory which would be supported by these macro-relationships. He concludes that the data support the permanent income hypothesis in connection with a “buffer stock” that consumers will use to cover stochastic impacts. His focus is on “predictable” consumer credit growth in the U.S. He concludes, “this paper finds evidence that consumption growth is correlated with predictable consumer credit growth in the U.S. aggregate data.”(8) His focus on “predictable” credit growth is in contrast to the focus of this study on unpredictable credit growth.

He also notes that in relationship to economic policies, “Independent variation in credit availability that is common across households will produce an additional source of volatility in aggregate consumption that is not associated with stocks in conventional indicators such as income and interest rates."[(9)]

This study focuses on unpredictable changes in consumer credit, and does so at the individual household level. The conclusions for aggregate variables behavior, though, are consistent with Ludvigson.

Having the point of view that the constraints are important, but not dealt with by most analysts, and not covered by the standard approach in the Euler equation, the next step is to review some work that has been done in trying to address the area in theory. Wilcox (1989) addresses liquidity constraints and the impact of several variables, including lending policy constraints. He "argues that households are often prevented from consuming as much as their permanent income justifies. The hypotheses is advanced that lending criteria based on payment-to-income ratio often inappropriately constrains borrowing and, therefore, consumption." He examines the issue in both micro and macro terms. He asserts that this (liquidity) constraint emanates from households being constrained in their ability to borrow as a result of lenders' payment-to-income restrictions. In this way, Wilcox is a good stepping-off point for this study. He has no microeconomic data to add to the body of evidence. This conjecture that consumers would be better off with a more lenient credit policy environment is tested in this study. Both of his points - that consumption is constrained, and that credit policies are too restrictive - appear to be validated by the empirical information in this study.

Deaton (1991) covers the effect of liquidity constraints on the levels of consumption. He concludes that the presence of liquidity constraints causes behavior that is similar to precautionary savings. Households will accumulate their own liquidity, in order to avoid being constrained at an inopportune time. As a result of this approach, households will only run into the constraints rarely, as this precautionary behavior will cause them to avoid such an experience.

In this construct, the constraint is avoided by the household using planning to curtail consumption, and thus lives within its budget by self-imposed discipline. Clearly, in this discussion we are assuming that the ideal consumption for a household, given its perception of its income, savings and credit options is the consumption we see. If a household is constrained, in regard to its intentions, we will not see that conflict with the above framework.

Attanasio articulates an approach with a similar behavioral frame;

"For liquidity constraints (or precautionary savings) to be relevant for individual behavior, it is necessary that the households concerned want to borrow, that is, they face an increasing income path and are impatient enough to want to bring resources from the future to the present."

If one rules out the possibility of dying in debt and considers finite lives and a marginal utility of consumption that goes to infinity when consumption goes to zero, it is possible that liquidity constraints are generated endogenously by the model. In particular, to avoid the possibility of having zero resource (and therefore zero consumption) in the last period of life, individuals will not want to borrow any amount in excess of what they can repay with probability one."[(10)]

This point of view has several key assumptions which may not hold. Many people die in debt. People die without it being part of the plan. Lenders do not necessarily evaluate the household in the same way as the household evaluates itself. Due to these violations of the underlying assumptions, we could easily see households choosing to outspend their income, or desiring to borrow within the discussion's constraints, but not have that view shared by a risk adverse lender. Liquidity constraints exist in the economy and are relevant to modeling, and the behavior of individuals. In fact, despite the above point of view, Attanasio, in summarizing recent research in consumption says: "the considerations above indicate that a profitable research strategy is one which aims at characterizing the response of consumption to various news when liquidity constraints are relevant."[(11)]

This leads naturally to the paper at hand. In regard to conceptual background, Deaton (1991) appears to be the leading groundbreaker. Hubbard, Steiner & Zeldes (1994, 1995) have also done some theoretical modeling in regard to borrowing restrictions. Both of these lines of reasoning center around precautionary savings as a way of avoiding the liquidity constraint. In this way consumption is smoothed by not consuming when the household desires, in contrast to accelerating consumption, which the lack of a liquidity constraint would allow.

As referenced earlier in this paper, Stiglitz and Weiss (1991) and Stiglitz and Jaffee (1990) develop frameworks in which we can have market equilibrium and credit rationing. Clearly, the empirical data examined in this paper is in concert with these frameworks. In particular, the Stiglitz and Weiss conclusions, that creditworthy consumers will not be able to obtain the credit desired in a framework that is in equilibrium due to a mismatch of optimality conditions between credit providers (banks in this example) and the desires of borrowers, is especially relevant.

This leads to the question of what empirical work has been done in regard to liquidity constraints. Attanasio (1999) notes "identifying the presence and the relevance of borrowing restrictions is not easy." Some work by Jappelli (1990) has been done with the Survey of Consumer Finance. Households were questioned about their credit applications, attitudes, and results. No actual activity monitoring was involved. Only intentions were viewed. Other work on the subject include Juster & Shay (1964) regarding consumer choice on loan tenure which did not include analysis of the actual loan use or household performance with the loan. Attanasio & Goldberg (1997) also analyzed households' behavior in regard to auto debt. They focused on loan length selection as well, but with actual observed data regarding the selection of loan tenure.

Additional empirical work has been done by Zeldes (1989) and Rumkle (1991). Both have used PSID to examine consumption. The PSID contained information regarding food consumption only, which is limited in scope. Both discuss liquidity constraints but do so by using this limited database to imply overall constraints. Zeldes (1989a) splits his sample into higher and lower wealth sample. The lower wealth consumption fits a lagged income line. The higher wealth does not. Zeldes theorizes that this may be due to a liquidity constraint. Due to the partial nature of the data and the absence of any borrowing data in the analysis, this conclusion would be logic based, not data based.

In her paper, "Credit Card Borrowing, Delinquency and Personal Bankruptcy", (2000), Stavins concentrates on the payment behavior of consumers with credit card debt outstanding. The study uses industry information at the aggregate level, from 1990 to 1999 in the U.S. The focus of the paper is not on the relationship between constraints and consumption, but it does provide helpful background regarding the use of credit cards, gross outstandings, revolving debt's growth as a proportion to total consumer debt, and the overall importance of the area to the U.S. economy at large. In particular, she notes that "the ratio of consumer debt (excluding real estate) to disposable income increased (in the 1990's) and it has remained above 20 percent, despite rising incomes."[12]

In companion studies, "Do Liquidity Constraints and Interest Rates Matter for Consumer Behavior?, Evidence from Credit Card Data" (2000) and "Consumer Response to Changes in Credit Supply: Evidence from Credit Card Data" (2001), Gross and Souleles analyze household specific data to track consumer behavior, in regard to credit card debt. Their database is composed of an extract from a larger database provided by several large U.S. credit card companies. They used this extract as the base for the paper. The core observation point is the monthly statement that customers receive. The sample size is twenty-four thousand accounts and the observation period is from January 1995 through

January 1998. Within this group, a subset of the accounts received credit line increases during the period.

This last group was carefully analyzed and the study concluded that "increases in credit limits generate an immediate and significant rise in debt counter to the permanent income hypothesis."(13) The results are in contrast to "The canonical Permanent Income Hypothesis (PIH) (which) assumes that consumers have certain equivalent preference and do not face any liquidity constraints."(14)

In their review, they observed that "credit cards play an important role in consumer finance, so they are a good place to look for the effects of liquidity constraints."(15) This data set provides significant advantages in relationship to prior studies, allowing for the analysis of individual households during a period of thirty-six months. In regard to the relaxation of liquidity constraints, they obtained a sub sample of just under four percent of the accounts in an average month (about 800 households) which received credit line increases. They were able to track this group and concluded that the credit line increase resulted in "an MPC of 13%… Hence, liquidity matters counter to PIH."(16) Here, Gross and Souleles are using the term MPC in relationship to line availability, so an increase in credit line of $100 would yield an increase in debt of $13. They go on to say that "we showed that this response is consistent with buffer-stock models of precautionary savings."(17)

Gross and Souleles attempt to quantify the aggregate implications of changes in credit supply. They concluded that there is an impact of "about 10 percent of the size of the annual increase in aggregate consumption"[18] under the assumption of a $2,000 line of credit increase to credit card customers. Their paper is consistent with the findings in this study. Both find a high MPC associated with credit increases. The databases in both are large and allow for tracking over many months.

In contrasting the Gross and Souleles' papers to this one, a key difference lies in the fundamental design of the databases. Gross and Souleles are working with a detailed extract of pre-existing credit card customers drawn from the billing statement records. All the households in the database were extracted from then current billings. As a result, all the households have some level of credit card balance outstanding at the start of the data period. Those households with no balance outstanding, would, of course, not be receiving a billing statement.

These households have several characteristics. They all have balances to start, they all hold those balances in relationship to some credit level, and they all have open accounts, which necessitates the fact that each of the households has passed some credit criteria screen for one of the banks, in order to obtain that open account. This study differs from the above construct in areas that are key to examining the extent of a liquidity constraint's existence, and the power of relaxing that constraint. To be specific about the difference, we will go through the major ones in each of them.

First, none of the accounts in this data set were open at the initiation of the study. The study commences with an offer in December, 1999. The offer is unanticipated by the accounts. In examining liquidity constraints a good tool may be the unanticipated relaxation of any pre-existing constraints. The current study is specifically well suited to that exact point. This point of departure is in contrast to Gross and Souleles, who initiate their analysis with customers who are in a pre-existing relationship. Many of these customers have had accounts open with their banks for years, and have had many months to evaluate their loan balances and relationship of those loan balances to the credit limit granted them by their bank. This difference is a crucial one in regard to examining the relaxation of the relevant liquidity constraint. In Gross and Souleles, households have had months or years to come to a balance between consumption and credit limit. In the current study, all the liquidity being offered is new. We are focused, therefore, on the household reaction to that new credit. The current study, by its design, is attempting to specifically review liquidity constraint relaxation, not the general use of liquidity provided to the household.

Within the Gross and Souleles study, there is a small subset of customers that received credit limit increases from their banks. This group comprises about four percent of the data extract. The study is unable to address two important aspects of those line increases. Firstly, the database does not distinguish between those households that requested a credit line increase and those households that had that credit line increase granted to them by the institution without it having been requested. This segmentation is an important one in regard to examining liquidity constraint relaxation. If a household requests a credit line increase, it clearly feels constrained, and would like to borrow more. Hence, the request. This household's use of the credit line granted will, typically in the industry, be more aggressive than those households that have been granted a credit line increase without its having to request same. Distinguishing between the two would be important in isolating the household's activity. The current study places all households in a "level playing field" by granting the credit lines with no pre-existing knowledge of any of the households. Therefore, this study does not suffer from the above-mentioned balancing of household action.

A second major characteristic of the Gross and Souleles credit line increase database is that it is not longitudinal in nature. The database tracks those households that have received credit line increases, and can distinguish between this subset and the households that did not receive these increases. This is an important capability. A second capability would be to take all the households that received credit limit increases in a given month, and track them as a separate subset for two years, or so. As the Gross and Souleles database has accounts which can enter or drop out, the absolute integrity of this type of tracking cannot be guaranteed. Tracking the households with the credit lines granted offers some insight, but tracking them as a separate group which remains intact over an extended period of time would allow for the credit line increase "impact", and then to track when that impact has dissipated.

The current study effectively does this type of tracking. All the households within the study received unanticipated increases in credit. This eliminates the first blurring of household intent mentioned above. In addition, we track the impact of this additional credit over the full thirty-three month period, as a group, so we can isolate the initial impact, as well as analyze the households as they settle into a new equilibrium.

Secondly, all the households in Gross and Souleles have credit card accounts with their institutions. They, of necessity, had to pass a credit screen of some type in order to receive those accounts. This is the "normal" business of credit card banking.

As a result of this selection criteria, however, we cannot review the reactions to a liquidity constraint relaxation for those households that are less creditworthy. One might hypothesize that the households that have not been approved for a credit card by one of the banks are more constrained than the database in Gross and Souleles. This subset of the population is an important one in the current study. One attribute of the current study is that it includes a broader sample of accounts. The offers in the current study were specifically designed to have a broader population than we would find in a typical bank's customer base. The reason for this approach was the intention of using the behavior of those not normally approved customers in order to develop new targeting techniques that would allow the bank to make credit card offers to a broader group of households. The inclusion of this group is a particularly fortunate aspect of the current study. This type of sampling is not routinely performed, and so the behavior of these households can be invisible to any study of current customers of banks. The result is that the current study has a fuller picture of U.S. households, and their response to a liquidity constraint relaxation. This is particularly important because, as Gross and Souleles note “we find that increases in credit limits generate an immediate and significant rise in debt. This response is sharpest for people starting near their limit, providing evidence that liquidity constraints are binding.”(19) Those households that are near their limit are more likely to have a stressed credit score and are less likely to receive a credit line increase in most industry credit screen models.

As might be expected, those households with a current balance close to their limit, or ones with a poor credit profile, and therefore having fewer credit options, are the households that are most constrained. We see in the study that the behavior of more credit stressed households indicates a higher use of the credit granted than those households with a better credit profile. As a result, the sampling that this study possesses of households that would normally not be approved for credit lines is especially interesting. The fuller sample is critical to an understanding of the extent of a response to a liquidity constraint. The data in this study are also from a more current time period. Additionally, the data points available for this study provide a much richer base for analysis. As the credit line is only increased for a small portion of the Gross and Souleles study, the number of households in this study is approximately four times larger.

There are, therefore, key differences between Gross and Souleles and the current study. The basic difference in database construction is the fundamental difference. Gross and Souleles examine pre-existing customers, many of whom are with their banks for years, and the current study exclusively looks at new offers of liquidity. Gross and Souleles, when the data is available (about 4% of the time) can view credit line increases, but cannot distinguish between customer-generated requests, and the independent quantity of credit line increases by the relevant bank. This study is homogenous, with all the credit granting being unsolicited by the household. Gross and Souleles have pre-existing customers only in the database, all of whom have passed credit screens in order to obtain their accounts. This study surveys beyond the normal credit criteria of banks, and is able to view more constrained households. Nonetheless, the findings in both analyses are consistent. Consumers respond to a relaxation of their liquidity constraint with significant increases in consumption in both sets of data. The difference in database framework yields results that are also directionally consistent. Whereas Gross and Souleles reach a 13% MPC in their sample using their definition, we would expect a higher MPC in this study's more expanded sample, which more fairly represents the true liquidity constraint of the U.S. household population. As noted later in this study, the MPC for the study's database was in excess of the growth in income during the thirty-three months, reflecting the more rigidly constrained nature of the fuller population, in contrast to those households who generally pass the industry's audit screens.

This study finds results consistent with Gross and Souleles, while extending the analysis, updating the observation points, and utilizing a more populous household database for analysis.

This completes the review of the topic from the consumption modeling point of view. Now we will proceed to discuss equilibrium models. In this frame, the topic of borrowing constraints and liquidity constraints appear. The specific areas of presence are in incomplete markets and in the empirical field of micro-evidence.

In regard to borrowing constraints, the Pareto optimal economy structure generally works with the assumption of no borrowing constraints. When the constraints are taken into account as in Miller (1974), Bewley (1977), Sheinkman & Weiss (1986), Aiyagari (1994) and Krusell & Smith (1998), they are brought into the model as a structural restriction. That is, no intertemporal transfers are permitted and only non-negative amounts of capital may be held. In effect, the constraint is that no borrowing is allowed. As discussed by Browning, Hauser & Heckman, then, in the Handbook of Macroeconomics, (1999) borrowing is largely addressed via the assumption of no constraints (Pareto Optimality) or specific rules (incomplete markets).

We have seen that the liquidity constraint is deemed to be important and that some empirical work has been completed to try and test household attitudes and responses. In this paper we further that work considerably. We are able to view household use of additional liquidity that has been provided. Importantly, we are able to view borrowings as a direct action in regard to supplementing income and not be constrained to try and test out liquidity demand via partial consumption patterns or questionnaire responses.

The database available in this study is far richer than any used in previous empirical studies of credit and liquidity. We will be able to not only view the liquidity constraint, but to follow over almost three years, the reaction to the loosening of that constraint.

FINDINGS

Overall, it appears that the population examined does respond to an exogenous relaxation of existing credit limits. The behavior that this group exhibits over a long period indicates that this borrowing change exceeds reasonable estimates for the equivalent changes in income. That is, while income for the group was up approximately 15% for the total period, the consumption was up over 70%. The segment of the population that was in the increasing balance group increased their overall balances, excluding mortgages, by 111% over the three years. These changes in behavior vary by the scored risk level of the household, which implies that a liquidity constraint, to the extent that it is present, varies by risk segment. These behaviors hold over a wide area of sampled geography. The sampled geography is available in the Appendix. The population is well distributed throughout the U.S. California has the largest proportion of any state at 13%. All 50 states are represented.

A key theoretical question is the relationship between the new liquidity available to the household and how that liquidity is utilized. A heavy use of the newly available liquidity would imply that the household may have been previously constrained and that now, with more funds available, the household will increase consumption and borrowing in order to reach a more desirable level.

Table 1 is designed to test that theory by analyzing the impact on balances outstanding for different time periods in response to additional credit lines granted. The exhibit looks at six time periods. The greatest impact on balances is in the first time period (from 12/99 to 2/00). In order to test the relationship between the change in the credit granted and the subsequent change in household activity, a series of regression tests were run. The changes in credit granted was found to have a significant impact on the balance change five to seven months after the initial granting, and then to have a diminished effect thereafter.

Table 1

Change in Credit Limit in Relationship to Balance Changes

Independent Variable	Dependent Variable	Intercept / Standard Error	Coefficient / Standard Error	T Statistic / P-value	Standardized Beta Coefficient	R-Square	Adjusted R-Square
Change in CL from 12/1999 to 02/2000	Change in BAL. from 12/1999 to 02/2000	339.35 (8.07)	0.197 (0.002)	85.48 (<.0001)*	0.46	21%	21%
Change in CL from 12/1999 to 02/2000	Change in BAL. from 02/2000 to 04/2000	73.51 (6.83)	-0.014 (0.002)	-7.32 (<.0001)*	-0.04	0.2%	0.2%
Change in CL from 12/1999 to 02/2000	Change in BAL. from 04/2000 to 06/2000	76.63 (5.17)	-0.009 (0.002)	-6.05 (<.0001)*	-0.04	0.1%	0.1%
Change in CL from 12/1999 to 02/2000	Change in BAL. from 06/2000 to 08/2000	29.47 (4.80)	-0.006 (0.001)	-4.53 (<.0001)*	-0.03	0.1%	0.1%
Change in CL from 12/1999 to 02/2000	Change in BAL. from 08/2000 to 10/2000	42.88 (5.11)	-0.002 (0.002)	-1.63 (0.104)	-0.01	0.1%	0.1%
Change in CL from 12/1999 to 02/2000	Change in BAL. from 10/2000 to 12/2000	84.36 (5.22)	-0.005 (0.002)	-3.46 (0.001)*	-0.02	0.4%	0.4%

* Significant at 99 or more percent confidence level.

As can be seen from the table, the 21% R^2 of changes in balance during the period four to seven months after the credit was granted is correlated with the granting of increased credit. The initial response to an increase in availability of funding seems to yield a response that is significant. The response thereafter is mitigated.

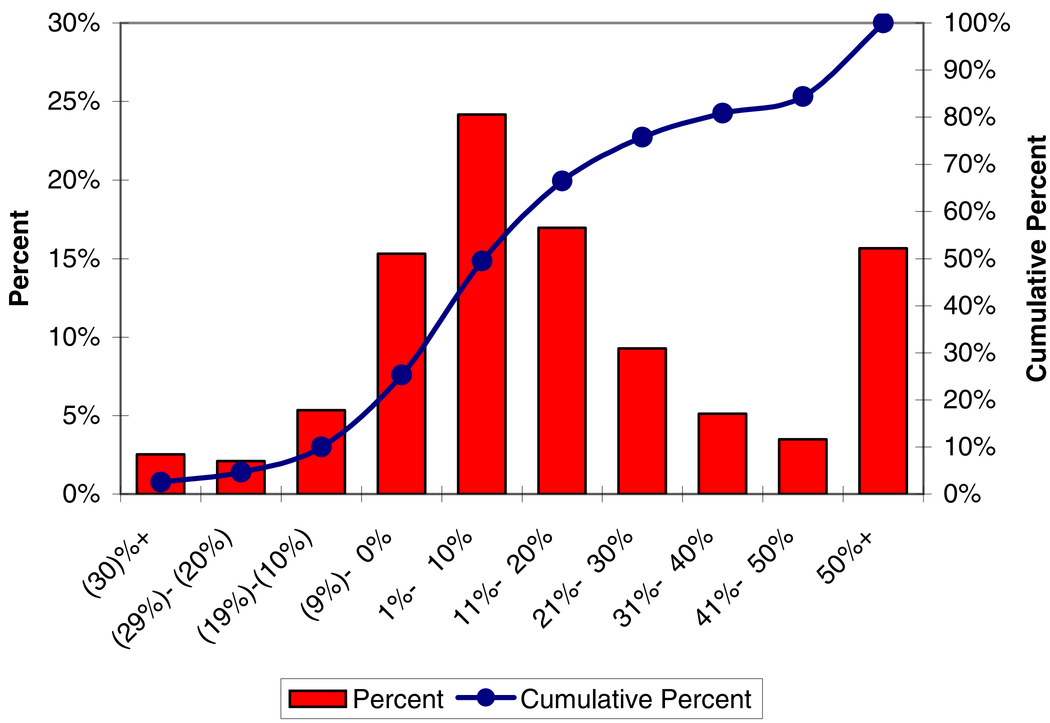
This change in balance outstanding is quite significant in relationship to the household's overall debt, and in relationship to the average household's overall income. During the first four to seven months, the average income for the population rose approximately 3%, so the consumption for the group was greatly in excess of that amount. The standardized beta coefficients depict the impact on the dependent variable of a unit increase in the effect variable. That is, a one dollar increase in credit limit is associated with an almost $0.50 increase in balances.

The current limit increase stimulus seems to be viewed as important by the households tested. They increase their consumption faster than income, and maintain an elevated level of borrowing for more than a year after the initial credit granting. In an effort to examine the relationship between changes in balances and other variables by which the households were categorized, further regressions were run. We examined changes in balances in relationship to changes in credit limit, risk profile, age, home value, annual income and wealth.

In aggregate, the population did respond to the credit line exercise. As is indicated in Chart 1, 75% of the population increased their credit usage while only 23% decreased their use of credit over the first year. Significantly 9% of the sample increased their use of credit by over 100%. The chart indicates the distribution between the granting of additional credit and the balance change during the first year.

Chart 1

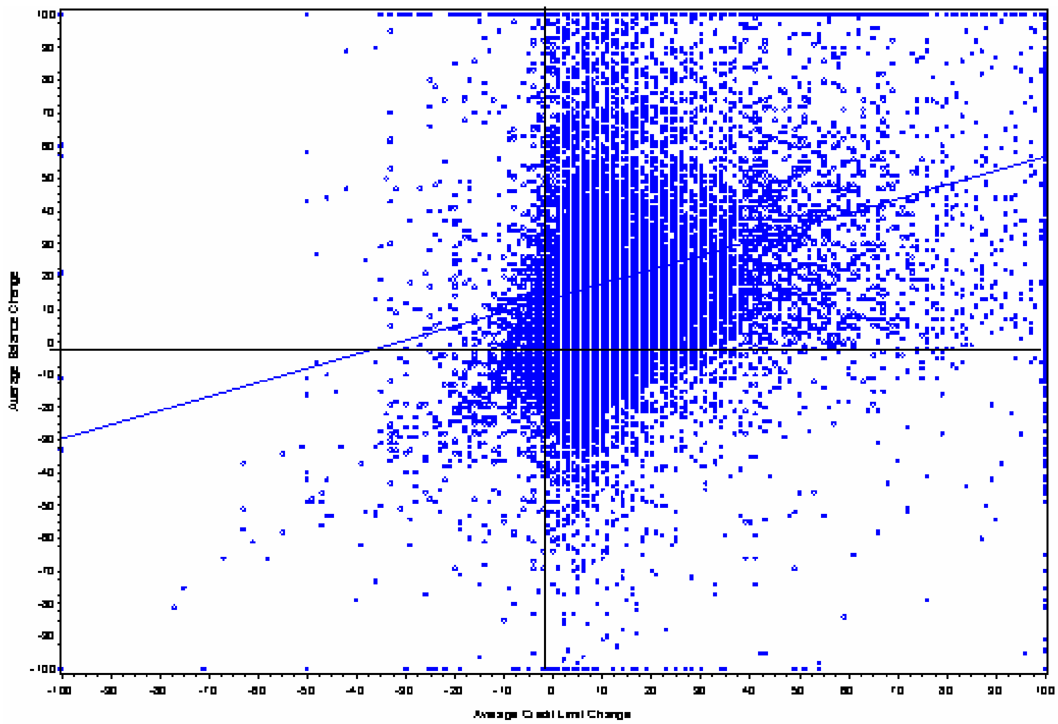
Distribution of 1st Year Balance Growth



In order to further illustrate the relationship between credit limit change and balance growth during the first year, the scatter gram and regression line in Chart 2 were constructed. As can be seen on Chart 2, the vast majority of test points show a general direction that follows the fixed regression line. Clearly there is a positive correlation between the credit line change in the first year and the balance growth. As illustrated in Chart 2, the test relationship is above the extant growth rate for income in the surrounding environment.

Chart 2

Balance Change and Credit Line Change in the First Year



In order to test for impact of change in credit, median age, median house value, annual income, and wealth, several regressions were performed. An effort was made to seek higher correlations by splitting the population into two groups. Those that had a decrease in balance over the period and those that had a steady increase in balances over the period. In this way it was thought that the results would be stronger by segmenting those households that more heavily used the credit and tracking their behavior. The total sample was comprised of 55,445 records of which 7,651 never displayed activity, leaving a remaining total of 47,794 in the population. While many in the sample had initial increases in balance and purchase behavior, the increasing balance group was chosen based upon a sustained increase in balances. This group was 26,559, or 56% of the total. The remaining group was 21,235, or 44% of the total.

A summary of the regression results is shown in Table 2. Table 2 illustrates the relationship between the first four-month balance change, as this is where the greatest change in balance occurs, and the several variables which were reviewed. The change in credit limit is introduced first. Following that regression, the next variable introduced is median age. The interaction between change in credit limit and median age is also addressed. The same regressions have been used for median home value, income and wealth. The change in balance is most closely tied to the change in credit limit. This is a cross-sectional analysis, which results in an R-Square of 9.40%. This is the highest R-Square result in all the demographic equations.

Table 2

Regressions Using 4-Month Balance build as a Continuous Dependent Variable

Model #	Model Fit		Model Estimates					
	R-Square	Adj. R-Square	Independent Variables	Estimates	Error	t Value	Pr > |t|	Std. Est.
1	0.0940	0.0939	Intercept	834.7705	10.70115	78.01	<.0001	0
			CL	0.10532	0.00195	53.91	<.0001	0.30654
2	0.0001	0.0000	Intercept	1222.7131	55.64078	21.98	<.0001	0
			Age	1.93075	1.50567	1.28	0.1997	0.00766
3	0.0952	0.0951	Intercept	629.00562	86.73765	7.25	<.0001	0
			CL	0.19345	0.01663	11.63	<.0001	0.56302
			Age	5.54433	2.35711	2.35	0.0187	0.022
			CL * Age Interaction	-0.00237	0.0004465	-5.31	<.0001	-0.26297
4	0.0012	0.0011	Intercept	1233.7583	12.49928	98.71	<.0001	0
			Home Value	0.0004043	7.089E-05	5.7	<.0001	0.03405
5	0.0940	0.0939	Intercept	825.11168	19.60182	42.09	<.0001	0
			CL	0.10485	0.00358	29.28	<.0001	0.30516
			Home Value	7.135E-05	0.0001146	0.62	0.5336	0.00601
			CL * Home Value Interaction	1.74E-09	1.96E-08	0.09	0.9293	0.00119
6	0.0205	0.0205	Intercept	1146.0643	9.08913	126.09	<.0001	0
			Income	0.00251	0.0001037	24.21	<.0001	0.14313
7	0.1018	0.1017	Intercept	740.13275	14.21245	52.08	<.0001	0
			CL	0.10627	0.00275	38.66	<.0001	0.3093
			Income	0.00205	0.0001766	11.59	<.0001	0.11672
			CL * Income Interaction	-1.00E-07	2.84E-08	-3.53	0.0004	-0.043
8	0.0060	0.0059	Intercept	1012.0336	22.75197	44.48	<.0001	0
			Wealth	0.00126	9.707E-05	12.96	<.0001	0.07721
9	0.0951	0.0950	Intercept	639.4732	35.49112	18.02	<.0001	0
			CL	0.12799	0.00657	19.47	<.0001	0.37251
			Wealth	0.0009028	0.0001552	5.82	<.0001	0.05539
			CL * Wealth Interaction	-1.04E-07	2.69E-08	-3.86	0.0001	-0.08359

Adding median age has only an insignificant effect on the explanatory power of the change in credit limit. Median age is positively correlated with balance build. Thus, the older the account holder, the higher the balance. When credit limit and age are taken together, the impact is significant, but the R^2 of 9.52% is only marginally above the 9.40% R^2 of credit limit taken by itself. The case associated with median home value is similar, where almost no change in explanatory power is associated with either the use of home value by itself, or in looking at the credit limit/home value interaction. Income has a small, but significant effect when the interaction of credit limit and income is calculated, the effect is to raise the overall R^2 to 10.2%. The effect is inverse, so that as income increases, a decrease in the rise of balances is experienced. This is consistent with the intuitive observation that those households who most need, and will use credit, will be concentrated in lower income segments. This finding is also consistent with the theory of liquidity constraints. As a household develops more alternative sources of liquidity, one of which is income, additional other sources such as a credit limit increase will explain less of this behavior. A final demographic variable, wealth, was also evaluated. Adding wealth had a very small marginal effect on the overall explanatory power associated with credit limit changes above. The wealth interaction with the credit limit change is also consistent with the liquidity theory. As wealth increases, the coefficient is negative, indicating that balance is immensely impacted by this wealth increase.

In concluding this section of analysis, it is clear that the credit limit change is what is driving balance change over the period. The addition of income brings the cross-sectional R^2 to 10.2%. Other demographic information has very marginal to no explanatory power.

The next step in the analysis is to take the risk score into account. As noted earlier, all accounts have a FICO score assigned to them. The FICO score intends to include in its calculation some of the demographic information that we have been discussing. FICO is designed to calibrate risk and in doing so, the model builders attempt to capture all relevant data in industry or household. Table 3 has the results associated with the risk score review. First, overall FICO relationships are reviewed, and then the table continues with a segmentation of the population into several FICO bands.

Table 3

Overall FICO Regressions

Model #	Model Fit		Model Estimates					
	R-Square	Adj. R-Square	Independent Variables	Estimates	Error	t Value	Pr > |t|	Std. Est.
10	0.0578	0.0578	Intercept	4928.9323	87.93751	56.05	<.0001	0
			FICO	-5.20349	0.12551	-41.46	<.0001	-0.2404
11	0.2216	0.2216	Intercept	6357.9948	82.06755	77.47	<.0001	0
			CL	0.14679	0.00191	76.79	<.0001	0.42723
			FICO	-8.16429	0.12042	-67.8	<.0001	-0.37719
12	0.2648	0.2647	Intercept	2252.6032	128.89151	17.48	<.0001	0
			CL	1.1685	0.02527	46.25	<.0001	3.40081
			FICO	-2.31786	0.18571	-12.48	<.0001	-0.10709
			CL * FICO	-0.00143	3.525E-05	-40.55	<.0001	-3.07776

FICO Score 700+

Model #	Model Fit		Model Estimates					
	R-Square	Adj. R-Square	Independent Variables	Estimates	Error	t Value	Pr > |t|	Std. Est.
13	0.0979	0.0979	Intercept	555.38071	15.55959	35.69	<.0001	0
			CL	0.09326	0.00242	38.55	<.0001	0.31292
14	0.0454	0.0453	Intercept	6631.9479	218.90325	30.3	<.0001	0
			FICO	-7.52674	0.29502	-25.51	<.0001	-0.21304
15	0.1729	0.1728	Intercept	7766.0592	205.25984	37.84	<.0001	0
			CL	0.10818	0.00235	45.94	<.0001	0.36298
			FICO	-9.83325	0.27918	-35.22	<.0001	-0.27832
16	0.1884	0.1883	Intercept	2744.0611	370.70345	7.4	<.0001	0
			CL	1.02141	0.05641	18.11	<.0001	3.42724
			FICO	-3.04676	0.50193	-6.07	<.0001	-0.08624
			CL * FICO	-0.00123	0.0000758	-16.2	<.0001	-3.10707

FICO Score 640 to 700

Model #	Model Fit		Model Estimates					
	R-Square	Adj. R-Square	Independent Variables	Estimates	Error	t Value	Pr > |t|	Std. Est.
17	0.2328	0.2327	Intercept	778.73754	15.80237	49.28	<.0001	0
			CL	0.19743	0.00346	57.02	<.0001	0.48246
18	0.0025	0.0024	Intercept	3803.1966	448.68439	8.48	<.0001	0
			FICO	-3.43359	0.66579	-5.16	<.0001	-0.04975
19	0.2438	0.2437	Intercept	5677.8833	391.98851	14.48	<.0001	0
			CL	0.20233	0.00346	58.48	<.0001	0.49443
			FICO	-7.29809	0.58346	-12.51	<.0001	-0.10575
20	0.2491	0.2488	Intercept	1359.2908	633.7385	2.14	0.032	0
			CL	1.41684	0.14038	10.09	<.0001	3.46231
			FICO	-0.89615	0.94092	-0.95	0.3409	-0.01299
			CL * FICO	-0.0018	0.0002076	-8.65	<.0001	-2.98069

FICO Score less than 640

Model #	Model Fit		Model Estimates					
	R-Square	Adj. R-Square	Independent Variables	Estimates	Error	t Value	Pr > |t|	Std. Est.
21	0.3398	0.3396	Intercept	784.14223	25.13725	31.19	<.0001	0
			CL	0.28833	0.00669	43.09	<.0001	0.58289
22	0.0001	0.0002	Intercept	1434.5546	451.27513	3.18	0.0015	0
			FICO	0.31657	0.73853	0.43	0.6682	0.00714
23	0.3414	0.3411	Intercept	2041.1564	366.54361	5.57	<.0001	0
			CL	0.29021	0.00671	43.24	<.0001	0.58676
			FICO	-2.06737	0.60195	-3.43	0.0006	-0.04661
24	0.3425	0.3420	Intercept	1002.7648	565.64196	1.77	0.0763	0
			CL	0.68297	0.16316	4.19	<.0001	1.38085
			FICO	-0.37055	0.92625	-0.4	0.6891	-0.00835
			CL * FICO	-0.00064	0.0002656	-2.41	0.016	-0.79916

The first regression is FICO alone in relationship to balance change. The R^2, at 5.8% is significant, but not as high as credit limit alone at 9.4%. The relationship is negative with a -.24 coefficient, and significant in absolute value. This negative relationship is in stark contrast to the credit limit/average balance change beta of +.31. Taking the two, FICO and credit limit, together, we obtain some very significant results. Our R^2 jumps to 22.2% - high for a cross-sectional analysis – and our beta coefficients become quite a bit larger. For credit limit, the coefficient jumps to 42.7%, and for FICO it rises to –37.7%, while remaining inverse. A next step was taken to calculate the interaction effects. Here, the results improve again. The R^2 rises to 26.5%. This is the highest correlation yet, and nearly triples the 9.40% R^2 of credit limit taken alone.

In order to derive a fuller effect from the risk score explanatory value, the population was segmented into three groups. The first is those households with a FICO score of over 700. This is generally regarded as a very low risk group. The second group is comprised of those households with FICO scores between 640 and 700. These accounts are regarded as having significantly more risk than those over 700, but are approved by many institutions. As a general rule, those households with FICO scores below 660 are regarded as “sub-prime” in industry language. The third group is the sum of those households having scores of less than 640. These households are not normally approved by mainstream lenders. As noted earlier in this paper, a fortunate construct in our sample is that it includes households not normally approved for credit offers. This less than 640 group is where we would find most of these households.

Some of these results are of particular interest. The group of >700 has an R^2 of 18.8%, when credit limit and interaction are taken into account. This is double the power of credit limit taken by itself for this population. The beta coefficient is negative at –3.22. For the households that are in the middle group, 640-700, we see the R^2 value increase to 24.9%. The interaction value is strong, and the coefficient negative. The final group, households with a FICO score of less than 640, has the strongest results. Credit limit taken by itself has a very high 34% R^2 value. This is the highest of any of the regressions run. Clearly in the high-risk group, credit limit drives behavior where the beta coefficient at 58.2% is very high. This number indicates that for every $100 increase in credit limit, the household balance grew by $58.20 during the first four months following the offer. Gross and Souleles found a 13% change in balances for each dollar of extended credit in their study. This result, at 4.5 times the use of credit limit by this population is powerful evidence of a liquidity constraint pre-existing for these households. This result is clearly outstanding, and brings new power to the evaluation of liquidity constraints. Table 3 is clear evidence of the power of credit limit and risk segmentation in evaluating this population and liquidity effects. Table 3 also fits the theoretical framework. As FICO scores increase, credit limit change has a consistently lower impact on the change in balance. Clearly, the largest reaction to the credit limit change is in the lower FICO segments which have fewer credit and liquidity options.

In order to further illustrate the use of credit limits by segmented population, the FICO ranges were further segmented in Table 4. Table 4 has the deciles referred to earlier in this paper. For each decile, the FICO range is listed. Next, the median credit limit granted is listed, along with the median balance after four months. In the sixth column, the utilization rate – balance divided by limit – is listed. Table 4 further delineates the usage rates that we saw in Table 3 for the highest FICO range, 767 plus, the utilization rate is the lowest at 8%, and for the riskiest group, below 631, the utilization rate is 65%, which is 8.13 times higher than the top group. Clearly the higher risk households use credit limits when they are made available.

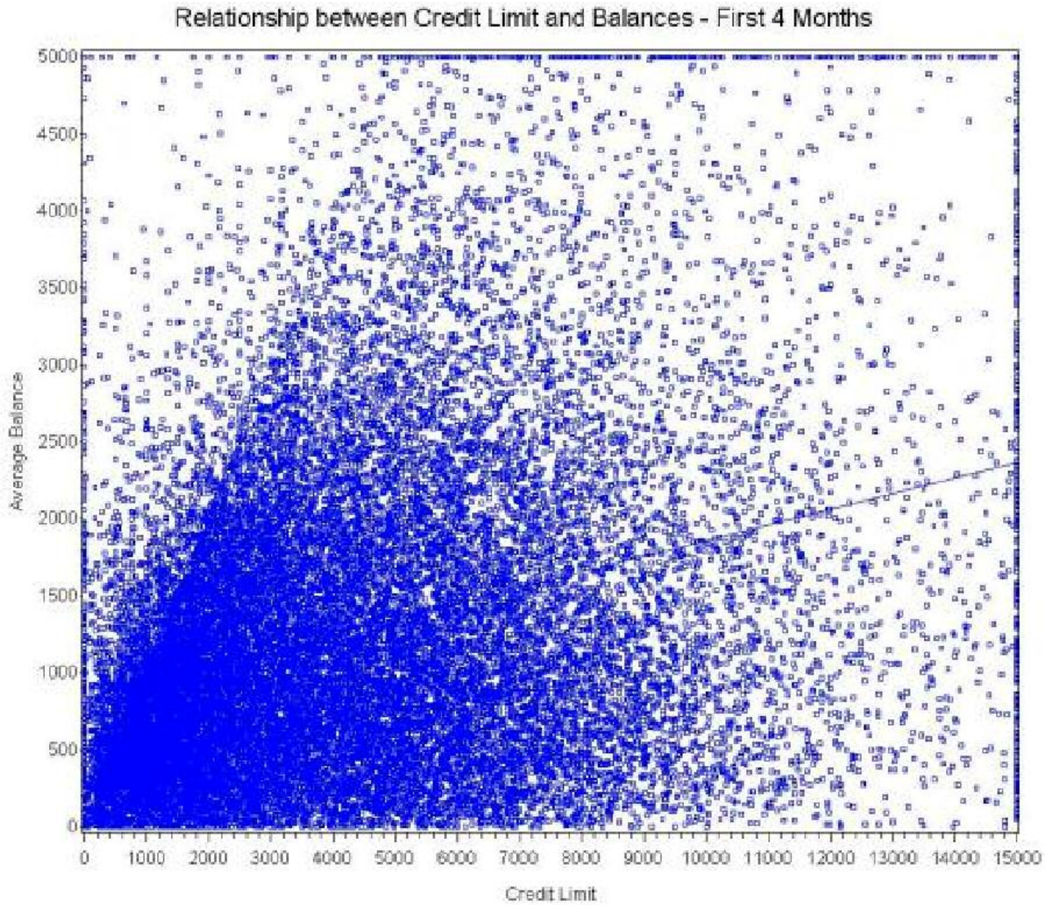
Table 4

Balances, Credit Limit and Utilization by FICO Deciles

FICO Rank	FICO Range		Balances				Credit Limit				Utilization	
	Min	Max		Mean		Median		Mean		Median	Mean	Median
Low	468	631	$	1,604	$	1,376	$	2,840	$	2,227	138%	65%
2	632	655	$	1,566	$	1,308	$	3,200	$	2,537	130%	55%
3	656	672	$	1,497	$	1,253	$	3,320	$	2,700	132%	50%
4	673	685	$	1,467	$	1,219	$	3,666	$	3,014	122%	43%
5	686	699	$	1,401	$	1,153	$	3,960	$	3,349	117%	37%
6	700	711	$	1,297	$	1,048	$	4,418	$	3,825	88%	29%
7	712	726	$	1,211	$	927	$	4,686	$	4,165	88%	25%
8	727	743	$	1,105	$	847	$	5,271	$	4,801	58%	19%
9	744	766	$	957	$	724	$	5,641	$	5,286	60%	15%
High	767	999	$	666	$	471	$	6,256	$	5,893	38%	8%

In order to illustrate these results in a more visual manner, some scatter grams have been included. Chart 3 plots credit limit change and balance change for the first four months for the entire population.

Chart 3



There is a clear positive relationship as we saw in the regression review. The slope of the fitted regression line is positive but not very steep. Chart 4 shows the same relationship for those households with FICO scores greater than 700. Here we see the same positive relationship but a shallower regression line.

Chart 4

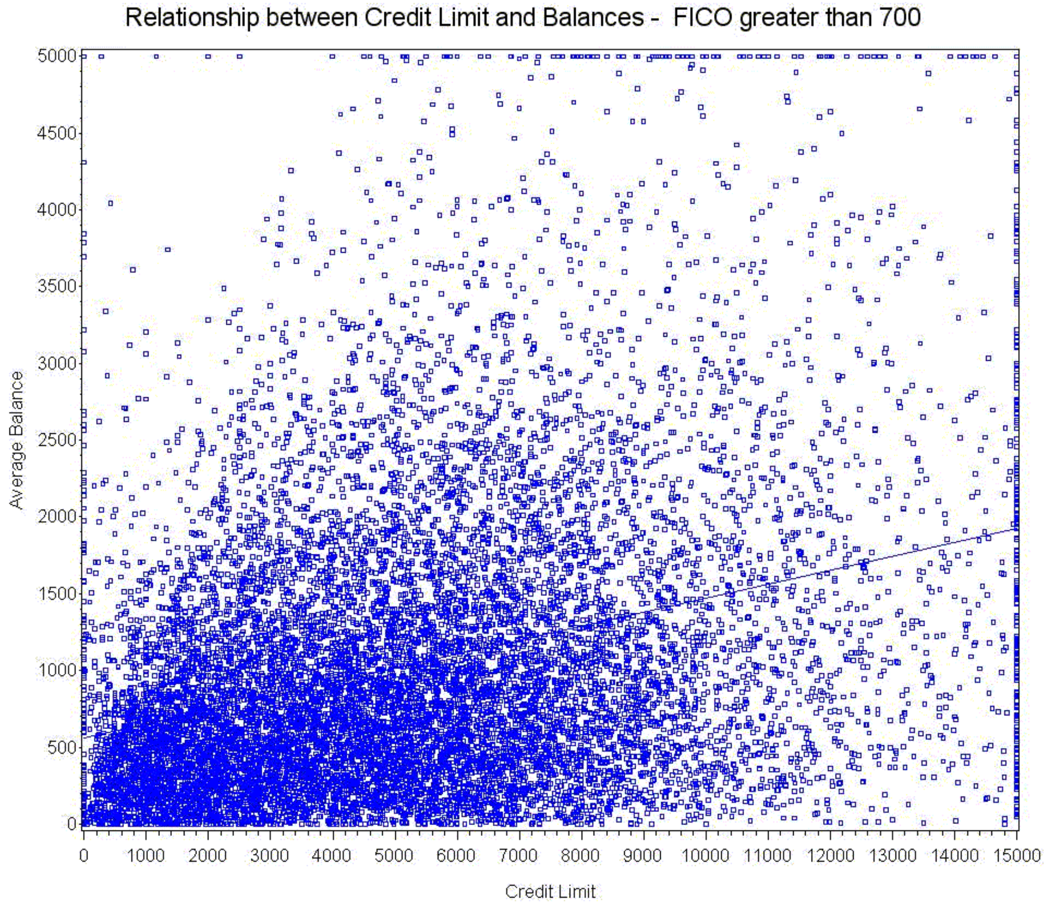


Chart 5 shows the middle segment, with a positive correlation and a steeper regression line. Finally, Chart 6 shows the credit limit change plotted against balance change for our riskiest segment, those households with FICO scores less than 640. The relationship is clear and the regression line is steep, as our coefficients indicated.

Chart 5

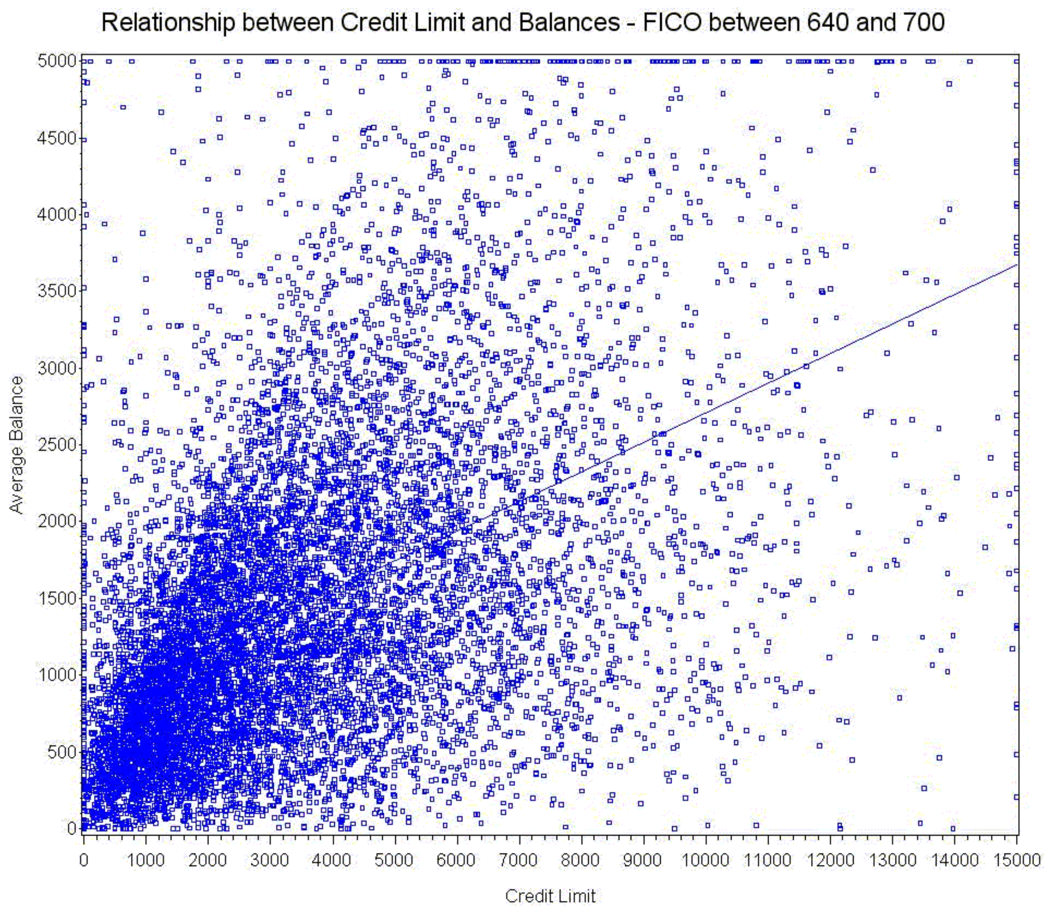
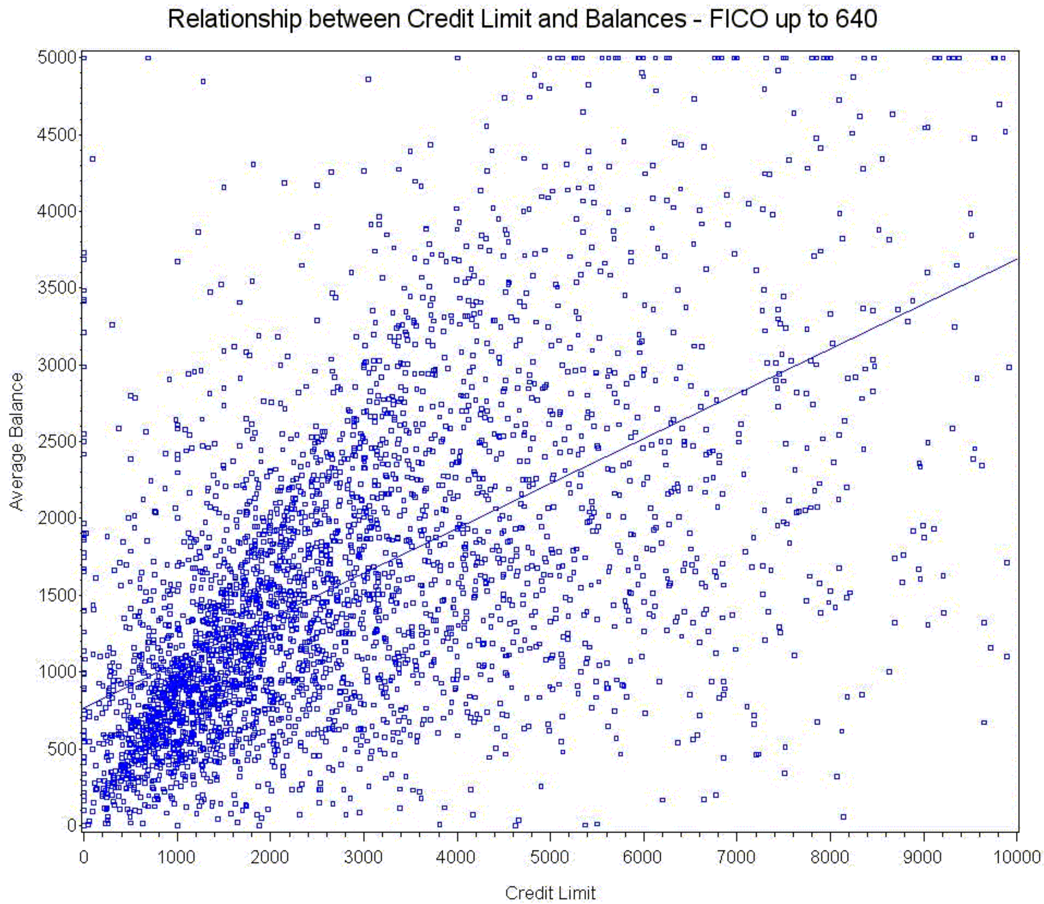

Relationship between Credit Limit and Balances - FICO between 640 and 700
Average Balance
Credit Limit
0
500
1000
1500
2000
2500
3000
3500
4000
4500
5000
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
12000
13000
14000
15000

Chart 6



These behaviors are important to the framework of consumption modeling as they imply that a true consumption constraint is present for some households and that the relaxation of that constraint significantly adjusts their consumption behavior. Proportions of the relevant household impact to the overall economy is one area of interest that results from these profiles. In addition, the impact of credit granting behavior by the lenders can be seen to be quite important to overall consumption for the households affected.

The impacts that we observed fit well into the overall discussion of liquidity constraints in the literature. The sample size appears to be adequate to support directional conclusions in regard to household reactions.

Within the data period, a sub-period of potential interest was uncovered. During the two quarters following the terrorist attack of 9/11/01, credit granters apparently adjusted their behavior across all risk segments. Less credit was made available to households. The level of change is significant.

Aggregate Credit Limit $MM:	**June '01**	**Aug '01**	**Oct '01**	**Dec '01**	**Feb '02**	**June '02**
	49.9	50.4	51.9	49.4	44.0	43.3

As creditors reacted to expected difficulties, credit limits were restricted by approximately 20%. The impact on individual household behavior was likely to be related. This could have had an impact on overall consumption at both the household level and in aggregate for the economy. Although it was not the original intent of this project to review such an event, the data are striking in the period. This links back to the earlier comments regarding the importance of this change to liquidity available to households. A constriction of 20% in available credit will restrict many households from consuming, as we have seen. The credit restriction has occurred at a time when many were concerned that U.S. consumers would restrict their travel and other purchases. This change of credit limit available would aggregate that concern.

In addition to these primary findings, the data in the study contained a large amount of the information in regard to the purchasing, consuming and borrowing behavior of the participants. Most of it supports the primary findings. The household debt, including mortgage, more than doubled in the three years for the increasing population, from $24,000 at the time of acquisition to $55,000 in 8/02, a growth of 126%. The average outstanding household debt was approximately $40,000 during the 3-year period. On average, 70% of this debt is attributable to mortgage loans. The mortgage share of the total household debt was 73% for the population with decreasing balances, while it was 69% for the population with increasing balances. Beginning in December, 2001, the mortgage share of the household debt has been on the rise, an indication of new home purchases and refinancing activity due to historically low interest rates. When mortgage is excluded, the total outstanding balances grew by approximately 70% over the three years for this population. The average outstanding balance was $17,000 over the three-year period.

The aggregate credit limit, from all sources, available to the households more than doubled during the three years, from $19,000 at the point of acquisition to $41,000 in 8/02. The growth was 131% for the population with increasing balances, with their limits increasing from $17,000 to $39,000, whereas it increased 84% for the population with decreasing balances from $24,000 to $44,000.

The credit limit for plastic products (bank, oil, national and retail credit cards) almost doubled in three years, from $20,000 to $39,000, a growth rate of

97%. The credit limit increases and the balance increases are correlated: this growth is 118%, more than double, for the population with increasing balances (from \$17,000 to \$38,000) whereas it is 71% for the population with decreasing balances (from \$24,000 to \$42,000). The revolving balances for plastic products grew 66% over the analysis period, from \$5,200 to \$7,500. This growth is 140% for the population with increasing balances (from \$5,000 to \$12,000) while it is 5% for the population with decreasing balances (from \$5,800 to \$5,500). On average, this population has a revolving plastic product utilization rate of 23%. The utilization rate is 28% for the population with increasing balances whereas it is 19% or the population with decreasing balances.

During the period, the credit performance of the population deteriorated somewhat, but not significantly. "Satisfactory trades" as measured by the credit bureaus, deteriorated for the overall population from 95% to 93%. The increasing balances group deteriorated from 95% to 92%, while the decreasing balances group remained unchanged at 90%. The higher use of credit was accompanied by a small fall-off in creditworthiness. Unsurprisingly, those people who desired credit used it, and apparently needed it to fulfill consumption desires. They did largely, however, keep payments current during the period.

Age distribution was captured and reviewed. While slight variations were present, there were no significant variations in age distribution between the two populations. Income estimates for segments were done by location and were derived from census track location. The increasing balance group was slightly over represented in income ranges under $55,000. This over representation was consistent through all segment breaks below $55,000, but was not very large.

The average representation in these segments was 100.3% of the overall population distribution. The highest over representation, however, was in the lowest segment tracked "$20,000 and under" where the increasing balances population had 15.41% of its population, 103.06% compared to overall distribution and the decreasing balance population had 14.40% of its population. This difference is not surprising either. The population that uses new credit is over represented in lower incomes. What may be more surprising is that the over-representation is as small as it appears to be here.

	Increasing Population		**Decreasing Population**	
Income Range	**% of Total**	**Index to Total**	**% of Total**	**Index to Total**
$20M & under	15.41	103.06	14.40	96.32
>$20M-$25M	5.35	102.24	5.09	97.30
>$25M-$30M	5.33	101.79	5.12	97.84
>$30M-$35M	5.48	100.97	5.37	98.83
>$35M-$40M	5.31	101.31	5.16	98.43
>$40M-$45M	5.44	100.77	5.34	99.07
>$45M-$50M	4.94	100.28	4.91	99.66
>$50M-$55M	5.12	100.08	5.11	99.94
>$55M-$60M	4.42	99.97	4.43	100.04
>$60M-$75M	12.41	99.30	12.00	100.84
>$75M-$100M	13.62	99.68	14.02	101.58
>$100M-$125M	6.71	97.94	7.02	102.48
>$125M-$150M	3.75	96.35	4.06	104.39
>$150M-$250M	5.07	95.81	5.56	105.04
>$250M-$500M	1.20	95.51	1.32	105.40
Over $500M	0.46	95.69	.50	104.10
Median	$52,676		$54,609	

Home value was estimated and reviewed for the two populations. The increasing balance population was skewed to the lower values. Again, the differences were not large. The increasing balance population with a home value of $125,000 and under was 41.15% while the decreasing balance population was 39.96% for this segment. Both groups had a wide range of representation across home value and similar representation in the highest segment of over "500,000" at 3.21% (increasing) and 3.58% (decreasing).

In the area of purchases, information was available for the new credit offered in December, 1999. Sales were tracked by various categories of expenditure. These are in the appendix, but include:

- Travel and Entertainment
- Restaurants
- Upscale retail
- Home-based personal goods
- Online purchases
- Clothing
- And others

In tracking the increasing balances group versus the total population, the results show that the increasing group was over-represented in travel and entertainment (7.8% of total expenditures vs. 7.4% for the entire group) and personal goods and services (17.8% vs. 17.4%). They were under-represented in online purchase (8.8% vs. 9.3%) and home-based purchases (10.4% vs. 10.8%). No significant consumption stood out by spending category.

In reviewing major delinquency records, the increasing balance group differed significantly from the decreasing balance group. Over the time tracked, major delinquencies for the increasing balance grew 49% from .57 per person to .85 per person. The decreasing balance group delinquencies declined during the period from .56 per person to .51 per person. A decline of 9%. The two groups were close in December of 1999 (.57 vs. .56). The subsequent behavior has introduced a wide gap. By August, 2002, the increasing balance group is 67% higher on major delinquencies (.85 vs. .51). This is one of the major differences in behavior between the two groups.

CONCLUSIONS

The population observed received a significant increase in credit availability over the period. The population, as a whole, certainly used the available credit. Overall, non-mortgage debt for the group increased 70% during the thirty-three months. During the same period, average household debt in the United States grew 20%. Income increased an estimated 15% over the same timeframe. The borrowed balances increase for the increasing balance group was $12,400, while income increased about $7,000 over the period. The result is that the increase in borrowing was significant to the population's increase in consumption. In fact, the increase in unsecured borrowing (non-mortgage) over the period was 177% of the increase in income.

The behavior of this group leads to the possibility that the group has reacted to an increase in available credit, in order to raise consumption to a more preferable level. This raises the possibility that the group was subject to a real (or perceived) credit constraint prior to the December, 1999 offering. If the group was credit constrained in their prior state, then their behavior may offer some information about the relaxation of that constraint. For some portion of the population, the behavior appears to be consistent with reasonable expectations regarding this pattern. Expenditures rise, debt level rises, delinquencies rise.

The rise in expenditures and borrowings is high. We can conclude that a credit constraint does exist for a portion of the U.S. population and that when that constraint is relaxed, the population affected will raise consumption and borrowing. Given the subsequent increase in the number of trade lines (lenders) there may be some evidence that the availability of credit is more important than the price. The study did not capture enough pricing information to comment on this, but further work could address the price demand elasticity for the constrained population.

The basic point illustrated, that an increase in credit availability leads to a dramatic change in a population behavior, is a key one. It raises the question of equilibrium (or perceived equilibrium) in the previous state. It also raises the profile of the credit constraint as addressed in current literature.

The macroeconomic implication of this study could be dramatic. As noted above, the increase in borrowing over the thirty-three month period was 177% of the income increase during the same period. Clearly, there is some potential to increase consumer consumption in the U.S. economy by relaxing liquidity constraints. To take an illustration based on recent U.S. data, we could say that economic growth in the U.S. was 3.5% over a period, and if consumer growth is 75% of that growth, a 177% lift in the consumer area would increase overall growth by 1.15% or 32.8%. This is very significant.

The management of liquidity is an important activity for U.S. households. There does appear to be an opportunity to increase the use of liquidity by some of these households. The proportion appears large. In effect, as earlier studies have indicated, there is a *de facto* credit rationing possibility in this area. The data suggests that some credit could be safely granted, that households will use the credit to increase consumption, that the resulting increase in consumption could be significant to overall U.S. economic growth, ant that this untapped demand could be sustainable, given the thirty-three month length of the study.

As an empirical verification of a theoretical framework, these results closely follow the Stiglitz and Weiss model. Over the course of almost three years, we can clearly see that there was a clear demand for credit use by a population that was able to use this credit responsibly, and that previously it had not been available. Their conclusion of a market in equilibrium with credit worthy borrowers desiring some credit but unable to borrow due to the optimization model of banks being unaligned with borrowers' desires, seems to fit the pattern of the data that we see here.

These results tentatively highlight a market imperfection that may have important implications.

ENDNOTES

(1) Handbook of Macroeconomics, Volume 1B
- Part 4 – Consumption and Investment
- Chapter 11 – Consumption. Page 745

(2) IBID. Page 772

(3) IBID. Page 772, 773

(4) IBID. Page 773

(5) IBID. Page 774

(6) IBID. Page 774

(7) Ludvigson, S. (1999), "Consumption and Credit: A Model of Time-Varying Liquidity Constraints." The Review of Economics and Statistics, Vol. 81, No. 3 (Aug. 1999), Page 434

(8) IBID Page 445

(9) IBID Page 445

(10) Handbook of Macroeconomics (1999), Page 776

(11) IBID Page 776

(12) Stavins, Joanna (2000), "Credit Card Borrowing, Delinquency, and Personal Banking", New England Economic Review, Page 15

(13) Gross, David and Souleles, N (2001), "Consumer Response to Changes in Credit Supply: Evidence from Credit Card Data", Page 12

(14) Gross, David and Souleles, N (2001), "Do Liquidity Constraints and Interest Rates Matter for Consumer Behavior? Evidence from Credit Card Data", Page 12

(15) IBID Page 3

(16) IBID Page 17

(17) IBID Page 34

(18) IBID Page 35

APPENDIX

Risk Group Breakdown

Initial Risk	Risk 6 Months Out	Risk 12 Months Out	Risk Group	Percent
Low	Low	Low	Consistently Low Risk	11.8
Low	Low	Medium	Consistently Low Risk	3.3
Low	Medium	Low	Consistently Low Risk	4.4
Low	High	Low	Consistently Low Risk	0.0
Medium	Low	Low	Consistently Low Risk	10.6
Sub-total				**30.1**
Medium	Medium	Medium	Consistently Medium Risk	20.6
Medium	Low	Medium	Consistently Medium Risk	4.4
Medium	High	Medium	Consistently Medium Risk	1.4
High	Medium	Medium	Consistently Medium Risk	9.3
Low	Medium	Medium	Consistently Medium Risk	7.4
Sub-total				**43.1**
High	Medium	Low	Decreasing Risk	4.8
High	Low	Low	Decreasing Risk	1.3
High	Low	Medium	Decreasing Risk	0.7
High	High	Low	Decreasing Risk	0.3
Medium	Medium	Low	Decreasing Risk	9.6
Medium	High	Low	Decreasing Risk	0.1
Sub-total				**16.8**
Low	Medium	High	Increasingly Risky	0.9
Low	Low	High	Increasingly Risky	0.1
Low	High	High	Increasingly Risky	0.4
Low	High	Medium	Increasingly Risky	0.5
Medium	Medium	High	Increasingly Risky	2.4
Medium	Low	High	Increasingly Risky	0.1
Sub-total				**4.4**
High	Medium	High	Consistently High Risk	0.7
High	Low	High	Consistently High Risk	0.0
High	High	High	Consistently High Risk	1.4
High	High	Medium	Consistently High Risk	2.1
Medium	High	High	Consistently High Risk	1.3
Sub-total				**5.6**
Total				**100.0**

Revolving Credit Line and Balance

Revolving Balances 02/2000				Distribution						
	Mean	Std	Mode	1st	5th	25th	Median	75th	95th	99th
Decrease: 50% or Less	$1,311	$1,287	$ -	$ -	$ 31	$ 427	$ 941	$1,812	$ 3,799	$ 6,276
Decrease: 50% to 75%	$1,591	$2,060	$ -	$ -	$ 106	$ 618	$1,223	$2,128	$ 4,153	$ 6,402
Decrease: 75% or More	$1,722	$1,401	$ -	$ -	$ 181	$ 761	$1,376	$2,297	$ 4,331	$ 6,632
Decreasing Total	$1,619	$1,605	$ -	$ -	$ 116	$ 652	$1,271	$2,168	$ 4,219	$ 6,466
Increase: 50% or Less	$1,737	$1,289	$ -	$ 35	$ 253	$ 855	$1,456	$2,285	$ 4,065	$ 6,337
Increase: 50% to 100%	$1,338	$1,138	$ -	$ -	$ 145	$ 586	$1,084	$1,761	$ 3,353	$ 5,393
Increase:100% or More	$ 969	$1,038	$ -	$ -	$ 10	$ 288	$ 686	$1,299	$ 2,932	$ 4,951
Increasign Total	$1,406	$1,223	$ -	$ -	$ 93	$ 565	$1,111	$1,901	$ 3,696	$ 5,814
Grand Total	$1,509	$1,424	$ -	$ -	$ 102	$ 605	$1,185	$2,037	$ 3,972	$ 6,146

Credit Lines 02/2000				Distribution						
	Mean	Std	Mode	1st	5th	25th	Median	75th	95th	99th
Decrease: 50% or Less	$5,050	$3,467	$ -	$ -	$ 433	$2,372	$4,571	$7,159	$11,031	$15,567
Decrease: 50% to 75%	$4,726	$3,315	$ -	$ -	$ 533	$2,167	$4,220	$6,635	$10,715	$14,875
Decrease: 75% or More	$4,383	$3,308	$ -	$ -	$ 500	$1,879	$3,735	$6,179	$10,369	$14,580
Decreasing Total	$4,586	$3,345	$ -	$ -	$ 500	$2,011	$4,000	$6,496	$10,609	$14,957
Increase: 50% or Less	$4,335	$3,174	$ -	$ -	$ 512	$1,924	$3,750	$5,998	$10,158	$14,491
Increase: 50% to 100%	$3,874	$3,083	$ -	$ -	$ 417	$1,554	$3,117	$5,500	$ 9,752	$13,693
Increase:100% or More	$3,834	$3,211	$ -	$ -	$ 117	$1,344	$3,000	$5,583	$ 9,947	$13,750
Increasign Total	$4,063	$3,168	$ -	$ -	$ 375	$1,631	$3,385	$5,774	$ 9,961	$13,920
Grand Total	$4,315	$3,265	$ -	$ -	$ 426	$1,802	$3,673	$6,117	$10,260	$14,457

Revolving Credit Line and Balance

Revolving Balances 04/2000				Distribution						
	Mean	Std	Mode	1st	5th	25th	Median	75th	95th	99th
Decrease: 50% or Less	$1,364	$1,386	$ -	$ -	$ 30	$ 400	$ 995	$1,894	$ 3,955	$ 6,763
Decrease: 50% to 75%	$1,647	$1,437	$ -	$ -	$ 111	$ 637	$1,294	$2,277	$ 4,304	$ 6,810
Decrease: 75% or More	$1,805	$1,468	$ -	$ 6	$ 181	$ 785	$1,454	$2,428	$ 4,579	$ 6,960
Decreasing Total	$1,690	$1,455	$ -	$ -	$ 117	$ 673	$1,340	$2,318	$ 4,449	$ 6,821
Increase: 50% or Less	$1,785	$1,353	$ -	$ 34	$ 237	$ 851	$1,499	$2,368	$ 4,279	$ 6,367
Increase: 50% to 100%	$1,383	$1,102	$ -	$ -	$ 147	$ 615	$1,136	$1,853	$ 3,408	$ 5,244
Increase:100% or More	$ 937	$1,007	$ -	$ -	$ 5	$ 263	$ 654	$1,273	$ 2,823	$ 4,652
Increasign Total	$1,430	$1,245	$ -	$ -	$ 84	$ 562	$1,134	$1,947	$ 3,790	$ 5,774
Grand Total	$1,556	$1,356	$ -	$ -	$ 98	$ 608	$1,225	$2,123	$ 4,112	$ 6,375

Credit Lines 04/2000				Distribution						
	Mean	Std	Mode	1st	5th	25th	Median	75th	95th	99th
Decrease: 50% or Less	$6,072	$4,995	$ -	$ -	$ 600	$2,849	$5,177	$7,899	$14,000	$23,768
Decrease: 50% to 75%	$5,579	$4,104	$ -	$ -	$ 750	$2,660	$4,800	$7,473	$13,010	$19,833
Decrease: 75% or More	$5,087	$4,038	$ -	$ -	$ 632	$2,304	$4,196	$6,875	$12,259	$19,000
Decreasing Total	$5,382	$4,240	$ -	$ -	$ 660	$2,489	$4,520	$7,230	$12,709	$20,103
Increase: 50% or Less	$4,883	$3,672	$ -	$ -	$ 675	$2,250	$4,154	$6,583	$11,723	$17,316
Increase: 50% to 100%	$4,484	$3,560	$ -	$ -	$ 580	$1,917	$3,625	$6,200	$10,888	$17,350
Increase:100% or More	$4,611	$4,166	$ -	$ -	$ 277	$1,789	$3,683	$6,469	$11,651	$18,000
Increasign Total	$4,693	$3,794	$ -	$ -	$ 525	$2,000	$3,875	$6,438	$11,450	$17,540
Grand Total	$5,025	$4,029	$ -	$ -	$ 596	$2,205	$4,167	$6,836	$12,150	$18,900

Revolving Credit Line and Balance

Revolving Balances 06/2000				Distribution						
	Mean	Std	Mode	1st	5th	25th	Median	75th	95th	99th
Decrease: 50% or Less	$1,463	$1,663	$ -	$ -	$ 29	$ 407	$ 993	$1,990	$ 4,265	$ 7,488
Decrease: 50% to 75%	$1,729	$1,588	$ -	$ -	$ 88	$ 605	$1,329	$2,418	$ 4,616	$ 7,331
Decrease: 75% or More	$1,901	$1,568	$ -	$ 16	$ 177	$ 814	$1,542	$2,560	$ 4,898	$ 7,427
Decreasing Total	$1,783	$1,597	$ -	$ -	$ 108	$ 670	$1,395	$2,442	$ 4,740	$ 7,427
Increase: 50% or Less	$1,812	$1,412	$ -	$ 31	$ 211	$ 819	$1,508	$2,440	$ 4,458	$ 6,681
Increase: 50% to 100%	$1,451	$1,186	$ -	$ 5	$ 137	$ 620	$1,182	$1,980	$ 3,691	$ 5,544
Increase:100% or More	$ 934	$1,046	$ -	$ -	$ 2	$ 237	$ 640	$1,261	$ 2,854	$ 4,840
Increasign Total	$1,460	$1,306	$ -	$ -	$ 77	$ 531	$1,139	$2,013	$ 3,953	$ 6,057
Grand Total	$1,616	$1,462	$ -	$ -	$ 89	$ 590	$1,257	$2,221	$ 4,349	$ 6,766

Credit Lines 06/2000				Distribution						
	Mean	Std	Mode	1st	5th	25th	Median	75th	95th	99th
Decrease: 50% or Less	$6,187	$5,096	$ -	$ -	$ 776	$3,000	$5,250	$7,917	$14,097	$24,633
Decrease: 50% to 75%	$5,659	$4,232	$ -	$ -	$ 750	$2,736	$4,920	$7,521	$13,125	$20,750
Decrease: 75% or More	$5,124	$4,049	$ -	$ -	$ 700	$2,360	$4,230	$6,844	$12,250	$19,500
Decreasing Total	$5,444	$4,302	$ -	$ -	$ 732	$2,547	$4,608	$7,216	$12,915	$20,467
Increase: 50% or Less	$4,850	$3,603	$ -	$ -	$ 684	$2,305	$4,164	$6,480	$11,423	$17,316
Increase: 50% to 100%	$4,528	$3,507	$ -	$ -	$ 605	$2,000	$3,750	$6,204	$10,848	$16,553
Increase:100% or More	$4,647	$4,173	$ -	$ -	$ 333	$1,900	$3,770	$6,443	$11,411	$17,633
Increasign Total	$4,702	$3,751	$ -	$ -	$ 567	$2,083	$3,942	$6,391	$11,250	$17,363
Grand Total	$5,060	$4,043	$ -	$ -	$ 633	$2,295	$4,237	$6,780	$12,200	$18,750

Revolving Credit Line and Balance

Revolving Balances 08/2000	Mean	Std	Mode	Distribution 1st	5th	25th	Median	75th	95th	99th
Decrease: 50% or Less	$1,495	$1,803	$ -	$ -	$ 17	$ 385	$ 991	$2,030	$ 4,381	$ 7,864
Decrease: 50% to 75%	$1,758	$1,663	$ -	$ -	$ 77	$ 613	$1,297	$2,469	$ 4,832	$ 7,540
Decrease: 75% or More	$1,940	$1,606	$ -	$ 10	$ 171	$ 803	$1,562	$2,629	$ 4,970	$ 7,495
Decreasing Total	$1,818	$1,663	$ -	$ -	$ 100	$ 661	$1,415	$2,500	$ 4,864	$ 7,560
Increase: 50% or Less	$1,799	$1,420	$ -	$ 12	$ 188	$ 794	$1,478	$2,436	$ 4,473	$ 6,646
Increase: 50% to 100%	$1,480	$1,220	$ -	$ -	$ 115	$ 604	$1,224	$2,017	$ 3,824	$ 5,876
Increase:100% or More	$ 932	$1,072	$ -	$ -	$ -	$ 204	$ 623	$1,278	$ 2,909	$ 5,023
Increasign Total	$1,462	$1,323	$ -	$ -	$ 57	$ 501	$1,142	$2,031	$ 4,011	$ 6,089
Grand Total	$1,634	$1,507	$ -	$ -	$ 75	$ 577	$1,262	$2,249	$ 4,470	$ 6,841

Credit Lines 08/2000	Mean	Std	Mode	Distribution 1st	5th	25th	Median	75th	95th	99th
Decrease: 50% or Less	$7,147	$5,031	$ -	$ -	$1,820	$3,937	$6,245	$9,000	$15,100	$27,500
Decrease: 50% to 75%	$6,521	$4,264	$ -	$ 808	$1,666	$3,660	$5,630	$8,325	$14,400	$21,333
Decrease: 75% or More	$5,983	$4,046	$4,000	$ 850	$1,584	$3,250	$5,136	$7,713	$12,980	$19,875
Decreasing Total	$6,320	$4,300	$ -	$ 808	$1,640	$3,438	$5,457	$8,076	$13,738	$21,375
Increase: 50% or Less	$5,698	$3,591	$2,500	$ 866	$1,508	$3,160	$5,000	$7,404	$12,200	$18,167
Increase: 50% to 100%	$5,287	$3,540	$3,500	$ 650	$1,400	$2,800	$4,470	$6,993	$11,580	$16,827
Increase:100% or More	$5,419	$4,184	$ -	$ -	$1,126	$2,703	$4,531	$7,122	$12,346	$18,944
Increasign Total	$5,503	$3,760	$ -	$ 365	$1,360	$2,901	$4,735	$7,216	$12,125	$18,000
Grand Total	$5,897	$4,050	$ -	$ 612	$1,500	$3,163	$5,064	$7,649	$12,971	$19,500

Revolving Credit Line and Balance

Revolving Balances 10/2000				Distribution						
	Mean	Std	Mode	1st	5th	25th	Median	75th	95th	99th
Decrease: 50% or Less	$1,593	$1,965	$ -	$ -	$ 10	$ 391	$1,020	$2,086	$ 5,122	$ 8,431
Decrease: 50% to 75%	$1,816	$1,731	$ -	$ -	$ 71	$ 584	$1,365	$2,521	$ 5,028	$ 7,895
Decrease: 75% or More	$2,015	$1,673	$ -	$ 9	$ 161	$ 838	$1,627	$2,726	$ 5,128	$ 7,908
Decreasing Total	$1,891	$1,746	$ -	$ -	$ 92	$ 670	$1,468	$2,584	$ 5,098	$ 7,937
Increase: 50% or Less	$1,768	$1,422	$ -	$ 11	$ 149	$ 748	$1,454	$2,393	$ 4,450	$ 6,758
Increase: 50% to 100%	$1,528	$1,291	$ -	$ -	$ 106	$ 585	$1,234	$2,107	$ 4,050	$ 6,237
Increase:100% or More	$ 952	$1,100	$ -	$ -	$ -	$ 182	$ 612	$1,354	$ 3,004	$ 4,913
Increasign Total	$1,468	$1,344	$ -	$ -	$ 41	$ 479	$1,137	$2,070	$ 4,071	$ 6,257
Grand Total	$1,672	$1,565	$ -	$ -	$ 62	$ 565	$1,288	$2,310	$ 4,601	$ 7,147

Credit Lines 10/2000				Distribution						
	Mean	Std	Mode	1st	5th	25th	Median	75th	95th	99th
Decrease: 50% or Less	$7,299	$5,125	$ -	$ -	$1,831	$4,009	$6,436	$9,138	$15,312	$26,667
Decrease: 50% to 75%	$6,687	$4,322	$ -	$ 740	$1,760	$3,790	$5,806	$8,533	$14,503	$21,750
Decrease: 75% or More	$6,074	$4,057	$4,000	$ 907	$1,631	$3,317	$5,238	$7,849	$13,160	$19,925
Decreasing Total	$6,442	$4,343	$ -	$ 759	$1,697	$3,521	$5,565	$8,261	$14,000	$21,780
Increase: 50% or Less	$5,744	$3,588	$2,500	$ 886	$1,517	$3,175	$5,046	$7,467	$12,133	$17,750
Increase: 50% to 100%	$5,380	$3,498	$ -	$ 533	$1,450	$2,875	$4,584	$7,096	$11,600	$16,900
Increase:100% or More	$5,558	$4,182	$ -	$ -	$1,183	$2,822	$4,700	$7,317	$12,600	$18,900
Increasign Total	$5,589	$3,746	$ -	$ -	$1,400	$2,991	$4,833	$7,329	$12,129	$17,773
Grand Total	$6,000	$4,067	$ -	$ 463	$1,500	$3,246	$5,169	$7,800	$13,057	$19,725

Revolving Credit Line and Balance

Revolving Balances 12/2000				Distribution						
	Mean	Std	Mode	1st	5th	25th	Median	75th	95th	99th
Decrease: 50% or Less	$1,789	$2,163	$ -	$ -	$ 25	$ 460	$1,165	$2,356	$ 5,497	$ 9,494
Decrease: 50% to 75%	$1,943	$1,809	$ -	$ 8	$ 115	$ 652	$1,469	$2,726	$ 5,364	$ 8,876
Decrease: 75% or More	$2,117	$1,734	$ -	$ 29	$ 197	$ 913	$1,724	$2,844	$ 5,351	$ 8,081
Decreasing Total	$2,016	$1,834	$ -	$ -	$ 128	$ 748	$1,583	$2,754	$ 5,375	$ 8,472
Increase: 50% or Less	$1,750	$1,419	$ -	$ 8	$ 146	$ 737	$1,429	$2,393	$ 4,447	$ 6,537
Increase: 50% to 100%	$1,591	$1,345	$ -	$ -	$ 114	$ 595	$1,268	$2,237	$ 4,232	$ 6,229
Increase:100% or More	$1,017	$1,191	$ -	$ -	$ -	$ 173	$ 635	$1,444	$ 3,288	$ 5,416
Increasign Total	$1,496	$1,372	$ -	$ -	$ 46	$ 482	$1,154	$2,118	$ 4,140	$ 6,238
Grand Total	$1,747	$1,632	$ -	$ -	$ 75	$ 596	$1,350	$2,424	$ 4,800	$ 7,430

Credit Lines 12/2000				Distribution						
	Mean	Std	Mode	1st	5th	25th	Median	75th	95th	99th
Decrease: 50% or Less	$7,515	$5,095	$ -	$ -	$2,000	$4,257	$6,650	$9,400	$16,083	$25,450
Decrease: 50% to 75%	$6,896	$4,909	$2,500	$1,039	$1,920	$4,000	$5,967	$8,660	$14,417	$22,000
Decrease: 75% or More	$6,159	$4,042	$2,500	$ 967	$1,727	$3,417	$5,314	$7,930	$13,109	$19,843
Decreasing Total	$6,583	$4,507	$ -	$ 950	$1,800	$3,690	$5,700	$8,384	$14,000	$21,450
Increase: 50% or Less	$5,805	$4,040	$3,500	$ 836	$1,526	$3,250	$5,134	$7,543	$12,125	$17,250
Increase: 50% to 100%	$5,522	$3,519	$3,000	$ 780	$1,524	$3,025	$4,736	$7,220	$11,800	$17,125
Increase:100% or More	$5,700	$4,136	$ -	$ -	$1,243	$3,000	$4,948	$7,440	$12,446	$19,025
Increasign Total	$5,696	$3,931	$ -	$ -	$1,467	$3,121	$4,967	$7,425	$12,100	$17,820
Grand Total	$6,123	$4,242	$ -	$ 688	$1,598	$3,375	$5,311	$7,903	$13,120	$19,583

Risk Profile

Risk Profile: Consistently Low	Mean	Std	Mode	Distribution						
				1st	5th	25th	Median	75th	95th	99th
Decrease: 50% or Less	0.352	0.478	0	0	0	0	0	1	1	1
Decrease: 50% to 75%	0.304	0.460	0	0	0	0	0	1	1	1
Decrease: 75% or More	0.263	0.440	0	0	0	0	0	1	1	1
Decreasing Total	0.289	0.453	0	0	0	0	0	1	1	1
Increase: 50% or Less	0.253	0.435	0	0	0	0	0	1	1	1
Increase: 50% to 100%	0.305	0.461	0	0	0	0	0	1	1	1
Increase:100% or More	0.411	0.492	0	0	0	0	0	1	1	1
Increasign Total	0.313	0.464	0	0	0	0	0	1	1	1
Grand Total	0.301	0.459	0	0	0	0	0	1	1	1

Risk Profile: Decreasing Risk	Mean	Std	Mode	Distribution						
				1st	5th	25th	Median	75th	95th	99th
Decrease: 50% or Less	0.198	0.398	0	0	0	0	0	0	1	1
Decrease: 50% to 75%	0.186	0.389	0	0	0	0	0	0	1	1
Decrease: 75% or More	0.154	0.361	0	0	0	0	0	0	1	1
Decreasing Total	0.170	0.375	0	0	0	0	0	0	1	1
Increase: 50% or Less	0.164	0.371	0	0	0	0	0	0	1	1
Increase: 50% to 100%	0.170	0.376	0	0	0	0	0	0	1	1
Increase:100% or More	0.167	0.373	0	0	0	0	0	0	1	1
Increasign Total	0.167	0.373	0	0	0	0	0	0	1	1
Grand Total	0.168	0.374	0	0	0	0	0	0	1	1

Risk Profile

Risk Profile: Medium Risk				Distribution						
	Mean	Std	Mode	1st	5th	25th	Median	75th	95th	99th
Decrease: 50% or Less	0.385	0.487	0	0	0	0	0	1	1	1
Decrease: 50% to 75%	0.415	0.493	0	0	0	0	0	1	1	1
Decrease: 75% or More	0.465	0.499	0	0	0	0	0	1	1	1
Decreasing Total	0.438	0.496	0	0	0	0	0	1	1	1
Increase: 50% or Less	0.464	0.499	0	0	0	0	0	1	1	1
Increase: 50% to 100%	0.430	0.495	0	0	0	0	0	1	1	1
Increase:100% or More	0.361	0.480	0	0	0	0	0	1	1	1
Increasign Total	0.425	0.494	0	0	0	0	0	1	1	1
Grand Total	0.431	0.495	0	0	0	0	0	1	1	1

Risk Profile: Increasingly Risky				Distribution						
	Mean	Std	Mode	1st	5th	25th	Median	75th	95th	99th
Decrease: 50% or Less	0.030	0.170	0	0	0	0	0	0	0	1
Decrease: 50% to 75%	0.041	0.198	0	0	0	0	0	0	0	1
Decrease: 75% or More	0.053	0.224	0	0	0	0	0	0	1	1
Decreasing Total	0.046	0.209	0	0	0	0	0	0	0	1
Increase: 50% or Less	0.049	0.217	0	0	0	0	0	0	0	1
Increase: 50% to 100%	0.042	0.200	0	0	0	0	0	0	0	1
Increase:100% or More	0.032	0.175	0	0	0	0	0	0	0	1
Increasign Total	0.042	0.201	0	0	0	0	0	0	0	1
Grand Total	0.044	0.205	0	0	0	0	0	0	0	1

Risk Profile

Risk Profile: Consistently High				Distribution						
	Mean	Std	Mode	1st	5th	25th	Median	75th	95th	99th
Decrease: 50% or Less	0.035	0.185	0	0	0	0	0	0	0	1
Decrease: 50% to 75%	0.054	0.226	0	0	0	0	0	0	1	1
Decrease: 75% or More	0.065	0.247	0	0	0	0	0	0	1	1
Decreasing Total	0.057	0.233	0	0	0	0	0	0	1	1
Increase: 50% or Less	0.069	0.254	0	0	0	0	0	0	1	1
Increase: 50% to 100%	0.053	0.225	0	0	0	0	0	0	1	1
Increase:100% or More	0.030	0.171	0	0	0	0	0	0	0	1
Increasign Total	0.054	0.225	0	0	0	0	0	0	1	1
Grand Total	0.055	0.229	0	0	0	0	0	0	1	1

Age

Median Age

				Distribution						
	Mean	Std	Mode	1st	5th	25th	Median	75th	95th	99th
Decrease: 50% or Less	37.1	4.5	36.1	26.3	30.5	34.6	36.9	39.4	44.0	49.4
Decrease: 50% to 75%	36.6	4.5	35.2	25.7	29.6	34.1	36.5	39.0	43.5	49.5
Decrease: 75% or More	36.7	4.6	35.3	25.7	29.6	34.2	36.6	39.0	43.3	51.0
Decreasing Total	36.7	4.6	35.3	25.9	29.8	34.2	36.6	39.0	43.4	50.0
Increase: 50% or Less	36.6	4.5	36.1	26.0	29.7	34.1	36.5	38.9	43.3	50.2
Increase: 50% to 100%	36.4	4.5	36.6	24.6	29.3	33.9	36.4	38.8	42.9	48.5
Increase:100% or More	36.8	4.5	35.2	25.8	29.4	34.3	36.7	39.2	43.6	50.0
Increasign Total	36.6	4.5	36.1	25.6	29.5	34.1	36.6	39.0	43.3	50.0
Grand Total	36.7	4.5	35.3	25.7	29.6	34.1	36.6	39.0	43.4	50.0

Age Segmented at 50

	Mean	Std	Mode	1st	5th	25th	Median	75th	95th	99th
Decrease: 50% or Less	0.008	0.091	0	0	0	0	0	0	0	0
Decrease: 50% to 75%	0.009	0.094	0	0	0	0	0	0	0	0
Decrease: 75% or More	0.011	0.106	0	0	0	0	0	0	0	1
Decreasing Total	0.010	0.101	0	0	0	0	0	0	0	1
Increase: 50% or Less	0.011	0.103	0	0	0	0	0	0	0	1
Increase: 50% to 100%	0.009	0.095	0	0	0	0	0	0	0	0
Increase:100% or More	0.010	0.101	0	0	0	0	0	0	0	1
Increasign Total	0.010	0.100	0	0	0	0	0	0	0	1
Grand Total	0.010	0.100	0	0	0	0	0	0	0	1

Annual Income

Annual Income	Mean	Std	Mode	Distribution 1st	5th	25th	Median	75th	95th	99th
Decrease: 50% or Less	$ 61,104	$ 54,442	$ 50,000	$10,000	$ 16,000	$ 33,000	$ 50,000	$ 72,000	$130,000	$300,000
Decrease: 50% to 75%	$ 60,108	$ 64,805	$ 50,000	$10,000	$ 17,000	$ 32,000	$ 48,000	$ 70,000	$125,000	$300,000
Decrease: 75% or More	$ 58,570	$ 63,021	$ 50,000	$10,000	$ 16,000	$ 30,000	$ 45,000	$ 70,000	$120,000	$320,000
Decreasing Total	$ 59,408	$ 62,244	$ 50,000	$10,000	$ 16,000	$ 31,000	$ 48,000	$ 70,000	$125,000	$300,000
Increase: 50% or Less	$ 57,688	$ 64,389	$ 50,000	$10,000	$ 16,000	$ 30,000	$ 45,000	$ 68,000	$120,000	$300,000
Increase: 50% to 100%	$ 56,857	$ 65,298	$ 50,000	$ 9,000	$ 15,000	$ 30,000	$ 45,000	$ 65,000	$120,000	$342,000
Increase:100% or More	$ 60,150	$ 74,293	$ 40,000	$ 9,000	$ 15,000	$ 30,000	$ 45,000	$ 70,000	$135,000	$360,000
Increasign Total	$ 58,158	$ 67,618	$ 50,000	$ 9,500	$ 15,000	$ 30,000	$ 45,000	$ 68,000	$122,000	$332,000
Grand Total	$ 58,761	$ 65,082	$ 50,000	$10,000	$ 16,000	$ 30,000	$ 45,000	$ 70,000	$125,000	$320,000

Income Segmented at $55M	Mean	Std	Mode	Distribution 1st	5th	25th	Median	75th	95th	99th
Decrease: 50% or Less	0.434	0.496	0	0	0	0	0	1	1	1
Decrease: 50% to 75%	0.414	0.493	0	0	0	0	0	1	1	1
Decrease: 75% or More	0.388	0.487	0	0	0	0	0	1	1	1
Decreasing Total	0.403	0.491	0	0	0	0	0	1	1	1
Increase: 50% or Less	0.380	0.486	0	0	0	0	0	1	1	1
Increase: 50% to 100%	0.370	0.483	0	0	0	0	0	1	1	1
Increase:100% or More	0.385	0.487	0	0	0	0	0	1	1	1
Increasign Total	0.379	0.485	0	0	0	0	0	1	1	1
Grand Total	0.391	0.488	0	0	0	0	0	1	1	1

Median Home Value

Median Home Value				Distribution						
	Mean	Std	Mode	1st	5th	25th	Median	75th	95th	99th
Decrease: 50% or Less	$159,155	$106,503	$500,001	$34,583	$ 52,512	$ 85,946	$123,326	$200,617	$411,449	$500,001
Decrease: 50% to 75%	$149,828	$ 96,645	$500,001	$35,938	$ 50,449	$ 84,350	$119,538	$189,013	$361,007	$500,001
Decrease: 75% or More	$144,870	$ 93,593	$500,001	$37,500	$ 51,184	$ 81,599	$116,329	$180,716	$344,819	$500,001
Decreasing Total	$148,554	$ 96,756	$500,001	$36,429	$ 51,258	$ 82,839	$118,349	$185,734	$359,863	$500,001
Increase: 50% or Less	$142,557	$ 93,218	$500,001	$34,590	$ 49,364	$ 78,576	$114,518	$178,304	$340,070	$500,001
Increase: 50% to 100%	$148,462	$ 95,948	$500,001	$36,314	$ 50,808	$ 82,322	$117,877	$186,138	$353,526	$500,001
Increase:100% or More	$152,802	$ 98,032	$500,001	$36,538	$ 51,765	$ 84,867	$120,290	$195,243	$354,025	$500,001
Increasign Total	$147,139	$ 95,472	$500,001	$35,625	$ 50,453	$ 81,656	$117,353	$185,631	$349,715	$500,001
Grand Total	$147,822	$ 96,095	$500,001	$35,938	$ 50,760	$ 82,128	$117,783	$185,688	$351,764	$500,001

Home Value Ssegmenetd at $200M				Distribution						
	Mean	Std	Mode	1st	5th	25th	Median	75th	95th	99th
Decrease: 50% or Less	0.250	0.433	0	0	0	0	0	1	1	1
Decrease: 50% to 75%	0.223	0.416	0	0	0	0	0	0	1	1
Decrease: 75% or More	0.204	0.403	0	0	0	0	0	0	1	1
Decreasing Total	0.217	0.412	0	0	0	0	0	0	1	1
Increase: 50% or Less	0.197	0.398	0	0	0	0	0	0	1	1
Increase: 50% to 100%	0.216	0.412	0	0	0	0	0	0	1	1
Increase:100% or More	0.237	0.426	0	0	0	0	0	0	1	1
Increasign Total	0.214	0.410	0	0	0	0	0	0	1	1
Grand Total	0.215	0.411	0	0	0	0	0	0	1	1

Wealth

Wealth				Distribution						
	Mean	Std	Mode	1st	5th	25th	Median	75th	95th	99th
Decrease: 50% or Less	$229,619	$ 72,816	$187,996	$91,756	$133,305	$176,694	$218,261	$276,936	$361,512	$436,504
Decrease: 50% to 75%	$226,465	$ 71,121	$120,801	$91,477	$127,908	$175,958	$215,065	$268,090	$361,220	$419,469
Decrease: 75% or More	$222,829	$ 68,859	$192,305	$89,592	$127,841	$174,404	$212,927	$263,661	$348,803	$414,344
Decreasing Total	$224,939	$ 70,187	$165,050	$91,475	$128,915	$175,077	$214,216	$266,425	$353,181	$416,858
Increase: 50% or Less	$220,771	$ 67,688	$146,239	$91,865	$127,536	$172,622	$210,758	$259,794	$344,882	$407,644
Increase: 50% to 100%	$221,161	$ 71,070	$145,584	$72,278	$122,086	$172,963	$210,396	$263,270	$352,067	$413,328
Increase:100% or More	$226,483	$ 71,638	$126,309	$84,848	$126,397	$176,336	$215,860	$270,025	$356,362	$429,345
Increasign Total	$222,511	$ 69,829	$145,584	$84,848	$125,645	$173,892	$212,079	$263,525	$350,765	$416,782
Grand Total	$223,683	$ 70,011	$145,584	$88,318	$127,367	$174,406	$213,175	$264,927	$351,505	$416,841

Wealth Segmented at $250M				Distribution						
	Mean	Std	Mode	1st	5th	25th	Median	75th	95th	99th
Decrease: 50% to 75%	0.329	0.470	0	0	0	0	0	1	1	1
Decrease: 75% or More	0.310	0.463	0	0	0	0	0	1	1	1
Increase: 50% or Less	0.300	0.458	0	0	0	0	0	1	1	1
Decreasing Total	0.322	0.467	0	0	0	0	0	1	1	1
Increase: 50% to 100%	0.307	0.461	0	0	0	0	0	1	1	1
Increase:100% or More	0.325	0.468	0	0	0	0	0	1	1	1
Increasign Total	0.309	0.462	0	0	0	0	0	1	1	1
Grand Total	0.315	0.465	0	0	0	0	0	1	1	1

Table Of Significance Results

Summary Table for Means and confidence Level Around Means –

Change in Balances	N	Change in Credit Limit Lower CL Mean	Change in Credit Limit Mean	Change in Credit Limit Upper CL Mean	Risk Profile: Consistently Low Lower CL Mean	Risk Profile: Consistently Low Mean	Risk Profile: Consistently Low Upper CL Mean	Risk Profile: Decreasing Risk Lower CL Mean	Risk Profile: Decreasing Risk Mean	Risk Profile: Decreasing Risk Upper CL Mean	Risk Profile: Medium Risk Lower CL Mean	Risk Profile: Medium Risk Mean	Risk Profile: Medium Risk Upper CL Mean	Risk Profile: Increasingly Risky Lower CL Mean	Risk Profile: Increasingly Risky Mean	Risk Profile: Increasingly Risky Upper CL Mean
A Decrease of 50% or Less	25,853	0.76	0.76	0.77	0.29	0.30	0.30	0.16	0.17	0.17	0.43	0.44	0.44	0.04	0.05	0.05
versus All Else	2,171	0.62	0.64	0.66	0.33	0.35	0.37	0.18	0.20	0.21	0.36	0.39	0.41	0.02	0.03	0.04
A Decrease of 50% to 75% versus	24,232	0.75	0.75	0.76	0.29	0.30	0.31	0.16	0.17	0.17	0.43	0.43	0.44	0.04	0.04	0.05
All Else	3,792	0.72	0.73	0.75	0.29	0.30	0.32	0.17	0.19	0.20	0.40	0.42	0.43	0.03	0.04	0.05
A Decrease of 75% or More	20,464	0.73	0.74	0.75	0.31	0.32	0.32	0.17	0.17	0.18	0.41	0.42	0.43	0.04	0.04	0.04
versus All Else	7,560	0.78	0.79	0.80	0.25	0.26	0.27	0.15	0.15	0.16	0.45	0.46	0.48	0.05	0.05	0.06
Total Decrease	13,523	0.74	0.75	0.76	0.28	0.29	0.30	0.16	0.17	0.18	0.43	0.44	0.45	0.04	0.05	0.05
	14,501	0.75	0.76	0.76	0.31	0.31	0.32	0.16	0.17	0.17	0.42	0.43	0.43	0.04	0.04	0.05
An Increase of 50% or Less	21,732	0.74	0.75	0.75	0.31	0.32	0.32	0.16	0.17	0.17	0.42	0.42	0.43	0.04	0.04	0.05
versus All Else	6,292	0.75	0.76	0.78	0.24	0.25	0.26	0.16	0.16	0.17	0.45	0.46	0.48	0.04	0.05	0.05
An Increase of 50% to 100%	23,955	0.75	0.75	0.76	0.29	0.30	0.31	0.16	0.17	0.17	0.43	0.43	0.44	0.04	0.04	0.05
versus All Else	4,069	0.74	0.76	0.77	0.29	0.31	0.32	0.16	0.17	0.18	0.41	0.43	0.45	0.04	0.04	0.05
An Increase of 100% or More	23,884	0.75	0.75	0.76	0.28	0.28	0.29	0.16	0.17	0.17	0.44	0.44	0.45	0.04	0.05	0.05
versus All Else	4,140	0.73	0.74	0.75	0.40	0.41	0.43	0.16	0.17	0.18	0.35	0.36	0.38	0.03	0.03	0.04
Total Increase	13,523	0.74	0.75	0.76	0.28	0.29	0.30	0.16	0.17	0.18	0.43	0.44	0.45	0.04	0.05	0.05
	14,501	0.75	0.76	0.76	0.31	0.31	0.32	0.16	0.17	0.17	0.42	0.43	0.43	0.04	0.04	0.05

Change in Balances	N	Risk Profile: Consistently High Lower CL Mean	Risk Profile: Consistently High Mean	Risk Profile: Consistently High Upper CL Mean	Median Age Lower CL Mean	Median Age Mean	Median Age Upper CL Mean	Median Home Value Lower CL Mean	Median Home Value Mean	Median Home Value Upper CL Mean	Annual Income Lower CL Mean	Annual Income Mean	Annual Income Upper CL Mean	Wealth Lower CL Mean	Wealth Mean	Wealth Upper CL Mean
A Decrease of 50% or Less	25,853	0.05	0.06	0.06	36.59	36.64	36.70	$145,710	$146,870	$ 148,029	$ 57,761	$58,564	$59,368	$222,334	$223,184	$ 224,034
versus All Else	2,171	0.03	0.04	0.04	36.88	37.07	37.25	$154,673	$159,155	$ 163,638	$ 58,813	$61,104	$63,396	$226,554	$229,619	$ 232,684
A Decrease of 50% to 75% versus	24,232	0.05	0.06	0.06	36.63	36.69	36.74	$146,299	$147,508	$ 148,716	$ 57,730	$58,550	$59,370	$222,368	$223,247	$ 224,127
All Else	3,792	0.05	0.05	0.06	36.47	36.61	36.76	$146,751	$149,828	$ 152,905	$ 58,045	$60,108	$62,172	$224,201	$226,465	$ 228,730
A Decrease of 75% or More	20,464	0.05	0.05	0.05	36.61	36.67	36.73	$147,583	$148,912	$ 150,241	$ 57,930	$58,832	$59,734	$223,033	$223,998	$ 224,963
versus All Else	7,560	0.06	0.07	0.07	36.60	36.70	36.80	$142,760	$144,870	$ 146,980	$ 57,149	$58,570	$59,991	$221,277	$222,829	$ 224,382
Total Decrease	13,523	0.05	0.06	0.06	36.66	36.74	36.81	$146,923	$148,554	$ 150,185	$ 58,359	$59,408	$60,457	$223,756	$224,939	$ 226,122
	14,501	0.05	0.05	0.06	36.55	36.62	36.70	$145,585	$147,139	$ 148,693	$ 57,057	$58,158	$59,258	$221,375	$222,511	$ 223,648
An Increase of 50% or Less	21,732	0.05	0.05	0.05	36.63	36.69	36.75	$148,058	$149,346	$ 150,634	$ 58,204	$59,072	$59,940	$223,586	$224,526	$ 225,465
versus All Else	6,292	0.06	0.07	0.08	36.52	36.63	36.74	$140,254	$142,557	$ 144,861	$ 56,096	$57,688	$59,279	$219,099	$220,771	$ 222,444
An Increase of 50% to 100%	23,955	0.05	0.06	0.06	36.66	36.72	36.78	$146,496	$147,713	$ 148,930	$ 58,261	$59,085	$59,908	$223,227	$224,111	$ 224,995
versus All Else	4,069	0.05	0.05	0.06	36.29	36.43	36.56	$145,513	$148,462	$ 151,411	$ 54,850	$56,857	$58,864	$218,976	$221,161	$ 223,345
An Increase of 100% or More	23,884	0.06	0.06	0.06	36.60	36.66	36.71	$145,744	$146,958	$ 148,173	$ 57,717	$58,520	$59,324	$222,313	$223,197	$ 224,081
versus All Else	4,140	0.03	0.03	0.04	36.66	36.80	36.93	$149,814	$152,801	$ 155,789	$ 57,887	$60,150	$62,414	$224,300	$226,483	$ 228,666
Total Increase	13,523	0.05	0.06	0.06	36.66	36.74	36.81	$146,923	$148,554	$ 150,185	$ 58,359	$59,408	$60,457	$223,756	$224,939	$ 226,122
	14,501	0.05	0.05	0.06	36.55	36.62	36.70	$145,585	$147,139	$ 148,693	$ 57,057	$58,158	$59,258	$221,375	$222,511	$ 223,648

Table Of Significance Results

T-Tests* for Differences between the Means –

Change in Balances	Change in Credit Limit	Risk Profile: Consistently Low	Risk Profile: Decreasing Risk	Risk Profile: Medium Risk	Risk Profile: Increasingly Risky	Risk Profile: Consistently High	Median Age	Median Home Value	Annual Income	Wealth
A Decrease of 50% or Less	12.69	-5.38	-3.83	4.54	3.33	4.24	-4.18	-5.72	-1.75	-4.11
A Decrease of 50% to 75%	2.77	-0.39	-3.15	2.14	1.01	0.4	0.92	-1.38	-1.37	-2.63
A Decrease of 75% or More	-8.23	8.49	3.96	-6.9	-4.55	-4.46	-0.55	3.13	0.3	1.24
Total Decrease	1.36	4.39	-0.69	-2.23	-1.57	-1.42	-2.09	-1.23	-1.61	-2.9
An Increase of 50% or Less	-2.6	9.48	0.91	-5.98	-2.38	-5.39	0.84	4.94	1.49	3.75
An Increase of 50% to 100%	-0.79	-0.66	-0.32	0.22	0.83	0.64	3.82	-0.46	2.02	2.49
An Increase of 100% or More	1.92	-16.73	0.22	9.97	4.2	7.7	-1.83	-3.61	-1.49	-2.79
Total Increase	-1.36	-4.39	0.69	2.23	1.57	1.42	2.09	1.23	1.61	2.9

* T-test measures whether or not and to what extend the differences between the means are significantly different than zero.

Relationship Between Levels Of Balances and Credit Lines

Percent of Variance Explained (R-square)

		Balance Growth																
		9912	0002	0004	0006	0008	0010	0012	0102	0104	0106	0108	0110	0112	0202	0204	0206	0208
	9912	14.6%	6.1%	3.6%	1.7%	1.0%	0.7%	0.5%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	0002		7.5%	5.4%	2.9%	1.9%	1.4%	1.0%	0.6%	0.4%	0.2%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
	0004			6.7%	4.2%	3.1%	2.3%	1.8%	1.4%	1.0%	0.7%	0.3%	0.4%	0.2%	0.2%	0.2%	0.1%	0.1%
C	0006				5.8%	4.0%	3.1%	2.5%	2.0%	1.5%	1.1%	0.4%	0.4%	0.2%	0.2%	0.2%	0.2%	0.1%
r	0008					7.7%	5.6%	4.7%	3.6%	2.8%	2.3%	1.1%	1.0%	0.8%	0.7%	0.7%	0.6%	0.5%
e	0010						6.9%	5.0%	3.8%	3.0%	2.4%	1.1%	1.0%	0.8%	0.7%	0.6%	0.6%	0.5%
d	0012							5.5%	4.0%	3.0%	2.5%	1.1%	1.0%	0.8%	0.7%	0.6%	0.6%	0.5%
i	0102								6.0%	4.3%	3.6%	1.8%	1.6%	1.3%	1.0%	1.0%	0.9%	0.7%
t	0104									6.8%	4.9%	2.4%	2.2%	1.9%	1.6%	1.5%	1.3%	1.1%
	0106										6.2%	2.7%	2.4%	2.1%	1.8%	1.7%	1.5%	1.4%
L	0108											5.2%	4.1%	3.7%	3.3%	3.0%	2.6%	2.4%
i	0110												5.5%	4.5%	4.1%	3.5%	3.2%	3.0%
n	0112													6.1%	4.8%	4.0%	3.8%	3.5%
e	0202														6.4%	5.3%	4.6%	4.4%
	0204															6.3%	5.4%	4.9%
	0206																6.7%	5.9%
	0208																	7.0%

Magnitude of Impact (Beta coefficient)

		Balance Growth																
		9912	0002	0004	0006	0008	0010	0012	0102	0104	0106	0108	0110	0112	0202	0204	0206	0208
	9912	$0.38	$ 0.25	$ 0.19	$ 0.13	$ 0.10	$0.08	$0.07	$0.05	$0.03	$0.02	$0.01	$0.01	$ 0.00	$ 0.01	$ 0.01	$ 0.01	$ 0.01
	0002		$ 0.27	$ 0.23	$ 0.17	$ 0.14	$0.12	$0.10	$0.08	$0.06	$0.05	$0.03	$0.03	$ 0.02	$ 0.01	$ 0.02	$ 0.01	$ 0.01
	0004			$ 0.26	$ 0.21	$ 0.17	$0.15	$0.14	$0.12	$0.10	$0.09	$0.06	$0.06	$ 0.05	$ 0.04	$ 0.04	$ 0.04	$ 0.03
C	0006				$ 0.24	$ 0.20	$0.18	$0.16	$0.14	$0.12	$0.10	$0.06	$0.06	$ 0.05	$ 0.04	$ 0.05	$ 0.04	$ 0.04
r	0008					$ 0.28	$0.24	$0.22	$0.19	$0.17	$0.15	$0.11	$0.10	$ 0.09	$ 0.08	$ 0.08	$ 0.08	$ 0.07
e	0010						$0.26	$0.22	$0.19	$0.17	$0.15	$0.10	$0.10	$ 0.09	$ 0.08	$ 0.08	$ 0.08	$ 0.07
d	0012							$0.23	$0.20	$0.17	$0.16	$0.11	$0.10	$ 0.09	$ 0.08	$ 0.08	$ 0.07	$ 0.07
i	0102								$0.24	$0.21	$0.19	$0.13	$0.13	$ 0.11	$ 0.10	$ 0.10	$ 0.09	$ 0.08
t	0104									$0.26	$0.22	$0.15	$0.15	$ 0.14	$ 0.13	$ 0.12	$ 0.12	$ 0.11
	0106										$0.25	$0.16	$0.16	$ 0.15	$ 0.13	$ 0.13	$ 0.12	$ 0.12
L	0108											$0.23	$0.20	$ 0.19	$ 0.18	$ 0.17	$ 0.16	$ 0.16
i	0110												$0.23	$ 0.21	$ 0.20	$ 0.19	$ 0.18	$ 0.17
n	0112													$ 0.25	$ 0.22	$ 0.20	$ 0.19	$ 0.19
e	0202														$ 0.25	$ 0.23	$ 0.21	$ 0.21
	0204															$ 0.25	$ 0.23	$ 0.22
	0206																$ 0.26	$ 0.24
	0208																	$ 0.26

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