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How to avoid household debt overhang? An analytical framework and analysis for India

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ADB Working Paper Series

HOW TO AVOID HOUSEHOLD DEBT OVERHANG? AN ANALYTICAL FRAMEWORK AND ANALYSIS FOR INDIA

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and Prachi Gupta

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Abstract

In this paper we develop an analytical framework using the household utility maximization approach to model stability conditions to avoid household debt overhang. Our theoretical framework suggests that household debt stability is a function of five factors, namely the rate of interest, period of lending, income growth, loan-to-income ratio, and households' disutility from borrowing parameter. Further, we apply our analytical model to the case of India and estimate household debt stability conditions for Indian households under various scenarios to estimate the ceiling borrowing ratios borrowing below which households can avoid the risk of running into a debt overhang problem.

Keywords: debt overhang, household finance, household borrowing

JEL Classification: C13, C15, C62, D10, H31

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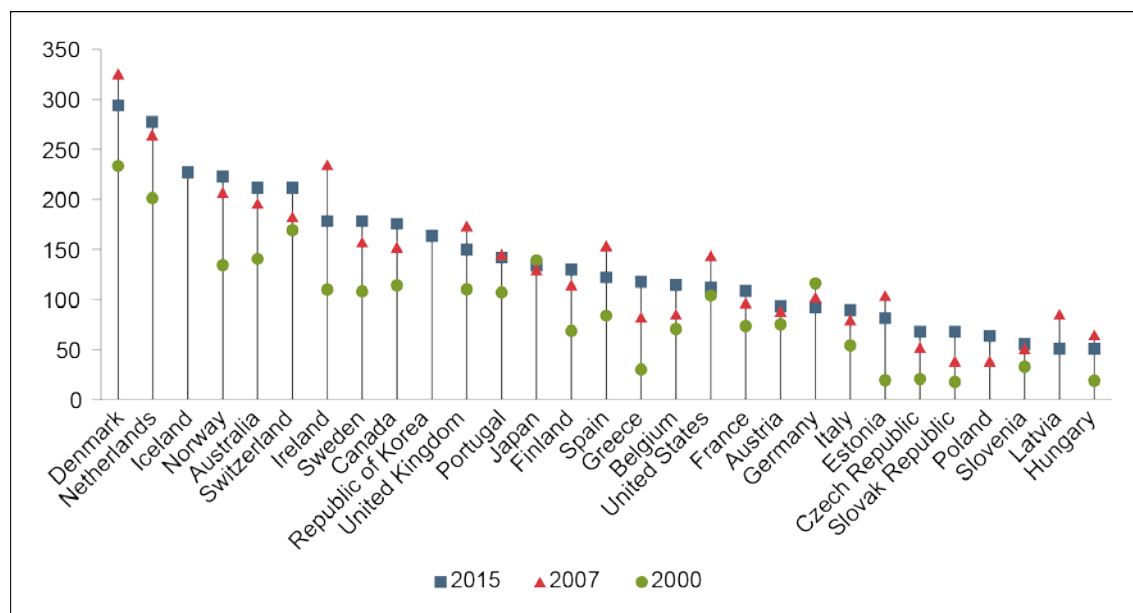
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1. INTRODUCTION

Household debt has been on the rise across countries since the early 2000s (see Figure 1). Estimates from the IMF suggest that household debt as a percentage of GDP rose from 35% in 1996 to more than 60% in 2016 (Figure 2). The proportion of household debt to disposable income in the Republic of Korea increased from a high of 120% in 2006 to a whopping 170% in 2016 (Figure 3). In the case of the United States, the rate stood at 96% in 1997, peaked at 128% in 2007, and stood at 100% in 2016 (Figure 3). Household indebtedness has also increased very rapidly in emerging market economies. In the People's Republic of China (PRC), household indebtedness doubled from 29.6% of GDP in 2012 to 44.3% in 2017.¹ Overall for emerging market economies, household debt as a percentage of GDP rose from 2% in 1996 to 20% in 2016.

Why is rising household debt an economic problem? Literature suggests that excessive levels of household debt can lead to situations of debt overhang, thereby curbing consumption, investment, and economic growth. Schularick and Taylor (2012) show that high levels of household debt are not only good predictors of financial crises but also an important determinant of the intensity of the ensuing recession. Another study, by Drehmann and Juselius (2014), demonstrates that household debt levels could predict future banking system crises. Using data from 54 countries for the period 1990–2015, Lombardi, Mohanty, and Shim (2017) show that in the long run a 1% increase in the household debt-to-GDP ratio leads to a 0.1 percentage point lower growth.

Figure 1: Trends in Household Indebtedness

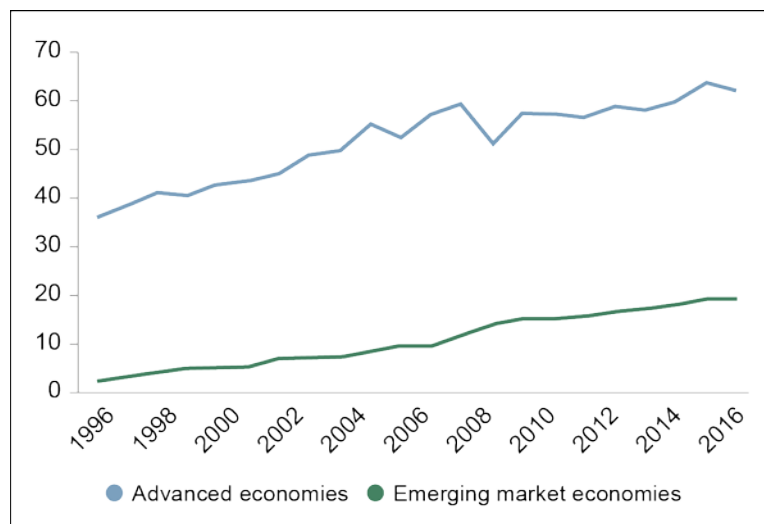
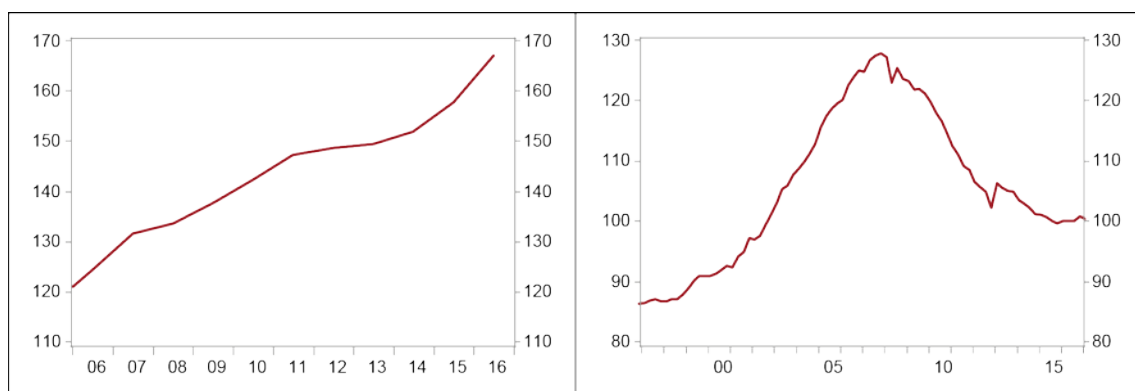


Note: For Iceland and Rep. of Korea, the square points refer to data from 2014 instead of 2015. For Ireland and Slovenia, the dot point refers to data from 2001 instead of 2000.

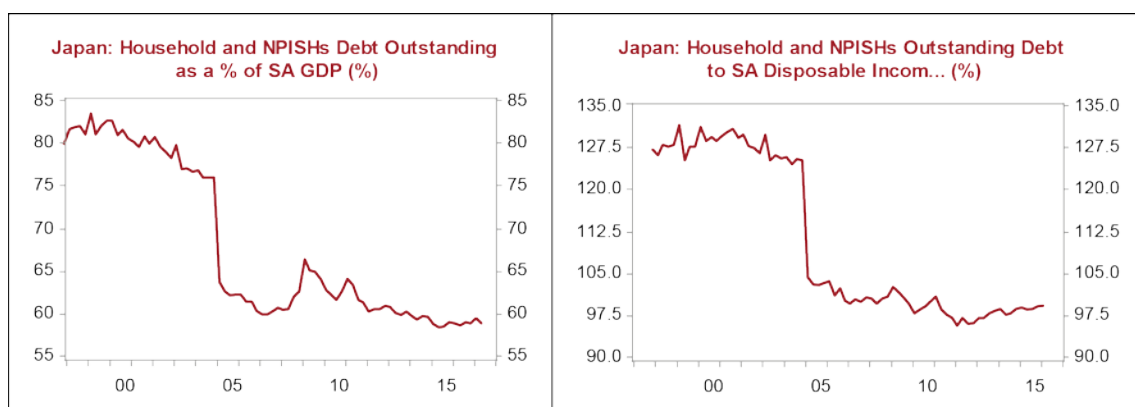
Source: OECD statistical insights².

¹ Estimates have been obtained from the CEIC database.

² See <https://www.oecd.org/sdd/na/statisticalinsightswhatdoeshouseholddebtsayaboutfinancialresilience.htm>.

Figure 2: Household Debt as a Percentage of GDPSource: IMF³.**Figure 3: Ratio of Household Debt to Disposable Income in the Republic of Korea (left) and the US (right)**

Source: Haver Analytics.

Figure 4: Ratio of Household Debt to Disposable Income (Japan)³ See <https://blogs.imf.org/2017/10/03/rising-household-debt-what-it-means-for-growth-and-stability/>.

Source: Haver Analytics.

Mian, Sufi, and Trebbi (2014) analyzed US household-level data and found that the great financial crisis of 2007–08 was aggravated by the fact that US households that had a higher marginal propensity to consume and were highly indebted rapidly reduced spending following the negative house price shock. In the case of recourse loans, wherein the lender can confiscate other assets to recover the value of the loan, poorer households with limited assets may have an automatic limited liability as they have nothing more to offer against the loan repayment (Basu 2011).

The question that arises next is: How can lending quality be improved to avoid the risk of default on debt? In this paper, we address this issue in the context of borrowings undertaken by households. We derive stability conditions for lending to households to avoid debt overhang. We start with a simple utility function with two components, consumption and debt. With a given condition that consumption equals income (and debt), households maximize their utility. Solving the Lagrangian condition, we obtain the theoretical stability conditions for household debt. This estimation can also be applied to the case of borrowing by small businesses, which has been discussed later in the paper.

For our empirical analysis, we use data from India to model stability conditions using different interest rates, periods of lending, and parameters of household utility function and obtain the ceiling loan-to-income ratio below which households' borrowing should fall in order to avoid debt overhang. We focus on India for three main reasons. Firstly, there has been a steady rise in household indebtedness in India. The GDP growth in India has been primarily consumption led, more so during the periods 2013–14 and 2016–17 (RBI 2017). Results from the 70th round of the National Sample Survey suggest rises in household indebtedness in India from 26.5% in rural households and 17.8% in urban households in 2002 to 31.4% and 22.4%, respectively, in 2013. In the case of rural households, 35% of cultivator households reported being in debt compared to 25.9% in 1991. And in the case of urban households, nearly one in five households were reported to be in debt in 2013.

Secondly, in recent years, India's banking sector has also seen a steep rise in its gross nonperforming assets (NPAs) due to bad loans, which stood at Rs7.29 lakh crore, or about 5% of GDP, in March 2017 and accounted for 9.6% of banking assets. As a result, India ranks second in terms of its ratio of NPAs among the major economies of the world after Italy, whose NPA stood at 16.4%. While household loans are not the biggest contributor to these NPAs, their contribution remains significant. In the case of housing loans below Rs.2 lakh, gross NPAs for all public sector banks stood at 12% in 2015–16. The reported NPA levels for some banks were reported to be as high as 40%–50%. Rising indebtedness and high NPAs suggest a potential crisis in the financial sector that needs to be urgently resolved.

Lastly, with the balance sheets of leading banks being badly affected by bad loans, alternate sources of credit have been seen to have increased their contribution to credit funding in India. The 2017 financial year marked a watershed in this regard, with banks' share in new credit slumping from a historical 50% to 35%, while funding from nonbank sources rose to 65% (RBI). Assessing creditworthiness has been an uphill task for lenders given that sources of income such as income tax returns are not considered particularly reliable. In the case of lending to rural households, institutional lending is limited and almost a quarter of all debt is still owed to moneylenders for short- or medium-term loans with compound interest rates as high as 40%. Further, institutional borrowing by young households is very low in India, and rises for older households. The predominant reasons for borrowing include buying real estate, funding medical emergencies, and purchasing gold for children's marriages. A lack of

retirement pension and health coverage often leaves these older households at risk of debt overhang.

Our theoretical and empirical findings suggest that with a given income growth, interest rate period of lending, and utility function, if the lending was restricted below our ceiling estimates, this could avoid situations of debt default or debt overhang for households and small businesses. Our paper provides estimates for various lending conditions and the estimated ceiling borrowing ratio. While these calculations have been undertaken for interest rates, lending periods, and economic growth rates relevant to India, the model can be easily replicated for any economy by altering the parameters of the stability conditions.

The major finding of this paper is that household debt stability is a function of five factors: (1) interest rate, (2) period of lending, (3) income growth, (4) household disutility from borrowing parameter, and (5) loan-to-income ratio. And the chances of debt overhang increase with rises in interest rate, as expected, and fall with increases in lending period, income growth, loan-to-income ratio, and household disutility from borrowing.

The rest of the paper is organized as follows. Section 2 discusses the case of Japan. In Section 3 we derive the stability conditions, while Section 4 covers the empirical analysis with respect to India, and Section 5 concludes.

2. CASE OF JAPAN

Our estimation strategy draws inspiration from the nonbank moneylending regulation in Japan. In the postwar period, the moneylending industry remained largely deregulated in Japan. Lending to small-scale and medium-sized enterprises in Japan is covered under the Small and Medium Enterprise Basic Law of 1963 (revised in 1999). This law covers microbusinesses such as restaurants, shops etc. that are operated by only one or two persons or by the owners themselves. Household debt, until the early 2000s, as a percentage of disposable income stood as high as 130%. In 2007, the FSA council passed a new regulation to amend the moneylending industry laws and prevent borrowers from becoming heavily indebted. The key features of the law are briefly outlined below⁴:

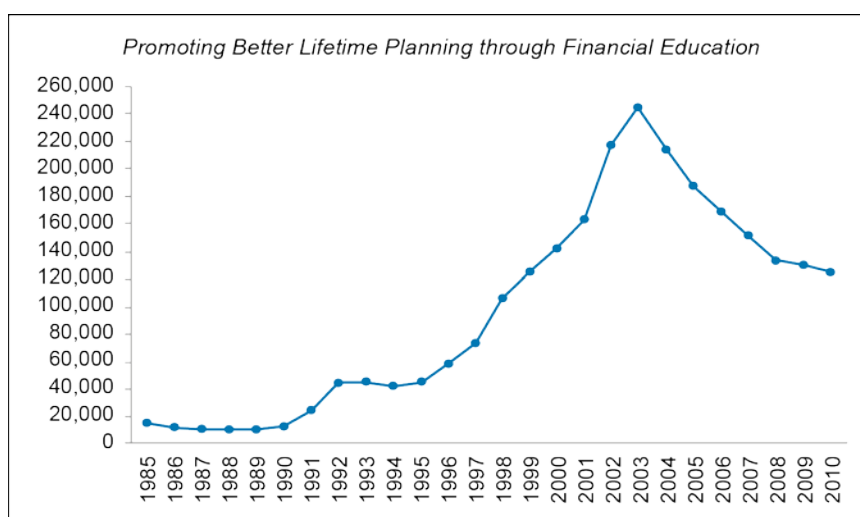
- a. Ceiling on borrowing ratio: Under the new law, the total amount of borrowing available to a household was capped at one-third of household income. This ceiling was established to ensure that households do not borrow beyond their repayment capacity and hence avoid heavy indebtedness.
- b. Interest rate ceiling: Prior to the law, interest rates in the Japanese moneylending industry stood above 100%. This was first reduced to 29% and further to 20% under the new law.
- c. Borrowers' information: The law required all individual borrowing within a household to be aggregated to obtain the total household borrowing, which was regulated by law.
- d. Self-regulatory association of moneylenders: A self-regulatory association of moneylenders was established to supervise the functioning of the moneylending industry.

⁴ The information has been drawn from the FSA council report chaired by Naoyuki Yoshino (see Yoshino 2006).

- e. Consumer care hotline: A consumer care hotline was established to empower consumers to report complaints with respect to disputed/unfair moneylending conditions.

Following this, as the regulation fixed a ceiling on borrowing ratios, interest rates, and other regulatory processes discussed above, a sharp decline was seen in the household default rate, with the number falling from 240,000 in 2002 to around 120,000 in 2010 (see Figure 5). This suggests that fixing a ceiling on the loan-to-income ratio along with other regulatory checks and balances reduced the defaults on household borrowings in the case of Japan. Drawing from the above, we proceed to building a simple theoretical model for lending to households and small businesses and we obtain the stability conditions required to avoid the situation of debt overhang. Our model can be easily applied to any economy, and in this paper we derive the conditions using data from India.

Figure 5: Household Default in Japan



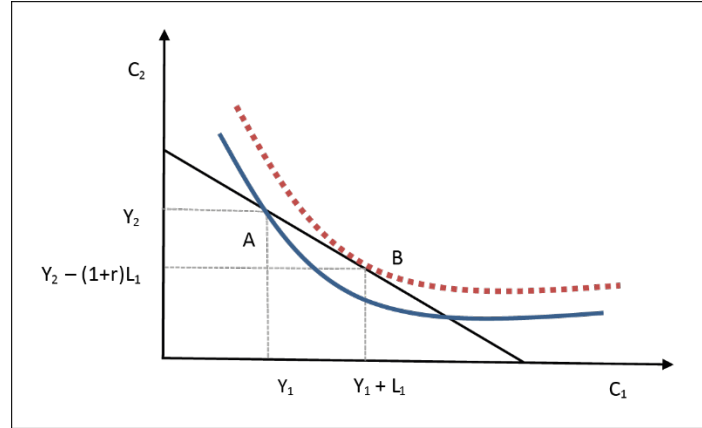
Source: FSA.

3. MODELING STABILITY CONDITIONS FOR HOUSEHOLD DEBT

3.1 Household Borrowing and Utility Function

We start with a two-period model. Suppose in case I there is no loan such that household consumption is equal to its income, that is, $C_1 = Y_1$ and $C_2 = Y_2$. In this case (see Figure 6), the household utility level will stand at suboptimal point B. However, in case II, we assume that the household is able to borrow L_1 , say for the purpose of buying a house, such that it increases its consumption in period 1 and repays the loan in period 2, which is $C_1 = Y_1 + L_1$ and $C_2 = Y_2 - (1+r)L_1$. In this case, the utility of the household will move from A to a higher level at optimal point B.⁵ This figure thus explains how borrowing in one period may help a household move to a higher utility curve.

⁵ This is a simple case where we assume that the household repays the loan in period 2. The model can also be easily extended to the case where the household borrows in period 1 and repays it over n periods.

Figure 6: Household Borrowing and Utility Function

In the next section of this paper, we move on to deriving the stability conditions for borrowing.

3.1.1 Household Utility Maximization

We begin by assuming a simple utility function for households:

$$U(C, L) = \log C_t - \beta \log L_t \quad (1)$$

Here, C_t is the household consumption at time t , L_t is the amount of loan outstanding at time t , and β is the coefficient that measures the disutility of indebtedness.

3.1.2 Household Budget Constraint

We assume that households borrow in each period and hence their consumption C_t in time period t equals income Y_t in time period t , plus a loan taken in time period t minus a loan taken in time period $t-1$ along with interest at the rate of $r\%$.⁶

$$C_t = Y_t + (L_t - L_{t-1}) - rL_{t-1} \quad (2)$$

The household utility maximization problem can hence be written as follows:

$$\begin{aligned} \text{Max } U(C, L) &= \log C_t - \beta \log L_t \\ \text{s.t. } rL_{t-1} + C_t &= Y_t + (L_t - L_{t-1}) \end{aligned} \quad (3)$$

We obtain the Lagrangian equation as follows:

$$\mathcal{L} = \log C_t - \beta \log L_t - \lambda(rL_{t-1} + C_t - Y_t - (L_t - L_{t-1})) \quad (4)$$

Differentiating the above with respect to C_t , L_t , and λ , respectively

$$\frac{\partial \mathcal{L}}{\partial C_t} = \frac{1}{C_t} - \lambda = 0 \quad (5)$$

⁶ In this paper we assume static maximization, however this utility maximization problem can also be extended to dynamic optimization.

$$\frac{\partial \mathcal{L}}{\partial L_t} = -\frac{\beta}{L_t} + \lambda = 0 \quad (6)$$

$$\frac{\partial \mathcal{L}}{\partial \lambda} = rL_{t-1} + C_t - Y_t - (L_t - L_{t-1}) = 0 \quad (7)$$

From (2) and (3), we obtain the optimal C_t as follows:

$$C_t = \frac{L_t}{\beta} \quad (8)$$

Substituting C_t from (8) into (7):

$$rL_{t-1} + \frac{L_t}{\beta} - Y_t - (L_t - L_{t-1}) = 0,$$

$$L_t \left(\frac{1}{\beta} - 1 \right) + (1+r) L_{t-1} = Y_t$$

we obtain the optimal amount of L_t as follows:

$$L_t = -\frac{(1+r)}{\frac{1-\beta}{\beta}} L_{t-1} + \frac{Y_t}{\frac{1-\beta}{\beta}} \quad (9)$$

Next, we assume that income grows at a constant rate “ a ” such that Y_t can be written as:

$$\begin{aligned} Y_t &= (1+a)Y_{t-1} \\ \Rightarrow Y_t &= (1+a)^t Y_0 \end{aligned} \quad (10)$$

Substituting Y_t from (10) into equation (9) we obtain:

$$L_t + \frac{(1+r)\beta}{1-\beta} L_{t-1} = \frac{\beta (1+a)^t Y_0}{1-\beta} \quad (11)$$

Solving the above first-order difference equation we can rewrite (11) as follows⁷:

$$\begin{aligned} L_t &= \left(\frac{-(1+r)\beta}{1-\beta} \right)^t L_0 + \frac{\frac{\beta (1+a)^t Y_0}{1-\beta}}{1 + \frac{(1+r)\beta}{1-\beta}} \left(1 - \left(\frac{-(1+r)\beta}{1-\beta} \right)^t \right) Y_0 < 0 \\ \frac{L_0}{Y_0} &< \frac{-\beta (1+a)^t}{(1+r)\beta} \left(\frac{(1-\beta)}{-(1+r)\beta} \right)^t \left(1 - \left(\frac{-(1+r)\beta}{1-\beta} \right)^t \right) \end{aligned} \quad (12)$$

We use the condition in equation (12) to model stability conditions for household debt.

3.1.3 Estimating Consumption Function and Marginal Propensity to Consume

We obtained from equations (8) and (9), $C_t = \frac{L_t}{\beta}$ and $L_t = -\frac{(1+r)}{\frac{1-\beta}{\beta}} L_{t-1} + \frac{Y_t}{\frac{1-\beta}{\beta}}$

⁷ See Chiang (1984).

Let $\Phi = \frac{1-\beta}{\beta}$, then equation (9) can be rewritten as follows:

$$L_t = -\frac{(1+r)}{\Phi} L_{t-1} + \frac{Y_t}{\Phi} \quad (13)$$

Substituting L_t in equation (8), we obtain C_t as follows:

$$C_t = \frac{1}{\beta} \left(-\frac{(1+r)}{\Phi} L_{t-1} + \frac{Y_t}{\Phi} \right) = \frac{Y_t}{\beta\Phi} - \frac{1}{\beta} \frac{(1+r)}{\Phi} L_{t-1} = \frac{Y_t}{1-\beta} - \frac{(1+r)}{1-\beta} L_{t-1} \quad (14)$$

Using the above equation, we next proceed to estimate the marginal propensity to consume (MPC). Substituting (13) in (14), we get the following:

$$C_t = \frac{Y_t}{1-\beta} - \frac{(1+r)}{1-\beta} \left[-\frac{(1+r)}{\frac{1-\beta}{\beta}} L_{t-2} + \frac{Y_{t-1}}{\frac{1-\beta}{\beta}} \right] \quad (15)$$

$$\Rightarrow C_t = \frac{Y_t}{1-\beta} - \frac{(1+r)\beta}{(1-\beta)^2} Y_{t-1} + (-1)^2 \left[\frac{(1+r)}{1-\beta} \right]^2 \beta L_{t-2}$$

$$\Rightarrow C_t = \frac{Y_t}{1-\beta} - \frac{(1+r)\beta}{(1-\beta)^2} Y_{t-1} + (-1)^2 \left[\frac{(1+r)}{1-\beta} \right]^2 \beta \left[-\frac{(1+r)}{\frac{1-\beta}{\beta}} L_{t-3} + \frac{Y_{t-2}}{\frac{1-\beta}{\beta}} \right]$$

$$\Rightarrow C_t = \frac{Y_t}{1-\beta} - \frac{(1+r)\beta}{(1-\beta)^2} Y_{t-1} + (-1)^2 \frac{(1+r)^2 \beta^2}{(1-\beta)^3} Y_{t-2} + (-1)^3 \left[\frac{(1+r)}{1-\beta} \right]^3 \beta^2 L_{t-3}$$

Assuming that in the long run $Y_t = \bar{Y}$

$$C_t = \frac{\bar{Y}}{1-\beta} - \frac{(1+r)\beta}{(1-\beta)^2} \bar{Y} + (-1)^2 \frac{(1+r)^2 \beta^2}{(1-\beta)^3} \bar{Y} + (-1)^3 \frac{(1+r)^3 \beta^3}{(1-\beta)^4} \bar{Y} \\ + \dots \dots (-1)^n \left[\frac{(1+r)}{1-\beta} \right]^n \beta^{n-1} L_{t-n} \quad (16)$$

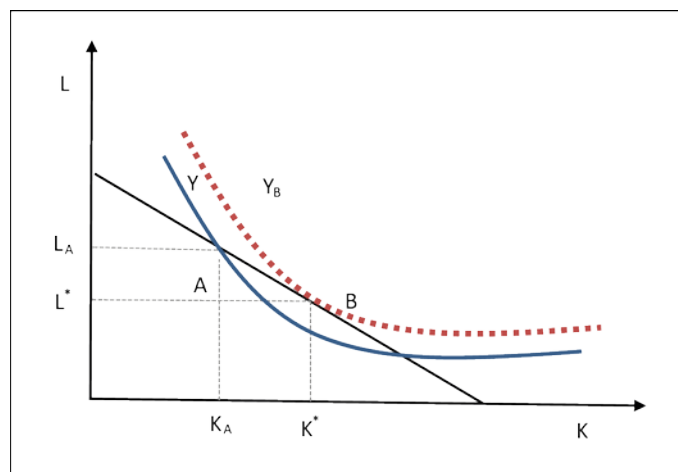
The sum of the series can be expressed as

$$C_t = \frac{\bar{Y}}{1-\beta} \left[1 + \frac{(-1)(1+r)\beta}{1-\beta} + \left(\frac{(-1)(1+r)\beta}{1-\beta} \right)^2 + \left(\frac{(-1)(1+r)\beta}{1-\beta} \right)^3 + \dots \left(\frac{(-1)(1+r)\beta}{1-\beta} \right)^n \right] \\ + (-1)^n \left[\frac{(1+r)}{1-\beta} \right]^n \beta^{n-1} L_{t-n} \\ \Rightarrow C_t = \frac{\frac{1}{1-\beta} \left[1 - \left(\frac{(-1)(1+r)\beta}{1-\beta} \right)^n \right]}{1 - \frac{(-1)(1+r)\beta}{1-\beta}} \bar{Y} + (-1)^n \left[\frac{(1+r)}{1-\beta} \right]^n \beta^{n-1} L_{t-n} \quad (17)$$

$$\text{For large } n, \left(\frac{(-1)(1+r)\beta}{1-\beta} \right)^n \rightarrow 0 \quad (18)$$

Then the coefficient of \bar{Y} reduces to $\frac{1}{1+r\beta}$, which equals the long-run MPC. Hence we obtain the following equation:

$$\bar{C} = \frac{1}{1+r\beta} \bar{Y} \quad (19)$$

Figure 7: SME Borrowing and Production Function

The above model can also be applied to the case of small and medium-scale businesses (see Figure 7). In this case, we start with a two-period model, where in case I there is no loan and the production happens at an inefficient point “A” on the isoquant Y_A , with L_A labor and K_A capital. However, if the SME is able to borrow money to buy additional capital, the production can move to optimal point B on Y^* with L^* labor and K^* capital. This move is feasible if gains in output are higher than the repayment of the loan, that is:

$$Y^* - Y_A > (1+r) L_1 \text{ given } K^* = K_A + L_1$$

4. EMPIRICAL ANALYSIS FOR INDIA

4.1 Estimating Marginal Propensity to Consume

We begin our analysis by estimating the marginal propensity to consume using the simple econometric technique of regressing final consumption expenditure on real GDP and lagged consumption expenditure for the period 1967–2017. The data for the same have been obtained from the RBI’s DBIE database. The regression results are displayed in Appendix Table A1. We estimate two models with one-year and two-year lagged consumption expenditure on the right-hand side; both the models yield MPC of around 0.81. For the condition in (18) $\left(\frac{(-1)(1+r)\beta}{1-\beta}\right)^n \rightarrow 0$ to hold, we require that $\frac{(-1)(1+r)\beta}{1-\beta} < 0$. Hence for a given r , this condition gives us the plausible values of β . For example, if $r = 0.05$, $\beta > 0.49$, or for $r = 0.15$, $\beta > 0.46$.

Assuming $r = 0.05$ and $\beta = 0.4$, MPC, which is estimated as $\frac{1}{1+r\beta}$, stands at 0.98. Similarly, if $r = 0.15$ and $\beta = 0.4$, MPC equals 0.93. This is expected to be higher than the estimated national average MPC that covers people from all income levels. However, the MPC of households who face the risk of debt default is expected to be higher than the national average MPC. In the case of India, our estimated MPC using aggregate data equals 0.81; in this case, to obtain a value of β such that $0 < \beta < 1$ the value of r must be very high, i.e. of a magnitude greater than 0.24.

Table 1: Estimated Values of β and MPC for Given r

| r (given) | β > (estimated) | MPC (estimated) |
|-------------|-----------------------|-----------------|
| 0.05 | 0.49 | 0.98 |
| 0.08 | 0.48 | 0.96 |
| 0.1 | 0.48 | 0.95 |
| 0.12 | 0.47 | 0.95 |
| 0.14 | 0.47 | 0.94 |
| 0.16 | 0.46 | 0.93 |
| 0.2 | 0.45 | 0.92 |
| 0.3 | 0.43 | 0.88 |

4.2 Calculating Stability Conditions to Avoid Household Debt Overhang

We use equation (12) to obtain the stability conditions for household borrowing in the case of India. To start with, we assume a , the rate of growth of income equal to the GDP growth rate of the economy for the past decade, however this assumption can be easily relaxed.⁸ The rate of interest r varies between 5% and 30% in our simulations while the period of lending varies from one to 15 years.

4.2.1 Results Based on Simulations

A. Maximum interest rate (r)

For our simulation, we use the range of lending rates prevalent in India. Lending rates (or bank lending rates) in India vary across a wide range based on the purpose of the loan. Housing loans have the lowest interest rates, which ranged between 7.5% and 13% in the period 1991–1992 to 2007–2008.⁹ Based on the latest available data from the website of a leading public sector bank, namely the State Bank of India, the rate of interest on housing loans stands at around 8.3%. For other loan categories such as for the purchase of consumer durables such as automobiles or gold and other personal loans, the interest rates lie in the range of 14% and above.¹⁰ We use the wide range of interest rates commonly applicable in India for the purpose of our estimation, and in Table 2 we provide estimates of ceiling ratios for varying r (5%, 8%, 10%, 12%, 14%, 16%, 20%, and 30%, respectively) assuming $a = 7\%$, $n = 15$ years, and $\beta = 0.5$. Hence, when the interest rate is 8%, the loan should be less than 1.76 times the household income at the time of lending. If the interest rate is increased to 20%, then the ceiling ratio falls to 1.35 times the household income.

In Figure 8, we simulate the results with varying values of r (5%, 12%, 15%, 18%, 20%, 25%, and 30%, respectively) as well as varying n (1–15 years), a is assumed to be 0.07, and β is fixed at 0.5.

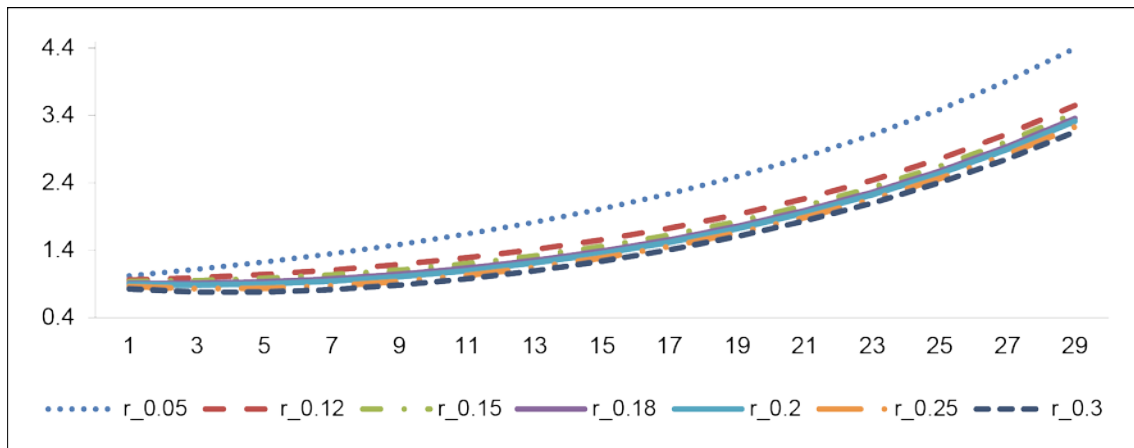
⁸ Fixing a , which is the expected rate of growth of income of the household, can be a challenging task that will vary from case to case and will require judgement on the part of the loan provider. In our paper, we provide simulation estimates for various ranges of income growth.

⁹ Source: <https://www.bis.org/review/r100617d.pdf>.

¹⁰ Source: <https://rbi.org.in/scripts/PublicationReportDetails.aspx?UrlPage=&ID=565>.

Table 2: Estimated Borrowing Ratio for Different Values of r

| r | β | a | n | $L0/Y0$ |
|------|---------|------|-----|---------|
| 0.05 | 0.5 | 0.07 | 15 | 2.01 |
| 0.08 | 0.5 | 0.07 | 15 | 1.76 |
| 0.1 | 0.5 | 0.07 | 15 | 1.64 |
| 0.12 | 0.5 | 0.07 | 15 | 1.55 |
| 0.14 | 0.5 | 0.07 | 15 | 1.48 |
| 0.16 | 0.5 | 0.07 | 15 | 1.43 |
| 0.2 | 0.5 | 0.07 | 15 | 1.35 |
| 0.3 | 0.5 | 0.07 | 15 | 1.23 |

Figure 8: Borrowing Ratio for Varying r ($\beta = 0.5$, $a = 7\%$)**B. Disutility from Borrowing (β)**

In Table 3, we provide ceiling ratio estimates for varying values of β (0.5, 0.51, 0.52, 0.55, 0.6, 0.7, and 0.8, respectively) given that $a = 7\%$, $n = 15$ years, and $r = 0.15$. Further, in Figure 9 we estimate the borrowing ratio ceiling for varying values of β (0.50, 0.51, 0.52, 0.55, 0.6, 0.7, and 0.8, respectively), and varying t (1–30 years) for each simulation a is assumed to be 7%.

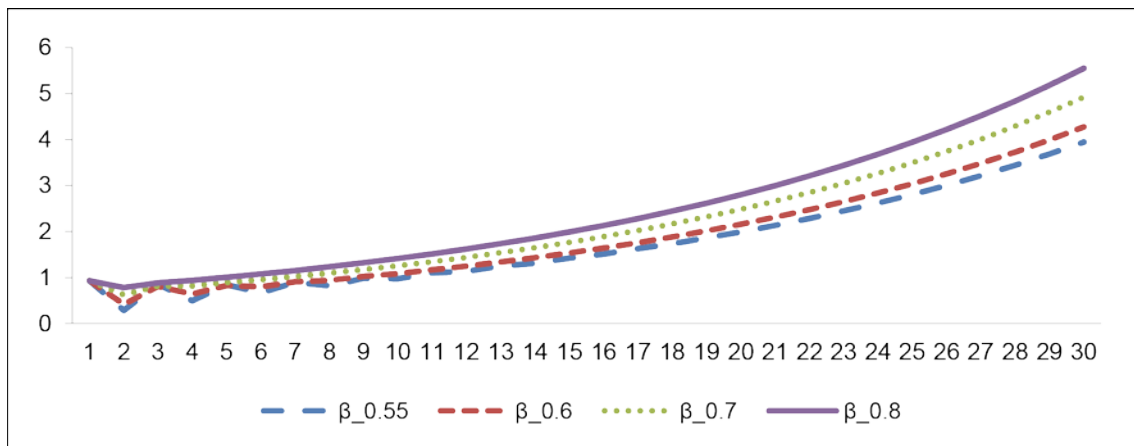
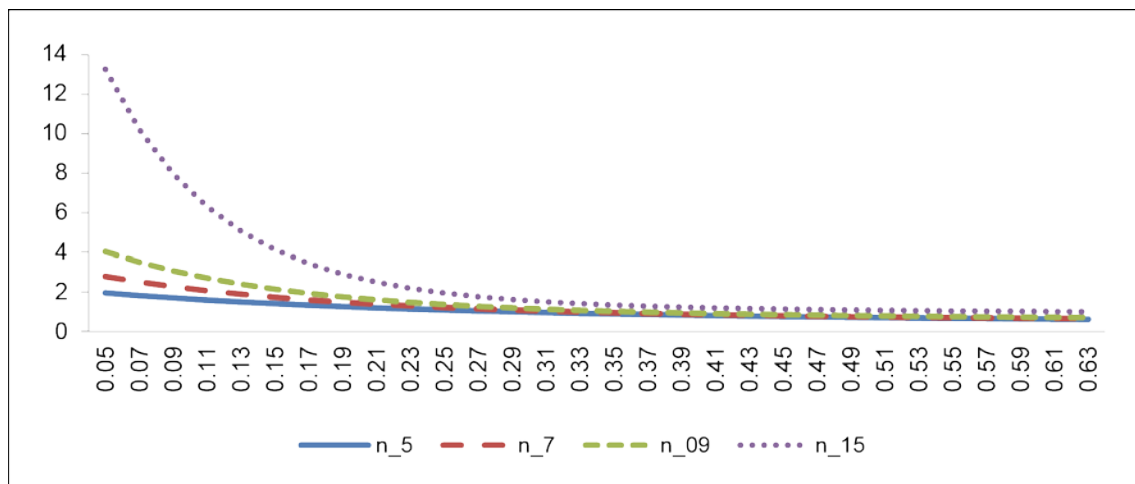
Figure 9: Borrowing Ratio for Varying β ($r = 15\%$)

Table 3: Estimated Borrowing Ratio for Varying β

| β | a | n | r | L_0/Y_0 |
|---------|------|-----|------|-----------|
| 0.50 | 0.07 | 15 | 0.15 | 1.46 |
| 0.51 | 0.07 | 15 | 0.15 | 1.41 |
| 0.52 | 0.07 | 15 | 0.15 | 1.39 |
| 0.55 | 0.07 | 15 | 0.15 | 1.42 |
| 0.6 | 0.07 | 15 | 0.15 | 1.53 |
| 0.7 | 0.07 | 15 | 0.15 | 1.77 |
| 0.8 | 0.07 | 15 | 0.15 | 1.97 |

C. Period of Lending (n)

In Table 4, we provide estimates of the ceiling ratio for varying values of n (1, 3, 5, 7, 9, 11, 13, and 15, respectively) given that $a = 7\%$, $\beta = 0.5$, and $r = 15\%$. For $n = 3$ years, the ceiling ratio estimate is 0.95; when n is increased to 15 the ceiling ratio rises to 1.45. In Figure 10, we plot the borrowing ratio estimates for varying values of t (5, 7, 9, and 15 years, respectively) and r (5% to 65%) for each assuming $a = 0.07$.

Figure 10: Borrowing Ratio for Varying n ($a = 7\%$, $\beta = 0.45$)**Table 4: Estimated Borrowing Ratio for Varying n**

| n | r | β | a | L_0/Y_0 |
|-----|------|---------|------|-----------|
| 1 | 0.15 | 0.5 | 0.07 | 0.93 |
| 3 | 0.15 | 0.5 | 0.07 | 0.95 |
| 5 | 0.15 | 0.5 | 0.07 | 0.98 |
| 7 | 0.15 | 0.5 | 0.07 | 1.03 |
| 9 | 0.15 | 0.5 | 0.07 | 1.10 |
| 11 | 0.15 | 0.5 | 0.07 | 1.20 |
| 13 | 0.15 | 0.5 | 0.07 | 1.31 |
| 15 | 0.15 | 0.5 | 0.07 | 1.45 |

In Appendix Tables A2–A3, we provide ceiling borrowing ratio estimates for different combinations of interest rate, period of lending, income growth, and β . For example, in Table A2, when r is assumed to be 15%, income growth 7%, and β 0.5, a loan with a repayment period of 3 years should have a loan-to-income ratio or borrowing ratio of less than 0.95. This implies that if the loan value is less than 0.95 times the income of the household/enterprise, it is highly likely that the household/enterprise will be able to repay the same without defaulting. Similarly, if, with the same conditions, the period of lending is 15 years, the borrowing ratio should be less than 1.46. In Table A3, we alter the interest rate to 10%, and the borrowing ratio for the 15-year period is estimated at 1.64.

In terms of policy recommendation, this paper serves a dual purpose. Firstly, it may be useful for households and small enterprises to know their borrowing limit beyond which they can run into the risk of debt overhang. Secondly, it may be helpful for banking and nonbanking lending institutions to fix lending limits within the range as estimated from the stability conditions in this paper, wherein we use the household utility function to analyze the stability conditions from the household side. Understanding the stability conditions from the lender's side is a topic for future research.

5. CONCLUSION

In this paper, we derive stability conditions for households and small enterprises so that they can borrow from the market without running into debt overhang. We use data from India to derive the empirical estimates. We develop a model that can be easily replicated for other economies for estimating lending conditions to avoid the risk of debt overhang. Our theoretical framework suggests that simply fixing a maximum rate of interest and hence “one size fits all” is not the approach for handling household debt overhang. The stability condition for borrowing such that borrowers do not go into debt overhang is a function of five parameters, namely the (1) rate of interest, (2) income growth, (3) coefficient of disutility from borrowing, (4) loan-to-income ratio, and (5) period of borrowing. Further, using data from India we simulate the ceiling loan-to-income ratios for varying values of the other parameters.

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APPENDIX

Table 1A: Estimation of Marginal Propensity to Consume

| Variable | Model 1 | Model 2 |
|----------------------------------------------|----------------------|----------------------|
| Y | 0.308*** (0.0369) | 0.438*** (0.0357) |
| C ₁ (one-year lagged consumption) | 0.619*** (0.0548) | |
| C ₂ (two-year lagged) | | 0.458*** (0.0573) |
| Constant | 526.9*** (108.8) | 753.6*** (127.6) |
| Observations | 49 | 49 |
| R-squared | 0.99 | 0.99 |

Standard errors in parentheses, *** p < 0.01, ** p < 0.05, * p < 0.1.

Dependent variable is final consumption, Y = income, C₁ is one-year lagged consumption, C₂ is two-year lagged consumption.

Note: Calculation of MPC from the above table (Model 1).

$$C_t = 526.9 + 0.308 Y_t + 0.619 C_{t-1} + \epsilon_t \quad (1a)$$

In the long run if we assume $C_t = C_{t-1} = C$, then equation 1a can be rewritten as:

$$C = 526.9 + 0.308 Y_t + 0.619 C + \epsilon_t$$

$$C = 1382.94 + 0.808 Y_t + \epsilon_t \quad (1b)$$

Table A2: Ceiling Borrowing Ratio for $r = 15\%$, $a = 7\%$, $\beta = 0.5$

| Year | r | a | β | Borrowing Ratio |
|------|-----|----|---------|-----------------|
| 1 | 15% | 7% | 0.5 | 0.93 |
| 3 | 15% | 7% | 0.5 | 0.95 |
| 5 | 15% | 7% | 0.5 | 0.98 |
| 7 | 15% | 7% | 0.5 | 1.03 |
| 9 | 15% | 7% | 0.5 | 1.10 |
| 11 | 15% | 7% | 0.5 | 1.20 |
| 13 | 15% | 7% | 0.5 | 1.31 |
| 15 | 15% | 7% | 0.5 | 1.46 |

Table A3: Ceiling Borrowing Ratio for $r = 10\%$, $a = 7\%$, $\beta = 0.5$

| Year | r | a | β | Borrowing Ratio |
|------|-----|----|---------|-----------------|
| 1 | 10% | 7% | 0.5 | 0.97 |
| 3 | 10% | 7% | 0.5 | 1.02 |
| 5 | 10% | 7% | 0.5 | 1.09 |
| 7 | 10% | 7% | 0.5 | 1.16 |
| 9 | 10% | 7% | 0.5 | 1.25 |
| 11 | 10% | 7% | 0.5 | 1.36 |
| 13 | 10% | 7% | 0.5 | 1.49 |
| 15 | 10% | 7% | 0.5 | 1.64 |