From Debtors to Creditors

Analyzing Household Debt and Consumption Loss
Caused by Unexpected Lowflation in Sweden

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Abstract

We analyze how redistributions caused by deviations between expected and actual inflation affect household debt and consumption. In order to estimate such redistributions, we use data concerning Sweden between 2006 and 2013. Even if our estimated redistributions are approximate, we come to the conclusion that deviations between expected and actual inflation have lead to redistributions from debtors to creditors corresponding to SEK 206.7 billion during 2006-2013. If we assume that the marginal propensity to consume is homogenous for different goods and services, we may conclude that the impact on household consumption has been more than 1 percent of aggregate consumption in 2012 and 2013. These results are substantial as the standard deviation of total consumption has been 1.4 percent between 2006 and 2013.\footnote{We would like to thank Erik Öberg and Lars Svensson, who gave us recommendations in the early stage of writing this thesis. We especially want to thank our tutor Roine Vestman for his valuable comments and advice, which unarguably have improved the final result of our thesis.}

Keywords: Inflation, Inflation expectations, MPC.
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1 Introduction

Sweden’s central bank, Riksbanken, shall according to the Sveriges Riksbank Act maintain price stability by attaining an inflation target of two percent of annual change in the consumer price index (CPI). During the last years the inflation rate has been lower than the inflation target and this has become an object of great debate in Sweden. For example, the former deputy governor Lars Svensson has loudly criticized the Riksbank’s monetary policy for being too contractionary, while the Chairman of the Riksbank Executive Board, Stefan Ingves, has justified the monetary policy by referring to the sharp increase in household debt.

In this thesis, we examine how household debt and consumption is affected by a lower inflation than expected (unexpected lowflation). First, we construct a theoretical model for analyzing such effects. Second, we use data on Swedish inflation and survey-based inflation expectations in order to observe how they have deviated from each other. If expected inflation turns out to be higher than actual inflation, indebted households will experience real costs ex post. On the contrary, lending households will experience real gains ex post. Such redistributions of wealth from debtors to creditors could potentially affect GDP through heterogeneity in marginal propensities to consume (MPC) between these two actors. Therefore, we also construct a method for analyzing such effects. For the sake of simplicity, we only analyze mortgage loans.

Even if our results are approximate, we conclude that unexpected lowflation leads to substantial redistributions from debtors to creditors. If we can assume perfect homogeneity in the MPC for different types of goods and services, we also find that such redistributions have had a great impact on total household consumption. In 2012 and 2013, when the redistributions have been the largest, the consumption loss could have exceeded one percent of total household consumption. We are not aware of any studies that have examined the degree of heterogeneity in the MPC on different goods and services, and we therefore include estimations based on an assumption of perfect homogeneity in our results. The results based on this assumption should be regarded as
upper bounds for the potential value of consumption losses.

Some specific studies and conclusions are taken as a point of departure when constructing our model. In Booms and Busts (1932) Irving Fisher states his theory of debt deflation which has been a benchmark for several studies on economic fluctuations (for instance, Mervyn King (1994)). A recent study made by Atif Mian, Kamalesh Rao and Amir Sufi (2013) found evidence for higher MPC for low income and levered households. We have not found similar studies regarding Sweden, and will therefore use the findings from Mian, Rao and Sufi (2013) when estimating the consumption loss caused by unexpected lowflation in Sweden.

We structure the rest of the thesis as follows. In the second Section we present an overview of previous research. Thereafter, we state our theoretical approach and model. In the fourth Section, we specify variables and data and discuss how to calibrate our model for analyzing the Swedish case. Finally, we present, discuss and summarize our results.

2 Previous Research

To our knowledge, there is no study that so far has specifically dealt with household consumption loss resulting from unexpected lowflation. However, economists have studied the effects on consumption from different types of distributional shocks. For example, Mervyn King (1994) considered a general model of how distributional shocks affected debtors and creditors. He suggested that the MPC out of wealth was higher for debtors than for creditors. James Tobin (1980) discovered evidence for such heterogeneity. Heterogeneity in the MPC between different households has also been the subject for more recent studies. Mian, Rao and Sufi (2013) investigated the MPC out of housing wealth across 2006 Adjusted Gross Income, and found evidence for substantial heterogeneity in the MPC across the income and housing leverage distribution.

Svensson (2014) estimates the possible unemployment cost of undershooting the inflation target in Sweden. His research shows that during 1997-2011, av-
verage inflation expectations have been close to the target of 2 percent, while the average actual inflation has been about 1.4 percent. Svensson argues that the average unemployment rate would have been about 0.8 percentage points lower if average inflation had been on target, and that much lower inflation than expected also substantially increased households’ debt burden. This aggressive critique of too low inflation has not gone by unnoticed. For example, Laseen and Strid (2013) and Andersson and Jonung (2014) have all criticized Svensson for making unrealistic assumptions.

3 Theoretical Framework and Model

Our model needs two legs to walk. One is an implementable estimation of redistributions from debtors to creditors caused by unexpected lowflation, and the other is a reasonable measure of the change in household consumption that has resulted from such redistributions. We will start by formulating a model\(^2\) for estimating the value of total redistributions. Thereafter, we will discuss the effect on household consumption.

3.1 A Model for Estimating Redistributions

We imagine a closed economy consisting of debtors and creditors where banks are frictionless intermediaries, so that liquidity is transferred between different households at no transaction costs. The redistributions resulting from unexpected lowflation can then be looked upon as a zero-sum game between debtors and creditors. Such redistributions run out from both deviations between the actual and the expected real interest rate and deviations between the actual and expected real amortization on loans.

On the one hand we have creditors with a large portion of financial wealth, and on the other, we have debtors in need of liquidity. Debtors borrow money from creditors and compensates creditors by paying either a predetermined fixed interest rate or a variable interest rate on the borrowed amount. The real value of interest rate payments transferred from debtor to creditor is, however, not only

\(^2\)The model is mathematically described in more detail in Appendix.
dependent on the nominal interest rate, but also on the realized inflation rate. The real interest rate is the difference between the nominal interest rate and inflation, and is thus an adjusted measure reflecting the real cost for debtors and the real yield for creditors. We will from now on make the assumption that all debtors and creditors have expectations about future inflation rates, and that they therefore are exposed to inflation rate risk. If the actual inflation rate is lower than expected inflation, debtors are worse off as they then pay a higher real interest rate than expected. Correspondingly, creditors are better off; and of course, the opposite relation holds if actual inflation turns out to be higher than expected inflation. Such redistributions are thus caused by deviated real interest rate costs. The deviated real interest costs for year $t$ can then be estimated by (1):

$$
\text{DRIRC}_t = \sum_{k=0}^{n} \sum_{i=k}^{n} \left( \pi_{t}^{e,t-k} - \pi_t \right) L_{i}^{t-k}
$$

where $\pi_{t}^{e,t-k}$ is the expected inflation rate for year $t$, formed in the beginning of year $t - k$. $L_{i}^{t-k}$ is loans with fixed interest periods of $i$ years, with inflation expectations originated in the beginning of year $t - k$. The deviated real interest rate costs for a given year $t$ are thus highly dependent on when expectations were formed. Please note that we assume that debtors at most can choose to have fixed interest rate payments for $n + 1$ years. The model also assumes that debtors choose to form expectations for equally many years as the length of the fixed interest rate period.

Inflation does not only affect the real interest rates, but also erodes the real value of money over time. As a direct consequence of this, positive inflation decreases the real value of a (fixed) nominal loan. This makes creditors worse off and debtors better off. However, if the actual inflation rate turns out to be lower than expected, such real amortizations on loans are not as large as expected. This leads to real redistributions from debtors to creditors.

$$
\text{DRAL}_t = \sum_{k=0}^{n} \sum_{i=k}^{n} \left( \frac{1}{1 + \pi_t} - \frac{1}{1 + \pi_{t}^{e,t-k}} \right) L_{i}^{t-k}
$$

6
We will from now on mention redistributions through the channel of real interest rate payments as deviated real interest rate costs \((DRIRC)\) and redistributions through the amortization channel as deviated real amortization on loans \((DRAL)\). Please note that positive values for \(DRIRC\) and \(DRAL\) indicate transfers from debtors to creditors, i.e. real loss for debtors and real gain for creditors. These effects should be regarded as shocks for both debtors and creditors.

It is most important to discuss for what time horizon households form their inflation expectations. Our model above assumes that debtors originate expectations for an equally long time as the fixed interest rate period. It is not clear why such an assumption should hold in reality. Debtors engaging in different types of contracts, e.g. a period of variable interest rate payments or a fixed interest rate period of five years, probably also form inflation expectations for different periods of time. However, these periods do not necessarily have to be equal to the length of the fixed interest rate periods. Even if our theoretical model suggests that debtors originate expectations for an equally long time as the fixed interest rate period, we will later assume that the time debtors choose to look forward is correlated with the length of the fixed interest rate period, but not exactly equal. This will be further explained in Section 4.3.

3.2 Aggregate Marginal Propensity to Consume

We have now presented a simple model for estimating the value of redistributions. Given that there is heterogeneity in the MPC between debtors and creditors, the redistributions will affect debtors and creditors differently in terms of changes in consumption. As we are interested in analyzing aggregate household change in consumption, it is crucial to understand these effects. Change in aggregate household consumption is given by the total value of redistributions \((R = DRIRC + DRAL)\) multiplied by the aggregate marginal propensity to consume out of such redistributions. The aggregate MPC is in turn given by the difference between the MPC out of redistributions for debtors and creditors.
\[ \Delta C = MPC_{agg} \cdot R \] (3)

\[ MPC_{agg} = MPC_C - MPC_D \] (4)

From equation (4) we can see that we need information about how debtors and creditors change their consumption due to such redistributions. We will start by discussing how the redistributions affect debtors and thereafter (in the next Section) focus on creditors.

Since there are no measures of \( MPC_D \) out of real loss caused by unexpected lowflation, we need to find a relationship between these redistribution effects and the balance sheet. To make it intuitively clear we create a simple balance sheet for households. This balance sheet contains six components which can be described as follows. Housing Wealth is equal to the current asset value of the house or property. The housing wealth and the housing price move one-to-one. Other Wealth is financial wealth and other real wealth. Mortgage is the debt on housing the debtor possess. Home Equity is the difference between Housing Wealth and Mortgage. Finally, Other Liabilities consists of other loans and Other Equity is equity that is not part of home equity. Note that the relation between housing wealth, mortgage and home equity can be pinned down by using the loan-to-value ratio. The mortgage loan is equal to housing wealth multiplied by the loan-to-value \((1 - \delta)\), and home equity is equal to housing wealth multiplied by the down payment \(\delta\).

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities &amp; Equity</th>
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<tbody>
<tr>
<td>Housing Wealth</td>
<td>Mortgage</td>
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<tr>
<td></td>
<td>Home Equity</td>
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<tr>
<td>Other Wealth</td>
<td>Other Liabilities</td>
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<td></td>
<td>Other Equity</td>
</tr>
</tbody>
</table>
Mortgage = (1 − δ) · Housing Wealth

Home Equity = δ · Housing Wealth

As we are dealing with real fluctuations, the components in the balance sheet presented above are given as real values.

$DRLA$ is defined as increased real value of the mortgage loan resulting from overestimated expected inflation. Assuming that the house is never sold, an increase in $DRLA$ is an unrealized loss. If we assume a steady level of the real housing wealth and no selling of the house then the real home equity will decrease as the real mortgage loan increases. In conclusion, $DRLA$ is a real increase in the mortgage loan, which is similar to an unrealized loss after a decline in the real home equity.\(^3\)

$DRIRC$ goes through the channel of real interest rate payments. Fluctuations in real interest rate costs should theoretically be handled in the same way as nominal interest rate costs, i.e. as realized costs for households. Changes in real transfers affect the real income statement which eventually lead to a drop in the real value of other equity. The real value of the mortgage does not increase as an effect from increased real interest rate costs, but we will for the sake of simplicity assume that a drop in real other equity affects debtors’ consumption patterns similarly as a decrease in real home equity caused by a higher real mortgage loan.

The discussion above leads to the conclusion that we could think of debtors’ change in consumption as the MPC out of mortgage. What really matters for households is the value of the difference between total assets and total liabilities, i.e. the sum of home equity and other equity. As we are interested in

\(^3\)This approach is consistent with the one presented in Mian, Rao and Sufi (2013, page 24), where they discuss how a nominal negative housing net worth shock (i.e. a drop in nominal home equity) is equivalent to a drop in the nominal home value. Please note that we, in contrast to Mian, Rao and Sufi, are dealing with real fluctuations in the mortgage loan.
analyzing how debtors change their consumption due to DRIRC and DRAL, we isolate the effect from an increase in the real mortgage loan by assuming a fixed real value of housing wealth. Making this assumption, an increase in real mortgage is equivalent to a decrease in home equity.

3.3 Summing MPC in the Cross-section

We compute the MPC out of mortgage for debtors by using estimates of MPC out of housing wealth on autos presented by Mian, Rao and Sufi (2013). The \( MPC_D \) is computed by summing the marginal propensities to consume for households belonging to different income deciles, weighted by their share of total household mortgage debt:

\[
MPC_D = MPC^M_D = \Lambda_j \sum_{i=1}^{10} (1 - \delta_{Di})MPC^{HW}_{Di} w_i \quad j = \{1, 2\} \quad (5)
\]

where \( (1 - \delta_{Di})MPC^{HW}_{Di} \) is the MPC out of mortgage (on autos) for households belonging to the \( i \):th income decile. \( w_i \) is the share of total household mortgage debt belonging to households in the \( i \):th income decile. It should be mentioned that we assume that households with any loan-to-value above zero will be defined as debtors. Correspondingly, creditors are assumed to have no mortgage loans.

The multiplier \( \Lambda \) is a factor that corrects our value for \( MPC_D \) so that it holds as an estimation for the MPC for all goods and services. Choosing a feasible value of this multiplier will be highly dependent on whether we believe that households’ marginal propensities to consume are homogenous or heterogenous for different goods and services. If we assume that there is perfect homogeneity in the MPC for different types of goods and services, we simply divide our estimated \( MPC_D \) by household consumption on autos as the expenditure share of total household consumption, i.e. choose \( \Lambda_1 = \frac{C_{\text{tot}}}{C_{\text{autos}}} \). If we assume that the MPC for different goods and services is heterogenous, we choose a multiplier \( \Lambda_2 = \frac{MPC_{\text{tot}}}{MPC_{\text{autos}}} \), so that we divide our estimated \( MPC_D \) by MPC on autos as share of MPC on all goods and services (total MPC).

In the beginning of Section 3.1 we assumed that financial intermediaries were
frictionless. Having this assumption and the balance sheet for households in mind, we can discuss how the balance sheet for creditors is affected by redistributions. We define creditors as individuals with some kind of excess of financial wealth which they are willing to lend to banks or other financial intermediaries. The financial intermediaries thereafter lend the money further to debtors. With this kind of reasoning, we come to the conclusion that redistributions through the amortization channel (DRAL) probably affect creditors’ real financial wealth, while redistributions through the real interest rate channel (DRIRC) probably affect their real other equity. However, we assume that redistributions from both DRIRC and DRAL go through real financial wealth. For simplicity, we also assume that the MPC out of shocks in creditors’ financial wealth is the same as the MPC out of housing wealth for the group with the highest income in Mian, Rao and Sufi (2013). As this is MPC on autos, we will equivalently to the derivation for \( MPC_D \) multiply \( MPC_C \) with \( \Lambda \). When comparing studies that have estimated wealth effects on consumption, Sierminska and Takhtamanova (2007) suggest that there is no consensus about whether the MPC out of housing wealth is larger than the MPC out of financial wealth (or vice versa). However, in their own study, they find that the wealth effect from housing wealth is larger than the effect from financial wealth. Such a result indicates that our assumption of an equally large MPC out of financial wealth as out of housing wealth leads to a relatively large measure of \( MPC_C \), leading to a conservative measure of \( MPC_{agg} \).

In addition to the assumptions mentioned above, we also assume that the difference between \( MPC_D^M \) and \( MPC_C^{H}\) should be the same in Sweden as in the US.

### 4 Specifications of Variables and Data

#### 4.1 Redistributions

Our variables of interest for estimating redistributions from debtors to creditors are the actual inflation rate (\( \pi \)), nominal loans (\( L \)) and the expected inflation rate (\( \pi^e \)). First, we present the data we have used for estimating
redistributions and discuss some advantages and disadvantages with the data. Second, we review the results from Mian, Rao and Sufi (2013) for which we have used to estimate $MPC_{agg}$.

Data for the actual inflation rate is taken from Statistics Sweden (October 2014). We use the yearly change in the Consumer Price Index for Sweden between January 2006 and January 2014. The reason for us using this measure is that it is the most frequently used measure for price changes, and more importantly it is the referred measure when asking households and money market players about their inflation expectations.

As mentioned in the introduction we narrow our catch-all-defined variable $L$ in equation (1) and (2) by only looking at Swedish household mortgage loans during the period of interest. We believe that mortgages are the most important loans to analyze as they constitute about 72 percent of total household debt, which in turn represented a value of more than 60 percent of Sweden’s GDP (Riksbanken, April 2014). We get the data from the Financial Market Statistics (September 2014), which contains observations for MFIs’ mortgage lending to Swedish households broken down by fixed interest rate periods. The sub-groups of the dataset are mortgages with interest rate periods of 0-1 years, 1-5 years and more than five years. Data in these sub-groups has been observed since December 2003. The reason for why we study such a relatively short period of time (2006-2013) is that we want to include five-year expectations for all our estimates, and at the same time minimize the use of estimations for the stock of mortgage loans. The data for the distribution of mortgage loans enables us to look at a period starting from 2008 (since five-year expectations for that year was originated at the beginning of 2004). By multiplying the shares of each sub-group in 2004 by the total value of mortgage loans in 2002 and 2003, we get estimated distributions for 2002 and 2003. This enables us to estimate the redistributions in 2006 and 2007.

There are three ways to measure expected inflation rates: surveys, forecasts or by looking at prices for financial instruments. All of these three have their

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advantages and disadvantages, and we will therefore go through all of them respectively.

We look at three surveys relevant for our study. Two of these, The Household Tendency Survey and The Business Tendency Survey, are conducted by the National Institute of Economic Research (NIER) and ask both households and firms about their inflation expectations. Households and firms are asked how much they expect CPI to change in the upcoming 12 months. While households are asked every month, the data for firms consists of quarterly observations that are published in April (Q1), July (Q2), October (Q3) and January (Q4). The Household Tendency Survey consist of 1,500 individuals between 16 and 84 years old, while The Business Tendency Survey consist of 4,500 firms wherein all Swedish firms with more than 100 employees and a random sample of firms with less than 100 employees are included. The response rate for The Business Tendency Survey is about 60 percent, while The Household Tendency Survey proceeds until 1,500 individuals have responded (NIER).

The third survey is conducted by TNS Sifo Prospera and commissioned by the Riksbank. We have included observations from this survey for money market players’ expected inflation rates for 12 months, two years and five years ahead. The response rate of this survey is about 90 percent, and the asked individuals includes 47 Swedish and 6 international money market players active in the Swedish fixed income market. The survey is conducted every month since 2010. Before 2010, it was conducted four times a year, aside from 2001 and 2009 when it was conducted three and five times respectively. In our results, we have included observations published in the first report for each year (we will discuss how this affects our results in Section 5).

Flodén (2012) shows that respondents to NIER’s business tendency survey have been the best predictors of future inflation during 1997-2012. We will, despite of this, use the Prospera survey for money market players, as we believe that their expectations give a better estimation of the expected inflation rate that is taken into consideration when setting the inflation premium for mortgages. It is important to note that Prospera could very closely capture
the correct inflation expectations for money market players, even though their predictions tend to be worse than those of other agents.\(^5\)

Several banks and other Swedish financial institutions and authorities publish forecasts of the inflation rate in Sweden. However, we have not had any access to consensus reports and estimates. All of these organizations publish their forecasts in separate reports and it is therefore time-consuming to go through all of them separately. We have manually collected forecasts on the annual inflation rate made by the Riksbank between 2000 and 2014. When doing so, we have looked at the Monetary Policy Reports and Updates.

Estimating financial market inflation expectations is also possible by comparing yields for nominal and real bonds. Given that nominal and real bonds are identical in all other aspects, the difference between nominal and real yields should lead to a precise measure of the expected inflation rate. However, the assumption of no other risk premia seems not as a very probable one. For example, when using historical data from Datastream, Swedish real bonds seem to expose investors to liquidity risk due to the low frequency of trades. It should also be added that it is hard to find Swedish real and nominal bonds with the same maturity dates for our period of interest.

In conclusion, there is no perfect measure for inflation expectations. We will discuss the results obtained when using inflation expectations from the Prospera survey as we find it to be the least problematic measure. It should therefore be mentioned that we assume that households get their inflation expectations from money market players, e.g. professionals at the banks from which debtors borrow their money. We think that this is the best measure partly because this includes households that have contact with financial intermediaries (e.g. households with mortgages), and partly because the inflation premium probably is set by money market players. It is also a more conservative measure of expectations than we would get from the NIER’s household

\(^5\)Jonsson and Österholm (2012) believe that inefficient expectations indicate that the expectations formation process might be suboptimal. However, they cannot conclude whether the expectation process is suboptimal or the expectations mismeasured.
Table 2: Quarterly observations for inflation and inflation expectations given as annual rates between February 2000 and October 2014. \( e \) stands for expectations, while \( f \) stands for forecast. \( B, NIER \) are expected rates from the business tendency survey and \( H, NIER \) are expected rates from the household tendency survey.

### 4.2 Aggregate Change in Consumption

The MPC in Mian, Rao and Sufi (2013) are presented for five sub-groups with respect to bounds of income in dollars per household in 2006. When estimating \( MPC_D \) (see equation (5) on page 10), we multiply the levels of income by seven to get an approximate value of what this corresponds to in SEK. Thereafter, we match the distribution for MPC in SEK with the distribution of income deciles in Sweden for 2006 and see that the first subgroup corresponds to the first, second, third, fourth and fifth income decile in Sweden. The second subgroup corresponds to the sixth and seventh decile and the third corresponds to the eighth, ninth and tenth decile. The fourth and fifth subgroup, with MPC of 0.01 and 0.008 respectively, consists of households with high incomes (more than SEK 1,400,000 per year) and are therefore not included in our estimation of \( MPC_D \) since they probably represents a very small part of the tenth decile (in 2006, the tenth decile had a lower bound of SEK 496,180).

We have then made our own three subgroups. We do not have access to data of the share of total mortgage debt per income decile in Sweden, but we get the share of total household debt across 2013 income distribution from Riksbanken (2014). We will assume that these shares are similar to the shares.
of total mortgage debt. The households in our first subgroup then contribute to 39 percent of total household debt. The second subgroup represents a share of about 19 percent of total debt. The last subgroup represents about 42 percent of total household debt. The MPC out of housing wealth for these groups are 0.024, 0.023 and 0.016 respectively. Finally, we use the mean of the loan-to-value ratios for 2011, 2012 and 2013 (Finansinspektionen) for each subgroup.

Doing as described above, we estimate that $\hat{MPC}_D = \Lambda \cdot 0.0135$. This estimator relies on many assumptions, and the most questionable one is probably that Swedish debtors have the same MPC as U.S. debtors. We do not have to pay very much attention to this assumption, since we later on will look at the difference between MPC for debtors and creditors. The very assumption to evaluate is then whether it is likely that the difference between $MPC_D$ and $MPC_C$ is the same in Sweden as in the U.S.

As mentioned in Section 3.3 we do not have the data to estimate $MPC_{FW}^C$, so we will use the MPC out of housing wealth for U.S. households belonging to the group with highest incomes in Mian, Rao and Sufi (2013). This is MPC on autos and is equal to 0.008, so we will also multiply this value by our multiplier $\Lambda$.

If we make the assumption that MPC out of financial wealth is equal to MPC out of real wealth, and also assume that the creditors’ MPC out of real wealth is equal to the MPC out of housing wealth for the U.S. households with highest disposable income, we get that $MPC_{agg}$ is:

$$MPC_{agg} = \Lambda (0.008 - 0.0135) = -\Lambda \cdot 0.0055$$

As discussed before, the size of the multiplier $\Lambda$ is dependent on whether we assume perfect homogeneity in MPC on different goods and services or not. In the case of perfect homogeneity, when $\Lambda = \frac{C_{tot}}{C_{autos}}$, the multiplier varies from year to year. We get data for household consumption from Statistics Sweden (COICOP\textsuperscript{6}) and can see that the consumption on autos as share of total

\textsuperscript{6}The Classification of individual consumption by purpose.
consumption varies between three and four percent, which is equivalent to a multiplier with values between 27 and 43. As mentioned in Section 3.3, we also consider a more conservative approach where we assume heterogeneity in the MPC on different goods and services. In order to do so, we use the estimate for total MPC from Mian, Rao and Sufi (2013) corresponding to 0.054, but it should be mentioned that they also have found estimates of 0.072 and 0.094. By this method, we get a far smaller estimation of our multiplier: $\lambda = 2.35$. One could think of these different estimates as a lower and upper bound for an interval indicating what the actual value of the multiplier could be in reality. As we see, our results will depend on whether we assume perfect homogeneity between goods and services or not.

4.3 Calibration to Swedish Data

It should be stated that we would need a complete nominal and real yield curve for every year to find the exact inflation expectations. As we discussed in Section 4.1, this is however not possible and we therefore need to use the inflation expectations observed in the Prospera survey. In order to do so, we must also make some additional assumptions to calibrate our model so that it fits our data.

We have monthly data for the total stock of mortgages with different interest rate periods. For example, the observation for January in 2009 is the sum of all loans with fixed (or variable) interest rate periods of 0-1 year that existed in January 2009. Thus, we will not know when inflation expectations for each loan in the stock was originated. Neither will we have information about for which period inflation expectations were formed. For example, some debtors with loans with variable interest rates taking part in January 2009 could have formed their expectations several years before. If we now assume that all of the loans taking part in January 2009 were taken in the same period, and that all debtors formed expectations for one year ahead, then we can use the observation in January 2009 as an approximation of $L$ in 2009. Correspondingly, we assume that debtors with loans with fixed interest rate periods of 1-5 years form expectations for two years ahead, and that debtors with loans with fixed interest rate periods of more than five years form expectations for five years.
ahead.

These assumptions are made for the sake of simplicity. We have chosen time horizons of one year, two years and five years only because we have data on inflation expectations for these intervals, and because we assume that debtors engaging in contracts of longer fixed interest rate periods also form inflation expectations for longer periods of time.

Using these assumptions, we estimate $DRIRC$ and $DRAL$ for the case when we only have data for loans with interest rate periods of zero to one year ($L_{0-1}$), one to five years ($L_{1-5}$) and more than five years ($L_{>5}$). For simplicity, we only include $L_{>5}$ (i.e. loans with fixed interest periods of more than five years, for which inflation expectations were originated five years ago). For example, $L_{>3}^{-3}$, $L_{>5}^{-2}$ and $L_{>5}^{-1}$ also lead to redistributions in year $t$, but we do not take these into account. Fitted to our data, we then have:

$$DRIRC_t = (\pi_t^e - \pi_t)(L_{0-1}^t + L_{1-5}^t + L_{>5}^t) +$$

$$(\pi_t^{e,t-1} - \pi_t)L_{1-5}^{t-1} + (\tilde{\pi}_t^{e,t-4} - \pi_t)L_{>5}^{t-4}$$

$$DRAL_t = \left(\frac{1}{1 + \pi_t} - \frac{1}{1 + \pi_t^e}\right)(L_{0-1}^t + L_{1-5}^t + L_{>5}^t) +$$

$$\left(\frac{1}{1 + \pi_t} - \frac{1}{1 + \pi_t^{e,t-1}}\right)L_{1-5}^{t-1} + \left(\frac{1}{1 + \pi_t} - \frac{1}{1 + \pi_t^{e,t-4}}\right)L_{>5}^{t-4}$$

The inflation expectations from TNS Sifo Prospera are given as annual inflation for one year $\pi_t^e$, two years $\pi_t^{e,t-1}$ and five years $\pi_t^{e,t-4}$, and we have computed $\pi_t^{e,t-1}$ and $\tilde{\pi}_t^{e,t-4}$ from this data.\footnote{For more detail, see Appendix.}
5 Results

Table 3 summarizes the stock of mortgage loans, redistributions and change in consumption between 2006 and 2013. Table 4 covers information about the deviations that affect the value of redistributions for the same period. Redistributions in Table 3 and deviations in Table 4 are both decomposed so that both the real interest rate channel and the amortization channel can be analyzed respectively.

<table>
<thead>
<tr>
<th>Year</th>
<th>Loans</th>
<th>Redistributions</th>
<th>Consumption</th>
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<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2) (3)</td>
<td>(4) (5) (6) (7) (8) (9) (10) (11)</td>
</tr>
<tr>
<td>2006</td>
<td>609</td>
<td>538 64</td>
<td>-2.9 -2.8 -5.7 -0.18 % 0.8 0.06 % 0.1 0.01 %</td>
</tr>
<tr>
<td>2007</td>
<td>714</td>
<td>582 76</td>
<td>-25.1 -23.9 -49.1 -1.49 % 7.2 0.51 % 0.6 0.05 %</td>
</tr>
<tr>
<td>2008</td>
<td>770</td>
<td>676 100</td>
<td>27.3 26.3 53.6 1.58 % -10.8 -0.74 % -0.7 -0.05 %</td>
</tr>
<tr>
<td>2009</td>
<td>939</td>
<td>648 107</td>
<td>15.6 15.3 30.9 0.94 % -7.3 -0.48 % -0.4 -0.03 %</td>
</tr>
<tr>
<td>2010</td>
<td>1 247</td>
<td>526 93</td>
<td>-19.1 -18.4 -37.5 -1.07 % 6.8 0.43 % 0.5 0.03 %</td>
</tr>
<tr>
<td>2011</td>
<td>1 343</td>
<td>590 90</td>
<td>10.8 10.3 21.2 0.58 % -3.6 -0.22 % -0.3 -0.02 %</td>
</tr>
<tr>
<td>2012</td>
<td>1 255</td>
<td>792 85</td>
<td>47.7 46.9 94.6 2.57 % -17.7 -1.07 % -1.2 -0.07 %</td>
</tr>
<tr>
<td>2013</td>
<td>1 183</td>
<td>965 81</td>
<td>49.7 49.0 98.7 2.51 % -18.5 -1.08 % -1.3 -0.08 %</td>
</tr>
</tbody>
</table>

Table 3: Total mortgage loans, total redistributions and change in consumption caused by unexpected lowflation. SEK Bn if not other stated. (1)-(3) are total stock of mortgage loans with interest rate period of 0-1 year, 1-5 years and >5 years. (4) is the total deviated real interest rate cost, (5) is the total deviated real amortization loss, (6) is the sum of (4) and (5), while (7) shows total redistributions as share of GDP. (8) is the change in consumption caused by unexpected lowflation assuming homogenous MPC for all goods and services, and (9) is (8) as share of total household consumption under that assumption. (10) is the change in consumption caused by unexpected lowflation assuming heterogenous MPC for different goods and services, and (11) is (10) as share of total household consumption under that assumption.

In general, there have been some fluctuations in the size of redistributions during the whole period, but also between year to year. However, one should be cautious when comparing redistributions from year to year because of the risk of mismatch due to low frequency of observations. We have chosen to use data on CPI and inflation expectations observed in the beginning of each year (between January and March). This could imply both seasonality effects and random error which may not represent the true CPI and inflation expectations for a whole year.

We see that redistributions have been transferred from debtors to creditors for five out of eight years, which have resulted in a net real loss of approxi-
mately SEK 206.7 billion for debtors during 2006-2013. It is obvious that the largest real losses have occurred in 2012 and 2013, where total redistributions have been above 2.5 percent of GDP. This is an effect from a relatively large deviation between the expected and actual inflation rate (Table 4) and a larger stock of total mortgage loans (column 1 to 3 in Table 3). It seems as if the biggest effect comes from the deviation between expected and actual inflation, which has been relatively large due to a low actual inflation rate.

<table>
<thead>
<tr>
<th>Year</th>
<th>Inflation</th>
<th>1 Year Expectations</th>
<th>2 Years Expectations</th>
<th>5 Years Expectations</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>0.020</td>
<td>-0.004 -0.004</td>
<td>0.004 0.004</td>
<td>0 0.001</td>
</tr>
<tr>
<td>2007</td>
<td>0.032</td>
<td>-0.014 -0.013</td>
<td>-0.010 -0.009</td>
<td>-0.011 -0.011</td>
</tr>
<tr>
<td>2008</td>
<td>0.013</td>
<td>0.014 0.013</td>
<td>0.009 0.009</td>
<td>0.008 0.010</td>
</tr>
<tr>
<td>2009</td>
<td>0.003</td>
<td>0.003 0.003</td>
<td>0.014 0.014</td>
<td>0.018 0.020</td>
</tr>
<tr>
<td>2010</td>
<td>0.025</td>
<td>0.009 0.009</td>
<td>-0.003 0.003</td>
<td>-0.006 0.003</td>
</tr>
<tr>
<td>2011</td>
<td>0.019</td>
<td>0.002 0.002</td>
<td>0.013 0.012</td>
<td>-0.001 0.003</td>
</tr>
<tr>
<td>2012</td>
<td>0</td>
<td>0.015 0.015</td>
<td>0.023 0.022</td>
<td>0.022 0.017</td>
</tr>
<tr>
<td>2013</td>
<td>-0.002</td>
<td>0.012 0.012</td>
<td>0.025 0.024</td>
<td>0.029 0.024</td>
</tr>
</tbody>
</table>

Table 4: The inflation rate and the deviations in inflation expectations against the actual inflation rate. Expressed in decimals. (1) is the annual inflation rate. (2) is the deviation described in equation (1) and (3) is the deviation described in equation (2). (4) is the deviation described in equation (1) for two-year inflation expectations, and (5) is the deviation described in equation (2) for two-year inflation expectations. (6) is the deviation described in equation (1) for five-year inflation expectations, and (7) is the deviation described in equation (2) for five-year inflation expectations.

If we exclude the redistributions in 2012 and 2013, we see that redistributions have been transferred from debtors to creditors for three out of six years. The net loss for debtors during 2006-2011 is only SEK 13.4 billion. It is thus probable that 2012 and 2013 are extreme values that have resulted from large deviations between the expected and actual inflation rate. Having this in mind, it would definitely be interesting to see the values of redistributions for earlier years as well as for 2014.

2011 is an interesting year. We can see that the stock of mortgage loans with short fixed interest rate periods has been the largest in relation to the other years. The aggregate stock of mortgage loans is also bigger than previous years (column 1 to 3 in Table 3). However, the size of redistributions is the smallest of all redistributions with positive values, and the second smallest of all abso-
lute values (column 5 to 7 in Table 3). The small value of total redistributions could be explained by the fact that a large share of total redistributions comes from loans with short-term expectations about future inflation. The deviation for short-term expectations (column 2 and 3 in Table 4) has in 2011 been the smallest compared to all other years. However, the deviation for expectations over two years has been the second largest compared to previous years. The small value of redistributions in 2011 can thus be explained by the large share of loans belonging to debtors with short-term expectations, who seems to have had fairly accurate inflation expectations.

![Redistributions Caused by Unexpected Lowflation.](image)

The results in 2011 exemplify why the inflation premium in mortgage rates should be considered as the most important component when discussing the value of real redistributions between debtors and creditors. In our model, the inflation risk premium is assumed to be set by money market players so that it compensates for the inflation risk that is part both of the interest rate channel and the amortization channel. If this premium is proved to be far too high (due to lower inflation than expected), the value of total redistributions will, ceteris paribus, be higher. Total redistributions will, correspondingly, be lower if there is a small deviation between expected and actual inflation.
The change in household consumption caused by unexpected lowflation is a function of redistributions, the multiplier $\Lambda$ and the deviation between marginal propensities to consume for debtors and creditors. As mentioned in Section 4.2, the impact on household consumption will be highly dependent on the value of the multiplier $\Lambda$. Please also note that the multiplier based on an assumption of heterogeneity is fixed, while the multiplier based on an assumption of perfect homogeneity is variable. For instance, in 2009 we can see that the absolute value of redistributions (column 6 in Table 3) is smaller than the absolute value of redistributions in 2007. If we then compare column 8 to column 10 for these years we see that the absolute value in column 8 is larger in 2009 than 2007, and that the absolute value in column 10 is smaller in 2009 than 2007.

As we see in Table 3 and Figure 2, the conservative approach with $\Lambda = 2.35$ indicates that redistributions have a very small impact on the change in total household consumption. Having stated that this small impact on household consumption is practically negligible, there is not much more to be analyzed for this conservative approach. However, the more aggressive approach assum-
ing perfect homogeneity in MPC for all goods and services with a multiplier between 27 (2006) and 43 (2009) leads to the conclusion that redistributions have huge effects on household consumption. As we see in Figure 3, a counterfactual consumption path without redistributions caused by lowflation would be much more stable with a standard deviation of 0.91 percentage points, compared to a standard deviation of 1.4 percentage points that has been the case for actual changes in household consumption. The effect on household consumption has been the smallest in 2006, which is a consequence of the small value of redistributions in the same year. For the same reason, the effect in household consumption has been the largest in 2012 and 2013.

Figure 3: Change in Total Household Consumption and Possible Effects From Unexpected Lowflation in Sweden During 2006-2013.

It should once again be mentioned that consumption on autos as share of total consumption have fluctuated during 2006-2013. More specifically, this share decreased from 3.7 percent in 2006 and 2007 to 2.3 percent in 2009. In 2012, this share was 2.9 percent. The general trend indicates that consumption on autos as share of total consumption has decreased from 2007 to 2009, and thereafter increased from 2009 to 2011. These fluctuations do not necessarily imply that there is a large portion of heterogeneity in the MPC for different goods and services. If the MPC was perfectly homogenous, consumption on
In Section 2, we mentioned Lars Svensson’s research about how lower inflation than expected both has increased unemployment and household debt. On the contrary, the Chairman of the Riksbank Executive Board, Stefan Ingves, has on several occasions expressed his concerns with heavily indebted households. While Svensson emphasizes that a high policy rate leads to too low inflation, which in turn increases real household debt, the main argument for Ingves has been that a low policy rate increases nominal household debt, which leads to higher sensitivity in household demand. From the results presented in Table 3 and 4, we can conclude that the deviation between actual and expected inflation has a large impact on the value of total redistributions. As mentioned above, there were small deviations in 2011 which lead to relatively small redistributions despite the large stock of mortgage loans. However, the magnitude of mortgage loans is definitely also a contributing factor to the value of total redistributions, which is clear when comparing 2007 to 2008. In Table 4, we see that the deviation between actual and expected inflation is similar between these two years. In fact, the deviation in 2007 has been slightly higher than in 2008, but as the magnitude of the mortgage loans has been higher in 2008, total redistributions have actually been higher in 2008 than in 2007. Undoubtedly, both Svensson and Ingves pinpoints two important effects. However, our conclusion is that the value of redistributions, hence the impact on household consumption, will be insignificant when the actual inflation rate is close to the expected inflation rate, regardless of the magnitude of household debt.

6 Summary

Our main goal with this study is to examine how Swedish household debt and consumption have been affected by a deviation between the expected and the actual inflation rate during 2006-2013. In order to analyze these effects, we
construct a model where unexpected lowflation leads to redistributions through the real interest channel and the amortization channel. Thereafter, the model uses differences in consumption pattern between debtors and creditors to analyze the effect on aggregate household consumption.

We conclude that inflation expectations have exceeded actual inflation rates during this period, and our results indicate that this deviation has lead to large redistributions from debtors to creditors. Our most interesting finding is that redistributions have been transferred from debtors to creditors for five out of eight years, which have lead to a real loss for debtors of 206.7 billion SEK. If we assume perfect homogeneity in the MPC on all goods and services, we estimate consumption losses exceeding 1 percent of total household consumption in 2012 and 2013. These results should be considered as significant, as the standard deviation of total consumption has been 1.4 percent between 2006 and 2013.

Our results are approximate. We therefore encourage coming studies to find reliable measures for MPC for debtors and creditors in Sweden and to investigate the degree of heterogeneity in the MPC on different goods and services.
7 References


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8 Appendix: Mathematics For the Theoretical Framework

The real interest rate: Say that \( i_{t-T} \) denotes the agreed fixed nominal interest rate for a loan \( \left( L_{T,T+1}^{t-T} \right) \) with inflation expectations originated at the beginning of year \( t - T \). The fixed interest rate period for this loan expressed in years is then \( T + 1 \) (since it also includes payment during year \( t - T \)). The debtor engaging in such a contract expects that the annual inflation rate on average will be \( \pi_{t-T,T,t}^{e} \) during the fixed interest rate period. In other words, \( \pi_{t-T,T,t}^{e} \) is the mean of expected inflation rates during \( T + 1 \) years:

\[
\pi_{t-T,T,t}^{e} = \frac{1}{T+1} \sum_{i=0}^{T} \pi_{t-T+i}^{e}
\]

The actual annual inflation rate is given by \( \pi_{t} \) for year \( t \), and the corresponding annual expected inflation rate is then \( \pi_{t}^{e} \) (when expectations are formed in the beginning of year \( t \) about the inflation during year \( t \)). The actual real interest rate at year \( t \) \( (r_{t}) \) and the expected real inflation rate \( (r_{t}^{e}) \) for a loan with inflation expectations originated in the beginning of \( t \) is then:

\[
r_{t} = i_{t} - \pi_{t}
\]
\[
r_{t}^{e} = i_{t}^{e} - \pi_{t}^{e}
\]

By subtracting the real interest rate by the expected real interest rate, we get to the following conclusion:

\[
(1 + r_{t}) - (1 + r_{t}^{e}) = \pi_{t}^{e} - \pi_{t}
\]

\[
\implies \pi_{t} < \pi_{t}^{e} \iff r_{t}^{e} < r_{t}
\]
So if the actual inflation rate is below the expected inflation rate, then the actual real interest rate will exceed the expected real interest rate. Such deviations will result in real loss for debtors and real gain for creditors. More specifically, the size of real loss and real gain of a loan with inflation expectations originated in the beginning of $t$ with a fixed interest rate period of $T+1$ years is given by

$\left((1+r_t) - (1+r_{e,t}^t)\right)L_{T+1}^t = (\pi_i^t - \pi_t)L_{T+1}^t$

One mathematically simple, yet interesting, fact is that we do not need to consider the nominal interest rates in order to compute the size of the redistributions from debtors to creditors. As we are interested in knowing the real loss and gain for all loans during year $t$ we also have to include loans with different interest rate periods:

$$DRIRC_t = \sum_{k=0}^{n} \sum_{i=k}^{n} (\pi_i^{t-k} - \pi_t) L_{i}^{t-k}$$

Given that there exist loans with fixed interest rate periods of $n$ years, the total deviated real interest rate costs for year $t$ are computed by including loans with inflation expectations formed $k$ years before year $t$ and fixed interest rate periods of $i$ years if $k \leq i \leq n$. This is the expression for $DRIRC$ (equation 1). Please note that a positive value indicates loss for debtors and gain for creditors.

**The real amortization:** If $P$ is the price level in the beginning of year $t$, then the expected price level in the end of $t$ ($P_{e,t}^t$) is:

$$P_{e,t}^t = P (1 + \pi_t)$$

(\star)

We express the actual price level at the same period as:

$$P_t = P (1 + \pi_t)$$

(\star\star)
In that case the debtor (with a loan with a fixed interest period of \( T + 1 \) years) faces the following actual (4) and expected (5) real loan at the end of year \( t \):

\[
\frac{L^t_{T+1}}{(1 + \pi_t)} \quad (9)
\]

\[
\frac{L^t_{T+1}}{(1 + \pi^{e,t}_t)} \quad (10)
\]

This will lead to the following conclusion:

\[
\pi_t < \pi^{e,t}_t \implies \frac{L^t_{T+1}}{(1 + \pi^{e,t}_t)} < \frac{L^t_{T+1}}{(1 + \pi_t)}
\]

So if the actual rate of inflation is below the expected rate of inflation, the actual real loan will be larger than the expected real loan. This leads to a redistribution between debtors and creditors making debtors more indebted than was first expected. The value of real loss for debtors and real gain for creditors at year \( t \) resulting from loans with a fixed interest rate period of \( T + 1 \) years is then given by:

\[
\left( \frac{1}{(1 + \pi_t)} - \frac{1}{(1 + \pi^{e,t}_t)} \right) L^t_{T+1} \quad (4 - 5)
\]

As we are interested in knowing the real loss and gain for all loans during year \( t \) we have to include all loans, i.e. not only those with inflation expectations originated at \( t \) and with interest periods of \( T + 1 \) years.

\[
\text{DRAL}_t = \sum_{k=0}^{n} \sum_{i=k}^{n} \left( \frac{1}{1 + \pi_t} - \frac{1}{1 + \pi^{e,t-k}_t} \right) L_{i-k}^{t-k}
\]

This is the expression for \( \text{DRAL} \) (equation 2).

**Computations for inflation expectations** From Prospera we have data for \( \pi^{e,t}_t, \pi^{e,t-1}_{t-1} \) and \( \pi^{e,t-4}_{t-4} \), so they are known.
\[
\hat{\pi}_{t-1,t} = \frac{\pi_{t-1}^{e,t-1} + \pi_{t}^{e,t-1}}{2}
\]

\[\iff \quad \pi_{t}^{e,t-1} = 2\pi_{t-1,t} - \pi_{t-1}^{e,t-1}\]

\[
\pi_{t-4,t}^{e,t-4} = \frac{\pi_{t-4}^{e,t-4} + \pi_{t-3}^{e,t-4} + \pi_{t-2}^{e,t-4} + \pi_{t-1}^{e,t-4} + \pi_{t}^{e,t-4}}{5}
\]

We do not have any information about \(\pi_{t}^{e,t-4}\), \(\pi_{t-1}^{e,t-4}\) or \(\pi_{t-2}^{e,t-4}\), and we therefore assume that long-term expectations converge to the same inflation rate:

\[
\hat{\pi}_{t}^{e,t-4} = \hat{\pi}_{t-1}^{e,t-4} = \hat{\pi}_{t-2}^{e,t-4} = 5 \cdot \pi_{t-4,t}^{e,t-4} - (\pi_{t-4}^{e,t-4} + \pi_{t-3}^{e,t-4})
\]

We use this kind of computation when estimating \(\pi_{t}^{e,t-1}\) and \(\hat{\pi}_{t}^{e,t-4}\) when computing DRIRC and DRAL.