Household Response to the Economic Crisis and Aggregate Consumption

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Abstract

This paper studies the economic impact of the current global economic downturn on the household sector. Household budgets can be negatively affected by declines in nominal wages and increases in unemployment. We empirically test this effect for the Czech economy. As a result of the lack of micro data on the Czech household finances, micro data are simulated. Our analysis clearly points out that there is a significant additional decline in consumption related to an increase in household default rates. We find that potential household insolvencies have important implications for the financial system as well as for the aggregate economy.

JEL: G28, G32, G33, G38
Key words: credit cycle, households' distress, insolvency, household default, aggregate consumption

1. Introduction

There are various studies addressing household financial distress. Some investigate the main drivers of the insolvency risk and try to link them to the macroeconomic environment while others focus on the effect of adverse macroeconomic scenarios on household consumption. Of note is that only a few studies discuss the household credit cycle as a whole. The lack of research on this issue is mainly related to insufficient household statistics covering structured balance sheets as well as consumption.

The ongoing economic crisis has a negative effect on household balance sheets and can cause financial distress. This paper aims to assess the impact of the economic recession on the financial situation of a household by taking their debt burden into account and by evaluating the negative feedback effect on the aggregate economy via a decrease in their consumption. This is of particular importance from a government point of view, as household insolvencies can significantly reduce government income and increase the need for social spending.

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The next section contains a literature review on household distress, insolvency triggers and the impact of adverse macroeconomic scenarios on a household balance sheet. Section 3 looks at the modelling framework and captures a model for a single household mortgage default. In addition, it looks at the impact of an adverse macroeconomic scenario on aggregate consumption. Section 4 contains a description of the available data for the Czech economy. The empirical results are presented in section 5. The final section summarises and concludes.

2. Related Literature

Various studies address the issue of household insolvency and focus specifically on the main drivers. To this end the recent financial turmoil and consequent economic recession are further encouraging creditors as well as regulators to deal with the issue. There can be identified four main streams of research. The first group looks at household default prediction using traditional insolvency framework. Second focuses on impact of household defaults on the financial sector using stress test framework to evaluate the potential negative effect of adverse macroeconomic scenarios. Third focuses on the optimal legal framework to cope with individual insolvencies and fourth aims to the credit cycle and consumption.

The first group of studies focus on household default prediction. Peter and Peter (2006) investigate the main drivers of household default. To this end they developed a risk management model for the Australian economy, using micro data from the Australian Bureau of Statistics. DeVaney and Lytton (1995) preferred to focus on household insolvency through the employment of a predictive model and the use of financial ratios to identify insolvent households. They present both implications for the monitoring of households solvencies and a response to insolvencies. Herrala and Kauko (2007) present a micro simulation model of household distress. They use logit analysis to estimate the extent to which a household's risk of being financially distressed depends on net income after tax and loan servicing costs. The impact of assumed macroeconomic shocks on the net income is calculated at the household level. The micro simulation model is used to simulate both the number of distressed households and their aggregate debt in various macroeconomic scenarios. Del-Rio and Young (2005) examine how attitude towards unsecured debt are related to household finances and other characteristics using a British Household Panel Survey. This analysis suggested that the main factors causing problems related to debt are the unsecured debt-income ratio, the level of mortgage income gearing, the level of financial wealth of households, their health, ethnicity and marital status. They also concluded that the increase in the levels of indebtedness of young people was the main factor driving the greater tendency to report debt related problems.

The second research stream tries to evaluate the impact of household defaults on the financial sector under adverse macroeconomic scenarios. Kadeřábek, Slabý and Vodička (2007) modeled household default probability as a function of macroeconomic variables such as wages, unemployment and interest rates. They further employed an estimated model within the stress test framework by applying exogenous stress scenarios for the development of these indicators. The authors pointed out that sensitivity of default probability to stress is mainly driven by the installment to income ratio and loan maturity. Jakubík, Schmieder (2008) estimated macroeconomic models to forecast household default for the Czech and German economies. They employed these models to stress test banking portfolios and pointed out that macroeconomic indicators on their own can have a limited value in explaining household default.

The third group of studies focuses on the optimal legal framework. Li and Sarte (2006) study the implications of US personal bankruptcy rules for resource allocation and welfare. They

found that by completely eliminating bankruptcy provisions cause significant declines in output and welfare as it reduces capital formation and labour input. Feibelman (2009) pointed out that the deepening of consumer finances promotes growth and development in emerging markets. Through his research he stressed the importance of consumer bankruptcy law as an effective form of regulation to address the problem of over-indebtedness. He calls for emerging economies to consider adopting a consumer bankruptcy system or to modernize their existing regimes.

The last fourth group of research focuses on consumption and economic growth and credit cycle models. Chang, Hanna, Fan (1997) presented and empirically tested a three-period model for optimal consumption. The latter suggests that many US consumers without sufficient levels of liquid assets may be acting rationally. Elmer and Seeling (1998) combine the issue of consumption and solvency. They proposed a theoretical model for a single family mortgage default and they investigated events that could trigger defaults within this framework. McCallum (1988) applies an evaluation of strengths and weaknesses of the real business cycle approach to the analysis of macroeconomic fluctuations. In Netherlands the impact of financial capital losses relative to gains on household savings and consumption is investigated by Berben, Bernoth and Mastrogiacimo (2006). Their results suggest that households react more to capital losses then to capital gains. Thus, the failure to take this asymmetry into account could seriously influence the estimates of marginal propensity to consume from wealth.

3. Theoretical Framework

Households are usually affected by the adverse negative economic scenario with some time lag, but the impact is more persistent than in the case of the corporate sector. As a consequence of the economic crisis, firms reduce production to cope with a declining aggregate demand. To do so, they need to reduce the labour force or decrease wages. However, the wages are usually "sticky down"; therefore firms need to make employees redundant. Alternatively, they could reduce the variable part of salaries such as bonuses or other benefits. As employees become unemployed they also become dependent on social benefits. Moreover, if they are indebted they are not able to cover their current payments with their current income. Thus, if they are not able to find employment the only solution is to use their savings. In the end this can only provide a temporary solution which postpones their insolvency.

Single-household Mortgage Default

To investigate household insolvency we can consider a three period pure exchange model with no taxes, e.g. Elmer and Seelig (1998). Individuals are endowed with initial income (y_0) and invest in real estate equity (p_0), financed by fixed-rate mortgage (m_0) at time 0. It could be further assumed that rents earned from real estate equity is fully consumed in the period received and that periodic consumption (c_t) is the recorded net of these earnings. Unsecured borrowing (b_t) are residual that smooth out intertemporal consumption. However it can also be positive and in this case it is interpreted as savings in the form of a deposit. Initial income, the value of investment into real estate equity and the interest rate (y_t, p_t, i_t) are known, but may differ from their future realised values. An individual choosing the optimal life cycle consumption pattern is as follows.

$$\max U(c_0, c_1, c_2) \tag{1}$$

S.T.

$$c_0 = y_0 - (p_0 - m_0) + b_0$$

$$c_1 = y_0 - m_0 i_0 - b_0 i_0 + b_1$$
$$c_2 = y_0 + (p_0 - m_0(1 + i_0)) - (b_0 + b_1)(1 + i_0)$$
$$c_0, c_1, c_2 > 0,$$

This model can easily be extended to include any arbitrary number of periods (see Fama and Miller (1972) or Hirschleifer (1970) for further details). Within this framework a key role is played by uncertainty about future income, interest rate and house prices. An adverse change in these variables increases the possibility of exercising the option to refinance a mortgage (*R*) or default (*D*). The strategic option to default is chosen if the default transaction costs exceed a present value of interest savings in case of mortgage refinancing. If the refinance and strategic default option fall out of the money, then the period 0 debt remains and the revised choice (1) can be reformulated to a two-period optimalisation with debt constraints from prior commitments.

$$\max U(c_0, c_1, c_2) \tag{2}$$
S.T.
$$c_1 = y_1' - m_0 i_0 - b_0 i_0 + b_1'$$
$$c_2' = y_1' + (p_1' - m_0(1 + i_0)) - b_0(1 + i_0) - b_1'(1 + i_1')$$
$$c_1', c_2' > 0,$$

We further focus on the situation of an adverse macroeconomic shock and its impact on household income. In our model framework, the consumer has at least to cover debt obligations in both periods. We further assume shock to income $y_1' \to 0+$ holding interest rate and house prices constant. Solvency in period 1 requires borrowing against period 2 wealth to at least equal $m_0 i_0 + b_0 i_0$, so households default if

$$p_0 - m_0(1 + i_0) - b_0(1 + i_0) - (m_0 i_0 + b_0 i_0)(1 + i_0) > 0$$
$$b_0(1 + i_0)^2 > p_0 - m_0(1 + i_0)^2 \tag{3}$$

that is, borrowing from previous periods exceed homeowner equity. It is quite an expected result as in the case when an individual can not meet his obligation; he can still sell owned real estate in order to avoid his default. However he will default if the value of his equity can not cover his debt obligation.

This simple framework can help us to understand the basic default trigger based on the shock to income. Nevertheless, in practice it is more complicated, as mortgages can have a different maturity, which also means different annuity, and it is usually regularly paid back in monthly constant instalments. We also need to calculate disposable income as an income purged of living costs. Moreover, Herrala, Kauko (2007) define household distress as a situation when the household surplus (income diluted by debt service payments) increment by the possibility of incurring new debt is smaller than the minimum level of consumption. They assume that households can temporarily sustain consumption by taking more debt or running down their stock of liquid assets.

Impact of Adverse Scenario on Aggregate Consumption

From the creditor's point of view, a precise estimation of future household default is one of the most challenging issues. On the other hand, the objective of financial regulators is to asses the future development of the economy and the potential threat to financial stability. Households' inability to meet their financial obligations does not only result in higher default rates and losses for the financial sector, but also as in a significant decline of household

consumption, which has a negative effect on the aggregate economy. To estimate this impact we can use a simple Keynesian framework (see e.g. Romer (2006))

$$C = C_0 + cY,$$ (4)

where C denotes aggregate consumption, C_0 autonomous consumption, c marginal propensity to consume and Y disposable income. We further assume an adverse macroeconomic scenario corresponding to a decline in gross domestic product as well as to disposable income. Then decline in consumption can be expressed as

$$\Delta C = c\Delta Y$$ (5)

However in the case of a significant increase in household default rates, there is an additional feedback effect of household insolvency on the aggregate consumption level. Hence, the decline in consumption calculated using formula (5) can be considerably underestimated due to the underestimation of the marginal propensity to consume.

To better estimate the impact of a decline in disposable income on consumption, we can simply divide consumers into two groups – defaulted [d %] and non-defaulted [(1-d) %]. Then, the total aggregate consumption can be expressed by the following formula.

$$C = dC_d + (1-d)C_n$$ (6)

where C_d denotes consumption of the defaulted and C_n non-defaulted households. Using this formula, the decline in consumption in response to the decline in disposable income or GDP can be derived. According to the Keynesian formula we can assume that consumers reduce their consumption proportionally to the decline in disposable income which corresponds to the decline in GDP. If we further assume that disposable income of the defaulted household group is equal to zero in limit, then their consumption is equal only to the autonomous consumption related to the necessary living expense. Formally,

$$C = dC_d + (1-d)C_n = d * C_0 + (1-d)(C_0 + cY) = C_0 + (1-d)cY$$ (7)

In case of an adverse macroeconomic scenario, GDP or disposable income declines and household insolvency rate increases. The total aggregate consumption is influenced by both these effects and can easily be derived using formula (7).

$$\Delta C = c[(1-d)\Delta Y - \Delta d(1+\Delta)Y)],$$ (8)

where Δ is operator of change in levels. We can see from equation (8), that for small changes in household insolvency we can omit the second term in formula (8), but for significant changes, it can play an important role and the omission of the second term can cause a significant underestimation of the decrease in consumption.

If we further take into account that the marginal propensity to consume could significantly differ for the unemployed and employed consumers then we can reformulate the equation (7) for the aggregate consumption.

$$C = C_0 + (1-d)(uc_U Y + (1-u)c_E Y)$$ (9)

where c_U and c_E is the marginal propensity to consume for the unemployed and employed consumers and u is the unemployment rate. In case of adverse macroeconomic scenario, we need to take into account together with change in GDP and change in the household default

rate also change in the unemployment rate to calculate the effect on the aggregate consumption. Formally, after some derivation we can obtain following formula (10)

$$\Delta C = (1-d)[u(c_U - c_E) + c_E]\Delta Y + [(c_U - c_E)(\Delta u - d\Delta u - \Delta du - \Delta d\Delta u) - \Delta dc_E](1+\Delta)Y$$

$$(10)$$

We can see from equation (10), that for no significant difference between the marginal propensity to consume for the unemployed and employed consumers and for the low unemployment rate, the formula (10) resembles formula (8). The formula (10) reveals, that significant difference between the marginal propensity to consume for the unemployed and employed consumers, change in the unemployment rate and default rate can have marked impact on the change in the aggregate consumption.

4. Available Data for the Czech Economy

The limiting factor of modelling household insolvencies is usually the availability of appropriate data sources. To estimate the household default rate we would need to know more about the distribution of income and the debt burden among the population. Furthermore, we need to have an estimate of the necessary living expenses as well as information about interest rates on loans to households. Unfortunately, for the Czech Republic the relevant data are not available.[2] Neither do we have micro data nor sufficient information about the distribution. However, we use a simplifying assumption to deal with this problem.

The Czech Statistical Office is the main data source for Czech household statistics. Apart from that, the Czech National Bank provides some additional statistics on the aggregate bases as household financial assets, banking and non-banking loans to households. Moreover, the average banking interest rates on consumption and housing loans to household are published by the Czech National Bank. Some additional characteristics of the mortgage markets can be obtained from Fincentrum Hypoindex. However, micro data are available only from the Czech Statistical Office. These statistics are based on household surveys and contains some characteristics of households. From the household insolvency point of view they provide information about household net income, but they do not contain characteristics of debt burden only binary information (yes/no) such as whether the given households have mortgages. Moreover the debt burden related to consumer loans is not covered by these statistics. Their main disadvantage is also the relatively long lag and of note is that the latest statistics is based on information collected in the year before the last finished year. The lack of appropriate statistics causes difficulties in estimations.

Income distribution of households with and without mortgage reveals that the indebtedness of low income Czech households is relatively limited. Income distribution of households with a mortgage is positive skewed compare to income distribution of households without mortgage.

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[2] The appropriate data can be obtained from credit registers or household surveys for some countries.

Chart 1: Household income distribution (Statistics of Family Accounts 2007)
        (axis x: household net income in ths. CZK, axis y: in %)

Households with mortgage ■   Households without mortgage ■
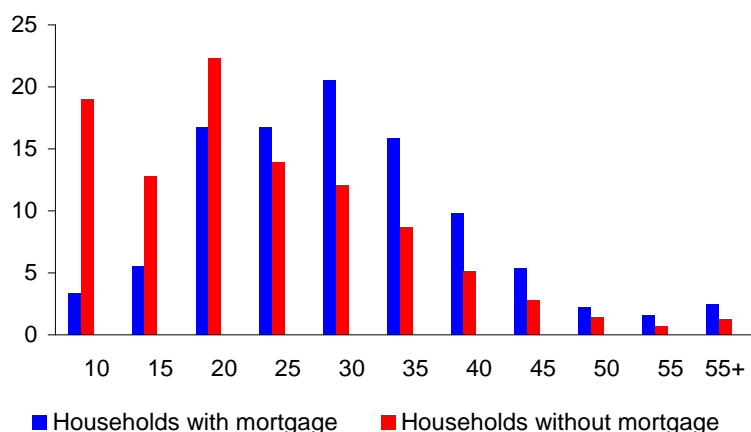
Source: Czech Statistical Office

Based on the statistics of Fincentrum Hypoindex we can see that since 2006 the average value of mortgage loans have been rising over time, but this increase is lower then increase in residential property prices (see Table 1). We can also observe lower growth in nominal wages compared to changes in residential property prices in the same period. It reveals the fact, that owner-occupation is less accessible to Czech households over time. Although the income situation had been improving until 2008, it still did not compensate for the increase in residential property prices.[3]

Table 1: Average mortgage loan

	2005	2006	2007	2008	03/2009
Average mortgage loan (end of period, in ths.CZK)	1412	1450	1707	1766	1802
Growth of average mortgage loan (in %)	11.4	2.7	17.7	3.5	2.0
Change in residential property prices (y-o-y, in %)	6.0	10.4	18.9	12.5	
Growth of average gross monthly nominal wage (y-o-y, in %)	5.3	6.5	7.3	8.5	-2.6
Consumer price Inflation (end of period, in %)	2.2	1.7	5.4	3.6	2.3

Source: Fincentrum Hypoindex
Note: 03/2009 correspond to quarterly change

5. Empirical Results

To evaluate the impact of the economic crisis on the household sector, we focus mainly on the income transmission channel which is also the most relevant to the current situation of the Czech economy.

Due to the lack of micro data on household balance sheets[4], we employ aggregate data from a bank credit registry and a one factor model to link the household insolvency to key macroeconomic variables (see detail of the model in Jakubik (2007) and Appendix).[5] This

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[3] At the end of 2008, banks started to tighten credit standards due to the ongoing economic recession. The increasing uncertainty about future income together with the resultant negative expectations by households causes a rapid slow down in credit growth. Moreover, the decline in economic which started in 2008 has been reflected in the rising household sector credit risk.

[4] Although we have information on the historical distribution of household net income, the rest of the statistics are available on the aggregate level only.

[5] Econometric models which employ macroeconomic indicators to explain the household insolvency rate use e.g. Kadeřábek, Slabý, Vodička (2007), Jakubík, Schmieder (2008) or Danmarks Nationalbank (2007). They employ

data covers newly past due loans which were used as a proxy for the credit default rate. The indicator for household credit risk was calculated based on new 3-months past due loans. However, the only short time series covered period 3Q/2007-3Q/2009 was available for the household sector. Although this data was available monthly, some macroeconomic variables as the GDP growth can be obtained only quarterly. In order to estimate the model despite short time series we used monthly data and linear interpolation for the GDP growth and its components as consumption. The model was calibrated by maximising a likelihood function (see Appendix). After testing various specifications, the final model is able to explain historic household default rate is chosen based on minimum residual sum of squares. In line with economic theory, we consider macroeconomic variables which can drive household insolvency and the Czech National Bank publishes their forecast. Automatic selection is used to find the combination of variables with the highest prediction power and optimal time lag. Moreover, we ensure that coefficients have signs in line with economic theory. According to our results, Czech household default rates can be explained by lagged real GDP growth, changes in the unemployment rate, lagged nominal wage growth and changes in interest rates – see the following equation (11) and Table 2, where the lag is in quarters and ψ denotes cumulative normal distribution function (see Appendix, Chart 2 for performance of the model).

$$df_t = \psi(c + \beta_1 gdp_{t-4} + \beta_2 (u - u_{t-1}) + \beta_3 w_{t-1} + \beta_4 (r_{t-3} - r_{t-4})) \tag{11}$$

Table 2: Macroeconomic model for the Czech household sector

Description of variable corresponding to estimated coefficient	Notation	Estimate	Standard error	Pr>|t|
Constant	c	-2.126800	0.014510	<.0001
GDP (β_1)	gdp_{t-4}	-0.028320	0.003036	<.0001
Change in unemployment (β_2)	$u - u_{t-1}$	0.012380	0.004372	0.009
Nominal wage growth (β_3)	w_{t-1}	-0.012140	0.000816	<.0001
Change in interest rate (β_4)	$r_{t-3} - r_{t-4}$	0.033980	0.007440	0.0001

Note: The lag length is in quarters.

Our results pointed out that lagged real gross domestic product growth negatively affects default rates. Moreover, a decrease in lagged nominal wage growth, an increase in the unemployment rate and an increase in lagged interest rates has a positive effect on household insolvencies. Our model captures both the asset and liabilities side of the households' balance sheet. While the unemployment and nominal wages have an impact on household income, interest rates have an influence on household financial costs. Real GDP is used as a proxy for the factors affecting disposable income not covered by the previously mentioned indicators. Household financial distress or default can be defined as a situation when a debtor is not able to service its outstanding debt. Under these circumstances, the disposable income of such a household is negative.

Nevertheless, the model based on individual data is usually able to better explain household defaults. Peter and Peter (2006) identify five groups of mortgage default determinants – factors related to: income, the credit history, macroeconomics, borrower location and

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as dependent variables indicators such as GDP, unemployment, wage growth, household income, interest rates or indebtedness of the household sector.

demographics. They pointed out that although the most important cause of mortgage default is a fall in household income, the other factors can also be important for future default estimation.

Decrease in Nominal Wages

Given the sharp fall in economic activity related to the economic crisis, the potential decrease in nominal wages (see Table 1) can be regarded as a relatively plausible scenario for the Czech economy. For this reason we try to identify a decrease in household nominal income that would cause a massive rise in loan defaults by households at the aggregate level and prompt a collapse of the mortgage market. Although individual data on household indebtedness are not available, the recently published survey of the Czech Statistical office revealed that about 10% of Czech households are repaying mortgage loans and roughly 20 % is repaying consumer credit. This means that it is a significant part of the population and a serious issue to analyze.

To quantify the effects of wage shocks we consider two variants of a typical indebted household. In the first case, the household is only repaying a mortgage loan and in the second case it is repaying both a mortgage loan and a consumer loan. Both are being repaid in regular monthly instalments. In both cases we assume a three-member family with one child and monthly essential living costs of CZK 15,000.[6] As micro data reflecting the current situation are not available, we use a micro data simulation to model household income assuming a normal distribution with mean and standard deviations based on the available aggregate statistics.[7] Furthermore, we assume that households are repaying a mortgage loan corresponding to 5 years income and with a maturity of 20 years where household income is sufficient to cover monthly instalments and the minimum living costs.[8] If household income is not adequate, the maturity is prolonged to a maximum of 30 years. If it is still not enough, the mortgage to such household is not granted. The interest rate is assumed to correspond to the average rate on mortgages at the end of 2009.

In the second variant we additionally consider the repayment of a consumer loan of a maximum of CZK 100,000 with a 5-year maturity and an interest rate corresponding to the average rate on such credit at the end of 2009. The amount of the consumer loan is set so that the household is able to cover the monthly payment. If household income is not sufficient to cover the monthly mortgage payment and essential living costs, a consumer loan is assumed not be granted.

For both variants we test the impacts of a wage shock on hypothetical family budgets in relation to initial nominal incomes. We can formulate a household surplus in line with model (1) which can be used for consumption.

$$S = Y - I - MC, \tag{12}$$

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[6] For both variants we assume a family corresponding to the typical mortgage recipient in the Czech Republic. According to CZSO data, this is most often a household with two economically active members and one child. The main breadwinner is a 39-year-old man with a secondary education. His partner is a 33-year-old employee or housewife with a secondary or basic education. Essential living costs can be estimated on the basis of the household budget statistics from expenditure on food, clothing, housing, health, transport and restaurants. This expenditure can alternatively be estimated as the sum of the minimum subsistence amount and normative housing expenses as stipulated in a government order of 16 December 2008. In both cases, the estimated amount is about CZK 15,000.

[7] We are aware of household income non-normality (see Chart 1). However due to a lot of other simplifications and assuming only households with mortgage, this should not significantly bias our results.

[8] It reflects common banking practice for the mortgage granting process in the Czech Republic.

where S denotes the household surplus, Y household net income, I loan instalment that household is committed to and MC household essential living costs. We define household distress as a situation where the household surplus is close to zero and the household is able to just cover the essential living costs. In contrast to Herala and Kauko (2007) we do not take into account a pledgeable amount of wealth as its distribution among households with a mortgage is not available. Contrary to Elmer and Seelig (1998) we also do not consider homeowner equity for simplification. For the calculation of household net income we take the Czech tax code into account.

The results show that if households with a mortgage had no other loan, the budgets of about 30% of them would get into deficit if nominal wages declined by more than 10%. If this group of households also had a consumer loan of CZK 100,000, around 50% of them would be hit. However, the estimates of the proportion of households with difficulty making loan repayments are extreme. For example, the assumption of constant living costs is very conservative, since households can in reality cut their living costs to some extent if needed. Moreover, a large proportion of households can cope with a potential bad situation by selling their assets (bank deposits, life insurance, private pension schemes, building saving schemes) or are insured against the inability to repay debts.

Alternatively the macroeconomic forecast model (9) can be employed. It suggests a much more modest impact of the shock. However, the macro model usually can not deal well with the extreme scenario and we could assume that the results obtained by micro-simulation would be much closer to the reality. Despite a lot of simplifications and limitation, our simple exercise points out that a potential decrease in nominal incomes can cause serious difficulties and cause distress to a significant number of households with debt burdens. This could happen as a result of a shorter working week or cutbacks in variable wage components. In such a situation, the number of insolvencies would rise sharply and the quality of bank loan portfolios would fall. This would lead to a decline in residential property prices due to the sale of collateral. A decrease in the value of collateral (or a fall in the LTV ratio) would increase the risk to which banks are exposed. Moreover, a significant increase in household insolvencies would also have a negative social impact.

Impact on Aggregate Consumption

The current economic crisis is manifested by increasing unemployment. According to CNB (2010) baseline scenario, the default rate on banking loans to households should increase roughly by 2 p.p. during 2010 due to a deteriorating labour market situation and a decline in household disposable income. In a highly unfavourable scenario this indicator could even rise by up to 5% p.p. Using formula (10), we can estimate the impact on the aggregate consumption for different negative changes in economic growth measured by GDP. The proportion of defaulted households can be obtained as a product of default rate and share of household with debt burden. According to the survey of the Czech Statistical Office, 20% of household are repaying mortgage loans and 10% consumer loan. We do not know how many households with mortgage loans are also repaying consumer credit at the same time. We will assume that 25 % of the Czech households have some debt burden. According to some studies the marginal propensity to consume (MPC) can differ for unemployed and employed consumers. Thomson, Chung and McKibbin (2009) empirically tested MPC for households worried and not worried about their future job and pointed out that MPC is significantly differs for these two groups. If we further express change in consumption as a relative change against GDP, we can reformulate equation (10) in formula (13).

$$\frac{\Delta C}{Y} = (1 - dk)[u(c_U - c_E) + c_E]\frac{\Delta Y}{Y} + [(c_U - c_E)(\Delta u - dk\Delta u - \Delta dku - \Delta dk\Delta u) - \Delta dkc_E](1 + \frac{\Delta Y}{Y})$$

(13)

where parameter k corresponds to the share of consumers with some debt burden ($k = 0.25$) and d corresponds to household default rate (we assume $d = 0,5$ corresponding to default on banking loan portfolio to households in the end of 2009). We employ coefficient 0.9 for parameter c_E - marginal propensity to consume for employed consumers and 0.4 for parameter c_U - marginal propensity to consume for unemployed consumers.[9] The following tables demonstrate the change in aggregate consumption as a result of change in the GDP growth rate, default rate and unemployment rate

Table 3: Change in consumption as a result of change in the GDP growth rate, default rate and unemployment rate (in % GDP)

$\Delta u = 1\%$		Change in household default rate (in percentage points)				
		1	2	3	4	5
Change in GDP (in %)	-1	-1.47	-1.69	-1.91	-2.13	-2.36
	-2	-2.32	-2.54	-2.76	-2.98	-3.20
	-3	-3.17	-3.38	-3.60	-3.82	-4.04
	-4	-4.02	-4.23	-4.45	-4.66	-4.88
	-5	-4.87	-5.08	-5.29	-5.50	-5.72
	-6	-5.71	-5.93	-6.14	-6.35	-6.56
	-7	-6.56	-6.77	-6.98	-7.19	-7.40

$\Delta u = 2\%$		Change in household default rate (in percentage points)				
		1	2	3	4	5
Change in GDP (in %)	-1	-1.86	-2.08	-2.30	-2.52	-2.74
	-2	-2.71	-2.92	-3.14	-3.36	-3.58
	-3	-3.55	-3.77	-3.98	-4.20	-4.42
	-4	-4.40	-4.61	-4.82	-5.04	-5.25
	-5	-5.24	-5.45	-5.66	-5.88	-6.09
	-6	-6.09	-6.30	-6.51	-6.72	-6.92
	-7	-6.93	-7.14	-7.35	-7.55	-7.76

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[9] The marginal propensity to consume can be estimated using aggregate data. Barry, Bradley, Kejak and Vavra (2000) employed the value of 0.8 for the Czech economy. Thomson, Chung and McKibbin (2009) estimated MPC for households worried about their future job close to 0.9 and for households not worried about their future job close to 0.5. The Czech aggregated data point out MPC close to 0.9. Hence we used this value for employed consumers. For unemployed consumers we set this parameter to 0.5 in line with the study of Thomson, Chung and McKibbin (2009) as MPC for households worried about their future job should be upper estimate for the unemployed consumers.

Δu = 3%		Change in household default rate (in percentage points)				
		1	2	3	4	5
Change in GDP (in %)	-1	-2.25	-2.47	-2.69	-2.91	-3.13
	-2	-3.09	-3.31	-3.53	-3.75	-3.96
	-3	-3.93	-4.15	-4.36	-4.58	-4.80
	-4	-4.78	-4.99	-5.20	-5.41	-5.63
	-5	-5.62	-5.83	-6.04	-6.25	-6.46
	-6	-6.46	-6.67	-6.87	-7.08	-7.29
	-7	-7.30	-7.51	-7.71	-7.92	-8.12

Δu = 4%		Change in household default rate (in percentage points)				
		1	2	3	4	5
Change in GDP (in %)	-1	-2.64	-2.86	-3.08	-3.30	-3.52
	-2	-3.48	-3.70	-3.91	-4.13	-4.35
	-3	-4.32	-4.53	-4.75	-4.96	-5.17
	-4	-5.15	-5.37	-5.58	-5.79	-6.00
	-5	-5.99	-6.20	-6.41	-6.62	-6.83
	-6	-6.83	-7.04	-7.24	-7.45	-7.66
	-7	-7.67	-7.87	-8.08	-8.28	-8.49

Furthermore the negative feedback effect on the aggregate consumption steaming from the adverse macroeconomic scenario can be calculated using the second term in the formula (13). The following tables demonstrate the size of this effect for different values for the GDP growth rate, default rate and unemployment rate.

Table 4: Additional feedback effect on aggregate consumption (in % GDP)

Δu = 1%		Change in household default rate (in percentage points)				
		1	2	3	4	5
Change in GDP (in %)	-1	-0.61	-0.84	-1.06	-1.28	-1.50
	-2	-0.61	-0.83	-1.05	-1.27	-1.49
	-3	-0.60	-0.82	-1.04	-1.25	-1.47
	-4	-0.60	-0.81	-1.03	-1.24	-1.46
	-5	-0.59	-0.80	-1.01	-1.23	-1.44
	-6	-0.58	-0.79	-1.00	-1.21	-1.43
	-7	-0.58	-0.78	-0.99	-1.20	-1.41

Δu = 2%		Change in household default rate (in percentage points)				
		1	2	3	4	5
Change in GDP (in %)	-1	-1.00	-1.23	-1.45	-1.67	-1.89
	-2	-0.99	-1.21	-1.43	-1.65	-1.87
	-3	-0.98	-1.20	-1.42	-1.63	-1.85
	-4	-0.97	-1.19	-1.40	-1.62	-1.83
	-5	-0.96	-1.18	-1.39	-1.60	-1.81
	-6	-0.95	-1.16	-1.37	-1.58	-1.79
	-7	-0.94	-1.15	-1.36	-1.57	-1.77

Δu = 3%		Change in household default rate (in percentage points)				
		1	2	3	4	5
Change in GDP (in %)	-1	-1.40	-1.62	-1.84	-2.06	-2.28
	-2	-1.38	-1.60	-1.82	-2.03	-2.25
	-3	-1.37	-1.58	-1.80	-2.01	-2.23
	-4	-1.35	-1.57	-1.78	-1.99	-2.21
	-5	-1.34	-1.55	-1.76	-1.97	-2.18
	-6	-1.33	-1.53	-1.74	-1.95	-2.16
	-7	-1.31	-1.52	-1.72	-1.93	-2.14

Δu = 4%		Change in household default rate (in percentage points)				
		1	2	3	4	5
Change in GDP (in %)	-1	-1.79	-2.01	-2.22	-2.44	-2.66
	-2	-1.77	-1.99	-2.20	-2.42	-2.64
	-3	-1.75	-1.97	-2.18	-2.39	-2.61
	-4	-1.73	-1.94	-2.16	-2.37	-2.58
	-5	-1.71	-1.92	-2.13	-2.34	-2.55
	-6	-1.70	-1.90	-2.11	-2.32	-2.53
	-7	-1.68	-1.88	-2.09	-2.30	-2.50

These sensitivity analyses points out that the impact of the macroeconomic shock to GDP is stronger then it would correspond to the original shock. Table 4 shows how important can additional effect be on consumption in case of a significant increase in the household default rate and unemployment rate.

6. Conclusion

The economic downturn arguably makes it less likely that households will be able to repay their loans. Household budgets can be negatively affected by declines in nominal wages and increases in unemployment. This effect was empirically tested for the Czech economy. Our analysis describes two basic mechanisms causing the increase in the household insolvency – a decline in nominal wages and an increase in unemployment. As a result of the lack of micro data on the Czech household finances, the extent of their financial distress which is caused by adverse macroeconomic shocks cannot be directly evaluated. However, with some simplifying assumptions, micro data were simulated and the impact of macroeconomic shocks on the household sector assessed. Alternatively the macroeconomic approach utilizes a simple Merton-type one-factor model was employed. Our analysis of a potential slump in nominal wages during 2010 pointed out that under the extreme scenario the budgets of about 30 % – 50 % of households with debt burdens would be in deficit if their nominal incomes were to decrease by more than 10%. This corresponds roughly to 7 % - 12% of the total Czech population.

The crucial second part of the empirical analysis deals with the estimation of aggregate consumption. A relatively simple theoretical model showed the extent to which an increase in household default rate and unemployment rate cause an additional decline in consumption, which is reflected as an economic slump. We illustrate that the impact of the change in unemployment on the size of the mentioned effect positively depends on the difference

between the marginal propensity to consume for employed and unemployed consumers. Our analysis based on the derived relationship for the aggregate consumption showed that for the Czech economy e.g. 4 p.p. increase in default rate and 3 p.p. increase in unemployment rate cause an additional decline in GDP by roughly 2 p.p. If we do not take this effect into account, the expected decline in economic growth can be significantly underestimated. The study clearly shows the importance of the transmission channel in the economy which is usually not taken into account within the monetary policy. We point out that omission of the feedback effect on household consumption can have important negative implication on the economic policies.

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