

Stepanchuk Serhiy¹: 11th Annual Macroeconomic Policy Research Workshop at MNB: Microeconomic Behavior and its Macroeconomic Implications During the Financial Crisis*

On September 6-7, 2012, the Magyar Nemzeti Bank hosted the 11th Macroeconomic Research Workshop organized jointly with the CEPR. The title of the workshop was 'Microeconomic Behavior and its Macroeconomic Implications During the Financial Crisis'. The event was highly topical, as the policymakers try to understand the impact of the financial crisis on different economic agents and tailor their response to it. The keynote speakers of the event were professors Christopher D. Carroll (Johns Hopkins University) and Matthew D. Shapiro (University of Michigan), who are well-renowned for their work which establishes the importance of agent heterogeneity and microeconomic behavior for macroeconomic outcomes. The event brought together researchers from both the academia and policymaking institutions, who presented their thought-provoking research which both empirically documented the importance of agent heterogeneity, and attempted to theoretically model its aggregate implications in the corporate, housing, banking sectors and labor markets.

This article provides a summary of some of the lessons from the workshop, focusing in particular on reviewing the contributions by the keynote speakers and the papers presented at the workshop.

MACROECONOMIC IMPLICATIONS OF MICRO-LEVEL HETEROGENEITY

Professor Christopher Carroll dedicated his keynote speech to illustrating and stressing the importance of agent heterogeneity in macroeconomic modelling. To motivate his talk, he started with recalling his experience of presenting the standard representative-agent based DSGE models to the members of the Federal Open Market Committee (FOMC), who met them with significant scepticism. One of the policymakers' biggest concern (which Professor Carroll fully shares) was the way these models approach uncertainty. This is quite understandable – policymakers face uncertainty about the potential impact of their decisions on the economy on a daily basis, and this has become especially important during the financial crisis. Uncertainty also often affects the behavior of consumers, firms, banks, financial markets and countries, which became especially apparent during the current sovereign debt crisis. At the same time, standard representative-agent based DSGE models treat uncertainty in a very rudimentary and unrealistic fashion.

Uncertainty is introduced into these models as either a sudden universal decline in economy-wide technological efficiency, as an arbitrary change in the representative agent's patience, or as a monetary policy shock which Professor Carroll referred to as 'monetary-policy-makers gone wild'. In addition to the lack of realism, the magnitude of these shocks is too small. In the micro-level data, the variance of the household-specific shocks is many times bigger than the variance of the shocks used in these models.

Professor Carroll believes that one of the big advantages of modelling agent heterogeneity explicitly is the availability of large micro level datasets which can be used to estimate and empirically test such models. This is in sharp contrast to the models with a representative agent which have to rely on aggregate-level data. As an example, Professor Carroll used the recent heated debate between Professor John Taylor (Stanford University) and Moody's Analytics chief economist Mark Zandi (and, more broadly, between the supporters of the Republican and Democratic parties in

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the US in general) about the possible effects of the Republican proposal to cut government spending on the US economy. According to John Taylor, such cuts, by improving the fiscal situation in the US, would reduce private sector's uncertainty about the possible future tax increases, and thus stimulate private spending and investment. Mark Zandi, on the other hand, does not think that these considerations play a big role for private sector agents, and predicts that the proposed spending cuts will have significant negative effect on aggregate demand, employment and output. Professor Carroll pointed out that, unfortunately, there is little hope of finding empirical support for either of the two views, since one would have to essentially rely on a single data point – the effect of the 2009 stimulus package on the US economy.

Next, Professor Carroll turned to comparing the predictions of the representative agent based DSGE models and macroeconomic models that explicitly address consumer heterogeneity about the marginal propensity of consume (MPC). MPC is important both for the economists and for the policymakers for a number of reasons. First, it relates to consumers' risk aversion, and hence influences their portfolio choice. This is of particular significance and interest during the financial and sovereign debt crises, when dwindling investors' appetite for risk may contribute to a drop in asset prices and increased interest rates for risky sovereign debt. Second, MPC related to consumers' labor supply decisions and intertemporal choices. Finally, it is of special interest for policymakers who try to decide on the effectiveness of the fiscal stimulus measures, since it determines how much of the additional income will be spent and how much of it will be saved. Empirical studies usually have found that MPC, measured as a change in consumption spending over a year in response to a surprise extra \$1 of income, lies somewhere between 0.2 and 0.7. However, a typical representative-agent based DSGE model which disregards wealth and preference heterogeneity, potential impact of borrowing constraints on less wealthy consumers, and confronts the representative agent with small aggregate-level income shocks usually implies that MPC is much smaller, between 0.02 and 0.05.

The solutions proposed in the literature that try to change the predictions of the representative-agent based models are far from satisfactory. The one proposed by Campbell and Mankiw (1989), who suggested adding some arbitrary fraction of the so-called 'hand-to-mouth' consumers, and assumed that this fraction earns 50 per cent of the economy's total income, has many drawbacks. It is rather ad hoc, and it fails to match the micro-level data, where only 10 per cent of households have zero wealth. In addition, it fails to address the potential effects of credit

and uncertainty, as they are irrelevant for both groups of consumers in this model, while these questions are of particular interest to policymakers. Another proposed solution – adding habit formation to the representative agent's utility, moves the model's predictions in the wrong direction, since in this case, one obtains the MPC of less than 0.01. As a result, Professor Carroll argues that one should not try to rationalize the behavior of the economy-wide aggregates with the choices made by a single agent.

Instead, Professor Carroll proposes to use the models that treat agents' heterogeneity explicitly, and follow the following approach:

- calibrate income uncertainty using household-level data;
- solve for optimal consumption behavior given preferences;
- simulate to generate wealth distribution;
- calibrate *ex ante* heterogeneity (in preferences, age, expected income growth, mortality risk) to match wealth distribution.

With the progress made recently in the development of numerical algorithms designed to solve such problems, and the rapid advancement of the computer hardware tools, this approach becomes increasingly feasible. Professor Carroll believes that this approach can deliver more plausible, understandable and informative answers for policymakers, and should eventually replace the 'representative agent' paradigm in macroeconomics.

DIFFERENTIAL IMPACT OF THE FINANCIAL CRISIS ON ECONOMIC AGENTS: EMPIRICAL EVIDENCE

There are important differences in the way the financial crisis has affected various economic agents. Professor Matthew Shapiro (University of Michigan) used his keynote speech to present his recent thought-provoking research in which he investigates the impact of the financial crisis on the well-being of older Americans. He finds large heterogeneity both in the impact of the financial crisis on this population group, and in their capacity to absorb it. In this research, Professor Shapiro relies on the data collected in the two waves of the Cognitive Economic Study (CogEcon), a survey conducted by the University of Michigan. This study provides baseline wealth measurements and very detailed information about the structure of households' portfolios for a representative sample of US individuals aged 50 years and older, and in addition, has a wide range of preference and cognition measures, including measures

of risk preference, expectations, financial knowledge and attitudes, and cognitive status, that should partially determine households' portfolio choices. The two waves of the CogEcon study provide a unique insight into the impact of the crisis on this group of Americans because of their timing. The first wave has been completed shortly before the financial crisis that began in the fall of 2008. The second wave was fielded in early summer of 2009. It re-measures some of the first wave's variables, but also contains many questions that assess the changes in circumstances, attitudes and plans that followed from the financial crisis.

The financial crisis had a negative impact on the stock market, directly affecting the stockholders. Higher wealth households on average have greater exposure to the stock market, and consequently have experienced greater wealth losses during the crisis. Professor Shapiro finds a positive relationship between cognitive skills among the people in his sample and both their wealth and their exposure to the stock market. Hence, he finds that on average people with high cognitive skills experienced larger financial losses due to stock market decline during the financial crisis.

At the same time, he finds that those who displayed higher cognitive skills appeared to be better able to deal with the effect of the crisis. People with low cognitive skills were more likely to have experienced some form of financial stress – having late payments on a loan, being denied credit, losing a home or a property due to a bank foreclosure etc. To some extent, this can be accounted by the fact that those with low cognitive skills were more likely to have low wealth, and thus lacked a financial buffer.

Interestingly, financial crisis had a non-monotonic effect on the plans to postpone the retirement for people with different starting wealth. The mean increase in reported planned work years was 1.32. The response was greater for those with greater capital losses from the crises (typically, the people with larger starting wealth). However, those with no wealth showed as big a mean increase in years worked as those with substantial losses.

There was a similar non-monotonic response in consumption. Professor Shapiro argues that consumption is likely to be a good measure of the overall well-being for this population group. They are typically no longer on the upward-sloping part of the life-cycle earnings profile, and should not be liquidity constrained. Thus, changes in consumption should closely track changes in lifetime resources. Overall, consumption in the CogEcon sample dropped by 3 per cent in response to the crisis. Those who lost more wealth report larger declines in consumption. However, those who have

little wealth look more like those who had big losses than those who had more modest losses. The response of consumption to the crisis was fairly flat across the levels of cognition, which suggests that there might have been offsetting factors related to cognitive capacity – high exposure to the stock market among the high cognition group might have been offset by a greater capacity of high cognition individuals to buffer shocks.

Multivariate regression analysis shows that after controlling for financial losses which are positively correlated with having high cognition, high the cognition status appears to be a buffer against consumption declines during the crisis, and high cognition group does distinctly better in terms of the consumption response to the crisis compared to the middle and low cognition groups.

Several other papers presented at the workshop added further insights into different aspects of the financial crisis' impact on different economic agents. Békés et al. (2011) use the data from the European Firms In a Global Economy (EFIGE) to document the impact of the crisis on firms in 7 European countries – Austria, France, Germany, Hungary, Italy, Spain and the UK. They find that even though the crisis had a large negative effect on firms on average – it led to a 12 per cent decline in sales, 11.6 per cent decline in export volume and 6 per cent of their workers were laid off, the firm response was quite diverse. In fact, more than a quarter of the surveyed firms experienced no decline in their sales. The response was similar across different industries, and across the firms of different sizes. Exporting firms appear to be affected more – an average exporter experienced a 3.2 percentage points larger decline in sales than an average non-exporter within the same country. Firms that outsource some part of their production and firms that control other companies did better during the crisis. Outsourcers witnessed a 1.8 per cent smaller reduction in sales. Firms that are controlled by other companies have reduced their sales by 4.2 per cent more than the average. On the other hand, firms that control other companies at home or abroad were able to preserve more jobs. They also find that firms relying on external finance suffered a greater decline in sales. However, this effect was quite modest – firm that rely on external finance suffered an additional 1 per cent reduction in sales compared to firms that rely more on internal funding. At the same time, they do not find any significant effect of the use of trade credit.

Demyanyk et al. (2012) investigate whether the decrease in house prices in the US has led to a lower labor mobility. This has become a popular hypothesis attempting to explain, at least partially, the rise in unemployment in The

US during the crisis, finding support both in academic articles and in the popular press (for example, in *The Economist*, August 28, 2010). In their analysis, the authors use an extensive dataset from one of the three major Credit Bureaus in the US, TransUnion, which contains a large number of credit characteristics for consumers who had at least one non-agency securitized mortgage at any point in time between April 2005 and December 2010. This dataset was merged with the mortgage loan-level LoanPerformance Securities database provided by CoreLogic. This allowed the authors to obtain both the individual and loan characteristics. They also tested the robustness of their findings using the data from another major Credit Bureau – Equifax. In this paper, the authors do not find evidence of negative home equity locking households into their local labor markets and preventing them from moving to regions with better job prospects. To the contrary, they find that individuals with negative equity are more likely to move, in particular if the amount of negative equity is large, exceeding 20 per cent of house values, and that potential costs associated with disposing of an underwater property are outweighed by the benefits of obtaining a job.

Haltenhof et al. (2012) examine how firm and household access to credit has affected manufacturing employment in the US. Using a variety of micro and macroeconomic data, they conclude that access to credit has affected employment in the manufacturing sector mostly through changes in the average size of establishments, that household access to finance matters more than firm access to loans for employment dynamics, but that both credit channels (for firms and households) appear to have been economically significant in the Great Recession.

Masier and Villanueva (2012) investigate the heterogeneous consumption of homeowners to the changes in loan conditions in Spain. According to economic theory, consumption of unconstrained homeowners should respond to the interest rate, while consumption of credit constrained homeowners is influenced by the size and timing of payments (mortgage maturity). The authors find that the consumption of households headed by an individual with a high school education responds more to mortgage maturity than to the interest rate, while the consumption of the rest of indebted households is insensitive to loan maturity.

Benczúr et al. (2012) use the data from the Hungarian Household Budget Survey from 1998–2008 and estimate the response of labor supply to taxation and transfers at the extensive margin. This is particularly relevant for Hungary, given that the recent (and possible future) fiscal reforms here are centered around labor market activity, and given a very low participation rate in Hungary. Unlike most of the

literature, they provide a unified treatment of taxes and transfers. They find that some subgroups that are highly responsible for Hungary's low participation rate (low-skilled, women at child-bearing age, elders) are relatively highly responsible to tax and transfer changes.

Endrész et al. (2012) investigate the issue which is very relevant for Hungary – the problem of foreign currency (FX) borrowing and currency mismatch in the balance sheet of firms. The ratio of FX loans relative to export in Hungary is not very high compared to other countries have experienced balance sheet type financial turmoil (Argentina in 2000, Mexico in 1994, Thailand in 1996). However, using a firm-level dataset, they find substantial heterogeneity among firms in Hungary. A significant share of firms with large FX debt has no natural hedge, i.e. no FX revenues from export. These firms exposed to currency mismatch had a sizeable share both in real aggregates and on the loan market before the crisis. Firms with currency mismatch tend to be larger and more indebted, which suggests that FX borrowing might have eased their liquidity constraint before the crisis. During the crisis balance sheet effects were likely to be triggered by the large depreciations. Firms with FX loans tended to have a larger decrease in the probability of making profit, a larger fall in investment, and were more likely to go bankrupt.

Beckmann et al. (2012) cast more light on the problem of foreign currency borrowing in Eastern European countries. They study the household sector FX debt, investigating the determinants of household arrears in these countries. Their findings suggest that FX loans increase loan arrears in countries that experienced currency depreciations, however, this increase is relatively modest. In addition, they find that arrears for both foreign and domestic currency loans are substantially higher in countries that experienced currency depreciation compared to non-depreciation countries, which suggests that, in addition to adverse balance sheet effects, currency depreciation have negatively affected loan repayments through other mechanisms, such as decreased households' income.

MODELLING MICROECONOMIC BEHAVIOR AND ITS MACROECONOMIC CONSEQUENCES

Several of the papers presented at the Workshop have explicitly modelled heterogeneous micro-level behavior of economic agents and investigated how it affects macroeconomic dynamics in different sectors of the economy, such as corporate finance, housing market or the banking sector. Motivated by the observed dynamics of the corporate finance structure in Europe during the last two

decades, and in particular during and after the financial crisis, De Fiore and Uhlig (2012) develop a model with heterogeneous firms that optimally choose between two sources of external finance – bank loans or debt securities. In their model, there is a continuum of ex ante heterogeneous firms who receive 3 types of productivity shocks. The first shock is public knowledge, and introduces ex ante heterogeneity. The second shock can only be revealed before the production at some cost. The last shock is known only to the entrepreneur after production, but can be monitored by an outsider at some cost as well. The firm needs to obtain a loan to pre-pay the factors of production. There are two types of financial intermediaries – banks that are willing to spend resources to acquire information about an unobserved productivity shock, and ‘capital mutual funds’ which intermediate bond finance and are unwilling to incur information-acquisition costs. Because information acquisition is costly, bond issuance is a cheaper but riskier instrument of external finance. In equilibrium, the firms that experience ex ante low productivity shocks and thus high risk of default choose to abstain from production and not raise external finance, which allows them to retain their net worth. Firms with relatively low risk of default choose to issue debt securities because this is the cheapest form of external finance. Firms with intermediate risk of default decide to approach banks, because they highly value the option of getting further information before deciding whether or not to produce. The authors consider the impact of three aggregate shocks that are designed to mimic the impact of the financial crisis: an increase in the ‘iceberg’ cost of obtaining bank financing, a decrease in capital quality and an increase in uncertainty. The results that they obtain can qualitatively replicate the changes in the composition of corporate debt which has been observed in the data during the crisis. In response to each of the aggregate shocks, their model produces a fall in the ratio of bank loans to debt securities, as a larger share of firms with high ex ante risk of default finds the cost of external finance too high and chooses not to produce. At the same time, a larger share of firms that experience intermediate realizations of the firm productivity shock find the flexibility provided by banks too costly and decide to issue bonds instead. This, in turn, increases the costs of both bond and bank finance. Bond finance becomes more costly as the quality of the pool of market-financed firms deteriorates. Similar effect obtains for the costs of bank finance, as the share of firms with low risk of default that move from bank finance to bond finance more than compensates the share of firms with high risk of default that move out of banking and decides not to produce. They can also quantitatively match the responses observed during the financial crisis when all three aggregate shocks are simultaneously introduced. Finally, they find that the firms’ ability to shift

between the two sources of external finance can smooth the effect of the aggregate shocks on the aggregate investment and output.

Forlati and Lambertini (2012) document the increase in ‘exotic mortgages’ during the pre-crisis period (2004–2006) in the US. The distinguishing feature of these ‘exotic mortgages’ is low early amortization – the reduction in borrowers’ initial monthly payments. They build a model with housing and endogenous default, and use it to evaluate how the introduction of such ‘exotic mortgages’ has impacted the housing market, and whether it could have exacerbated the effects of the mortgage default crisis. They model the crisis as the sudden increase in the variance of the idiosyncratic shock to the house value (which they call ‘mortgage risk shock’), relating it to the entrance of subprime borrowers in the mortgage market. They find that low early amortization increases housing demand, housing prices and the leverage ratio. At the same time, it amplifies the macroeconomic effects of the mortgage risk shock. This happens both through the steady-state effects – higher loans and housing stock lead to larger negative wealth effects following the shock, and through the dynamic effects, as borrowers strategically postpone default. As a result, there is lower default during the early periods of the mortgage life (when the consumer has to pay smaller payments and still enjoy the housing services), but much higher default in the later periods. There is also a negative second-round equilibrium effect, as both consumption and housing prices fall.

Caggese and Perez (2012) develop a model with financial and labor market frictions, and analyze the aggregate implications of the precautionary behavior of firms and households. In their model, financial frictions generate costly bankruptcy risk for firms and limited insurance against unemployment risk for workers. Precautionary decisions of households and firms interact to significantly amplify the effect of financial factors on aggregate output and unemployment.

Bluhm et al. (2011), motivated by the widespread concern about the increased systemic risk during and following the financial crisis, develop a dynamic network model with heterogeneous banks, whose links emerge endogenously from the interaction of their optimizing decisions and an iterative tatonnement process that determines market prices. They assume that banks hold liquid assets in the form of cash and deposits, and lend to each other in the interbank market to invest in non-liquid assets, such as bonds or collateralized debt obligations. At time zero, banks differ in their returns on non-liquid assets due to different information and administrative costs. This leads to

heterogeneous optimal portfolio allocation, and hence to demand and supply of bank borrowing and lending. The resulting banks' links are given by the cross-lending and borrowing in the interbank market. The authors use their model to investigate the systemic risk. They model contagion as a result of the transmission of shocks to non-liquid assets. Since banks are interlinked through the counterpart exposure in the interbank market, a defaulting bank transmits losses to creditor banks. At the same time, there is an indirect contagion through fire-sales – a negative shock in the value of non-liquid assets induces several banks to de-leverage, which produces a fall in the market price and a cascade of losses in marked-to-market balance sheet of all other banks. They also investigate the impact of prudential policies – an increase in the capital requirement ratio and a Pigouvian systematic risk tax. They find that the increase in the capital requirement makes financial system less interconnected and more homogenous. They also find that the Pigouvian tax is an adequate measure that reduces systemic risk, but its effect is non-monotone on all banks. They also find that there seems to be a trade-off between banks' stability and banks' investments in non-liquid assets, which they interpret as banks' links with the real economy. Thus, their results indicate that higher stability may come at the cost of a lower provision of financial products and services to the real economy.

CONCLUSIONS

The event presented an excellent opportunity for researchers who work in various areas of macroeconomics to present their work which documents the importance of agent heterogeneity and microeconomic behavior during the financial crisis. The two keynote speeches and the papers presented at the workshop made a strong case for moving towards incorporating agent heterogeneity in the standard macroeconomic models, arguing that this can strongly enhance our understanding of the aggregate economy and devise better policy responses to the crisis. In addition, lively formal and informal discussions during the workshop have provided a lot of interesting ideas for future research.

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