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INTRODUCTION

The three excellent papers raise interesting and relevant issues, some of which I will reflect upon here in writing. I agree on the importance of collecting and using micro data. The need for relevant micro data is constantly increasing, and the general awareness of the benefits is growing as well.

As mentioned by Mr. Knot, Mr. Kenç and Mr. Carstens, an important use is the possibility to inform new regulation – both the preparatory work and analysing the effects following implementation. Without micro data supervisory authorities may have to rely on second best information such as the stated practices, which might differ from actual practices. The use of detailed micro data would, therefore, potentially improve the quality of new regulation.

An issue raised by Mr. Knot is the fact that micro data includes information on customers, which is sometimes even more detailed than the institutions have stored themselves. As a means to support financial stability, it is important to share relevant information between authorities and the financial sector – e.g. by providing institution level feedback loops to the financial institutions in order to increase their knowledge of own business and benchmark against the rest of the sector. Feedback loops with data for individual borrowers should also be considered, but may face legal and other constraints.

Mr. Kenç describes some of the measures Turkey has undergone in order to improve macroprudential policies, and how micro data has proved useful e.g. when analysing data by subsectors or instruments. I can only agree that the entire distribution, including the tail end and subcomponents are equally relevant from the point of macroprudential policy.

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One of the main benefits of micro data is allowing for improved analyses of current potential risks and the build-up of new risks, where the risk relates to the distribution of exposure as much as with aggregate numbers. This improves authorities' capabilities to evaluate whether or not to react to potential risks. Likewise they will have a stronger platform for necessary measures. All three articles contain relevant examples of the above, e.g. Mr. Carstens mentions an example of the increasing credit card sector risks in Mexico in 2007 which were managed in a timely manner due to the availability and use of micro data.

In the following I will reflect on some of the general issues in the articles and reflect on some Danish experiences on the use of micro data and what lies ahead.

DESIGNING NEW REGULATION

Micro data – when available – may be used to a higher degree ahead of designing new regulation. As an example, without readily available micro data, the levels chosen for a recently introduced supervisory guidance on loan-to-value (LTV) and loan-to-income (LTI) in Denmark took into account anecdotal evidence in terms of what the large players in the market stated was current or best practice. On that basis the new supervisory guidelines were not expected to deviate from current practices. However, following implementation, the new requirements reportedly had some effect leading to tighter credit policies according to both our bank lending survey and real estate agencies.

From a macro perspective, estimates of the effects of high debt ratios on the economic cycle should also be considered, when deciding an appropriate level for LTV or LTI limits. For instance, in Denmark following the decline in house prices 2009-11 we have found a substantial negative consumption effect from individual households having high LTV ratios ahead of the crisis, cf. later. While by far most households, including those stressed in this respect, continuously serviced their debt they cut back substantially on private consumption, implying the existence of a negative "debt externality". This adds to the need for careful lending and the way in which such needs are communicated.

With the introduction of the upcoming Danish credit registry, the calculations used to determine and assess appropriate risk weights for the specific exposure to a sector may also become more precise, as it will become possible to stress test the actual borrowers and calculate potential losses.

SHARING RELEVANT INFORMATION BETWEEN AUTHORITIES AND THE FINANCIAL SECTOR

Receiving detailed micro data from financial institutions may result in having more detailed information about borrowers than the financial institutions have themselves.

Due to Acts on the processing of personal data, we may face legal issues regarding the

possibility of feedback loops containing detailed data for each borrower. However, to support financial stability, it is important to share relevant information between authorities and the financial sector. By providing institution level feedback loops to reporting entities, it is possible to increase the financial institutions' knowledge of the fundamentals of their customers – also compared with those of other financial institutions.

In Denmark we provide feedback loops on institution level on most statistics with varying degrees of details. Reporting institutions to our MFI-statistics receive benchmark information on both balance sheet items (shares of the market) and interest rate levels. In 2014 we implemented a new detailed micro statistics on pension savings where the feedback loops are far more advanced. By combining the individual based pension savings with registry data from the Danish National Statistical Institute (NSI), it is possible to provide feedback loops on institution level divided into income intervals, type of family, type of housing etc. We also provide aggregated information on the amount of pension savings the customers of a particular institution hold in other institutions (without revealing their identity). The information is inter alia used to improve advising of groups of customers on pension matters. Institution level feedback loops hereby provide reporting agents with valuable information in return for the work they invest in the reporting task.

RESPONSIBILITY WHEN COLLECTING DETAILED DATA

We should also strive for the harmonisation of data across institutions – both domestic and across countries. Due to differences in the structure of national financial systems it is difficult to harmonise all data requirements across countries. However, the establishment of the European credit registry, AnaCredit, is a step in the right direction. The harmonisation of data supports efficient collection of data. It becomes possible for different authorities to join forces and share data, rather than burden each institution with requests for similar data. The collection of cross border data also becomes easier with more harmonised data. The financial sector will benefit from the highest possible harmonisation of reporting requirements. Similarly, from a user perspective, we should also strive for consistency between micro and macro figures in order to generally improve the basis for economic analysis. One of the great benefits of micro data is the possibility to further understand developments in the macro figures, but this requires consistency between the two.

It is always a great analytical advantage to have long time-series. This implies that we should strive for establishing consistency over time for the most relevant micro data. This also adds to the need for simplifying the reporting burden, so that reporters do not have to frequently adapt their systems to new requirements. It might be necessary to collect additional data sometimes, but ad hoc reports should be avoided as much as possible.

With detailed data follows responsibility to use it in order to examine economic and financial developments and identify possible risks. However, it carries a similar, if not higher responsibility, if otherwise deciding not to collect important data. With a mandate to ensure financial stability we have to collect data which can potentially help identify the build-up of systemic risks.

Micro data also has some HR implications. In order to derive the maximum advantage from the micro data it is important to train employees in the use of micro data and employ economists with micro econometric skills.

MICRO DATA IN DENMARK

The Danish NSI has a long history of collecting registry data for the entire population and making it available to researchers on an anonymised, individual level. The data is collected from many sources and administrative registries. Data collected from tax records contains exact information on income, all interest received and paid, dividends and other capital income, size of financial assets, and debts. Other sources such as work places, health registry, and property registry provide a large variety of other variables, e.g. number of sick days, number of days in the hospital and information on owned properties, highest level of education, type of family (single/couple, with/without children) and house type (owned or rented). Included is also the knowledge in *inter alia* current or past records in these respects of relatives, *inter alia* parents. Having data provided by official registries leads to high quality data covering all Danes, which provides an exceptional foundation for detailed micro analyses on Danish households. In general registry data on households is only available after a lag of two years. However, there is long time-series for most registries; some data is available as far back as 1970. Hence, it is possible to analyse different economic and generational cycles.

Several newer collections of data include data on mortgage banks loans and pension savings. Detailed data for mortgage bank loans to private individuals is available from 2009 and contains e.g. data on fixed/variable interest rates, term to maturity, deferred amortisation and fixed-rate period. Data on private pension savings (total private pension savings exceed some 150 per cent of GDP) started in 2014 and contains detailed information on all pension savings, including type of pension, taxation of the pension, and when a person can receive the pension. Detailed data on mortgage deeds is available in an online registry, and will soon become available in an analytical setting. Since micro data on mortgage bank debt and pension savings is reported directly it is available with a considerably shorter lag than registry data. Data on mortgage loans is available after 3 months and pension savings is available after 6 months.

The use of micro data when considering macroprudential analyses increased during the financial crisis with the collection of the data on households' mortgage bank debt which combined with registry data provides a very solid foundation for analysis on

households' mortgage debt. However, mortgage debt is the most secure part of household's debt and may well be the last type of debt on which households in financial distress violate their obligations. Information on households' other debt, primarily in universal banks, is therefore also of great interest from a financial stability point of view – partly because a failure to service bank debt may increase the risk of not servicing mortgage debt in the future. This kind of analysis will become possible with the establishment of a Danish credit registry, where financial institutions are planned to start reporting from the second part of 2019. This will also provide the possibility to stress test each financial institution more accurately. Finally the establishment of a credit registry will shorten the lag of data availability for a broad set of variables related to households.

We have until now less information on Danish non-financial corporations' debt, compared to households' debt to mortgage banks, and thereby their effect on financial stability. However, the (small and medium sized) Danish financial institutions that failed during the financial crisis did not fail due to consumer lending but due to risky exposure to non-financial companies in particular companies involved in the real estate market, e.g. property speculators and building and construction companies. Based on this evidence, more detailed information on non-financial corporations' debt is clearly needed from a financial stability perspective. With the establishment of the Danish credit registry it will become possible to stress test non-financial corporations and thereby examine the effects on the financial institutions, including whether some are overly exposed to sectors particularly vulnerable to certain economic shocks. Hence, this is a very important contribution from the establishment of a credit registry.

Even with the establishment of a credit registry we still lack information on debt given outside MFI credit institutions (which may be regarded as shadow banking activity). In 2017 Danmarks Nationalbank will receive detailed information on both household and business mortgage deeds from both MFIs and non-MFIs, which covers part of this shortage. It will be possible to combine this data with business registry information and real estate registry data. This new data will improve our knowledge of the underlying collateral for mortgage loans, provide information on property-based shadow banking credit activity and support the analysis of business lending related to mortgage deeds, which was an area that contributed to the failure of some financial institutions during the financial crisis.

RISK ANALYSIS BASED ON MICRODATA – SOME EXAMPLES

The following gives a brief summary of four practical examples of risk analysis based on Danish microdata available until now.

a. Stress-testing households against higher interest rates and unemployment

Through information on average consumption and each household's income, interest payments and debt levels it is possible to estimate a financial margin. If the financial margin is negative, we define the household as being financially vulnerable. Stressing households through increased interest rates on debt shows that most households can handle quite substantial temporary increases in interest rates. In the case of more persistent interest rate changes effect would grow. Stressing through employment shows same kind of robustness of households; e.g. if the household's main provider becomes unemployed for 3 or 6 months by far most households can manage this.

b. Stress-testing households against major economic shocks

Based on information on households in arrears of their mortgage bank debt (such arrears have always been at very low levels below one per cent and even for the most vulnerable groups below 2-3 per cent), we can observe the correlation between the risk of arrears and a large number of family specific variables such as employment, income, liquid assets and other assets, education, geographical location and even divorce and sickness. Assuming that a change in such variables affects the probability of arrears accordingly, we can simulate the impact of shocks corresponding to respectively the oil crisis in the 1970's and the financial crisis in 2008-2010. The result suggest that even through a two-year stress period only very few households fall into arrears on their mortgage bank debt and they do not pose a direct threat against financial stability.

c. The consumption impact of debt levels

Danish households have one of the highest debt-to-income ratios in the world. However, they also have high asset ratios both in terms of financial assets and housing leading to net debt levels being on average compared to the OECD countries. That triggers a need for understanding both the distribution of debt and assets and the overlap between them at the individual level. The stability risk attached to high debt levels decreases with the extent to which the very same indebted households also hold large financial assets. In fact, studies on micro data show that the households with high debt ratios most often also have both high income and high asset ratios. A large share of "indebted" households also holds large assets, cf. annex 1. Very likely the massive build-up of private pension savings has allowed newer generations to enter retirement with higher debt levels than previous generations would have had.

Nevertheless, the combination of asset and high debt levels – the inflated balance sheet of households – and the very low probability of arrears triggers the question how households adjust consumption levels in case of house price volatility.

There was a large aggregate drop in consumption following the financial crisis and a collapse of the housing bubble until 2008. The available micro data shows that especially households with high LTV ratios ahead of the crisis lowered their consumption following 2008, even if their growth in both income and asset values turned out more

favourable than for other households. To some degree this effect may reflect a normalisation following excessively high consumption for these households during the years of overheating. Actually consumption ratios of groups with initially high LTV's converged to the almost constant level of consumption ratios as households with low LTV. However it also appears that consumption dropped the most for households with high LTV's even if their income and net asset positions were the same as for others. Overall this micro-evidence suggests that avoiding high LTV's for households in good times could help obtaining a more stable macroeconomic development.

d. The impact of interest-only mortgages

Around half of the households' mortgage debt is interest-only, and those having such debt most often have interest-only on their entire mortgage debt. In addition many have high LTV-ratios, partly due to the falling real estate prices from 2008 to 2012 in most parts of the country. Studies show that most households with interest-only loans have higher debt levels prior to obtaining interest-only loans, they obtain larger loans, and they do not amortise enough on other debt to compensate for the deferred amortisation on their interest-only loans. However, this result is mainly driven by young households, who may expect increasing future income, and retirees, who often have high asset levels and do not have as high debt levels prior to obtaining interest-only loans as the average borrower with interest-only loans.

An analysis of behaviour following the expiration of deferred amortisation improves the appearance of interest-only mortgage loans. On Danish mortgage bank debt it is possible to have up to 10 years deferred amortisation. Afterwards, the loan has to be amortised over a maximum of 20 years. If the LTV ratio is less than 80 per cent it is possible to refinance the loan with a new loan with 10 years deferred amortisation. Experience shows that most households start to amortise after the interest-only period expires. An analysis has showed that most households are capable of amortising their interest-only loans over 20 years. Assuming that the possibility to restructure loans is used when relevant, the share of households who have difficulties amortising their debt over 20 years only account for 1.5 per cent of the debt to universal banks and 1 per cent of the debt to mortgage banks. Hence, expiry of deferred amortisation poses no direct threat to financial stability.

ANNEX1. HOUSEHOLD DEBT AND ASSETS

The chart shows how the overall volume of gross debt is distributed across households according to the size of their holdings of three types of assets (bank deposits, total liquid assets and pension wealth). Hence, the chart shows how large a share of debt households, within each interval of assets, are liable for. Households with e.g. bank deposits below DKK 100,000 owe 57 per cent of total gross debt, while households with bank deposits above 1,000,000 owe 4 per cent of total gross debt. In comparison households with liquid assets above DKK 250,000 are liable for more than 30 per cent of total gross debt. It is also possible to see that the group of households, where the oldest member's age is between 50-59 years of age, has higher assets compared to debt. If we consider pension wealth (corrected for tax), households with low pension savings account only for a small share of the debt. The chart underlines the fact that gross debt is primarily found among the families with most financial assets, including pension wealth after tax.

