

Contents

EDITORIAL: Interaction of strategic complementarities in debt and financial market: sovereign debt fragility and banking instability	1
Information costs, inattentiveness and lumpy plant level investment dynamics	3
Liberalisation of financial markets in China	6
Events	8
Recent Bank of Finland research publications	9



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ISSN 1796-9131 (online)

EDITORIAL: Interaction of strategic complementarities in debt and financial market: sovereign debt fragility and banking instability

The most recent financial crisis has vividly demonstrated the possible existence of a 'diabolic loop'¹ between banks and sovereigns. Whereas in Greece it was the sovereign default that pushed otherwise solvent banks over the brink into insolvency, the 'diabolic loop' ran in the opposite direction in Ireland, where the government suddenly faced insurmountable obstacles in the attempt to obtain funding. Despite the relatively low level of debt at the start, the markets apparently became concerned about the magnitude contingent liabilities involved in a bailout of Ireland's insolvent banking system.

But what underlies the channels that transmit fragility between sovereign debt and banking markets, and how should we try to model those channels? This is clearly a vital question that has gained increasing emphasis in both academic research and policy debate ever since the idea that the vicious circle between government debt and the banking system has to be broken surfaced in the public debate as a key requisite for improving the current crisis management systems and as a means of lowering the probability of future financial crises. On the one hand Calvo (1988)² studies sovereign debt fragility in models where debt repudiation is possible. He shows that the existence of government bonds generates multiple equilibria. The key feature of Calvo's model is that the expected (partial) debt repudiation would tend to raise the interest rate on government bonds, while the larger the burden of the debt, the stronger the incentive to repudiate it.

On the other hand, Diamond and Dybig (1983) is the standard reference on a canonical model of banking instability. In that model households are either impatient or patient, and they can share liquidity risk through the banking system. Banks portfolio for households provides the needed liquidity and, at the same time, generates returns from longer-

¹ This is the term R. Cooper and K. Nikolov use for the vicious circle of banks and sovereigns hurting each other in their very recent paper *Government Debt and Banking Fragility: The Spreading of Strategic Uncertainty* (NBER wp No. 19278/2013).

² G. Calvo (1988) "Servicing the Public Debt: The Role of Expectations", *The American Economic Review* Vol 78, No. 4, pp. 64-661.

term illiquid investment projects. Therefore, banks face both liquidity and solvency risk, and the interaction between liquidity needs and illiquid investment can generate fragility in the form of bank runs. One of the critical features of the Diamond-Dybvig model is the sequential service constraint (first come, first served), which explains banking sector illiquidity and underlies fragility.³

In a very recent paper *Government Debt and Banking Fragility: The Spreading of Strategic Uncertainty* R. Cooper and K. Nikolov combine the two models alluded to above to analyze the interaction between government debt markets and the interbank market. Fragility in both markets means that they are excessively sensitive to fundamentals and prone to strategic uncertainty. The authors consider two channels whose interactions complete the 'diabolic loop'. The first one is the tendency of banks to hold mainly their own government's debt, as both a long-term investment and a source of liquidity. This feature is well supported by the evidence. The second channel is the outcome of explicit or implicit guarantees that governments provide to their banking systems.

The interaction between these two channels involves powerful feedback effects on the financial wealth of the sovereign. The authors model the possibility of sovereign default by assuming that the government's capacity to tax (investors' endowments) varies randomly so that in effect the debt market can switch between optimism and pessimism about the government repaying its debt. Pessimism is then transmitted to the banking system, which, in the case of reduced liquidation value of the long-term investment, can result in a collapse of the banking system, although the government does not *ex post* default on its debt. Providing implicit guarantees, via either deposit insurance or debt buy-backs, tends to worsen the government's sustainability problem, since these guarantees impinge adversely upon the price of public debt precisely at the least favourable times.

The authors also consider some simple policy alternative to break the 'diabolic loop'. One of these is to let the banking system fail. If implemented, this would reduce the need for bailout assistance and hence would for reduce the pressure on government debt during a sovereign crisis. However, as the authors argue, such a commitment is not credible for the well known reason that, under discretion, governments want to avoid the output losses associated with a breakdown of the intermediation process.

The paper by Cooper and Nikolov is an important step to understanding the strategic interaction between sovereign debt markets and interbank markets. The model incorporates a crisis amplification mechanism and powerful feedback effects on the financial health of the sovereign, which seem to be able to capture some of the developments observed during the European sovereign debt crisis. More research is of course needed to check for the robustness of the suggested mechanisms and outcomes. Abundant incentive for doing additional research in this area should exist, considering that the production of successful research is so highly rewarding.

Jouko Vilmunen

³ See e.g. N. Wallace (1988), "Another Attempt to Explain the Illiquid Banking System: The Diamond and Dybvig Model With The Sequential Service Constraint taken Seriously", *Federal Reserve Bank of Philadelphia Quarterly Review*, Fall, pp.3-16.

Information costs, inattentiveness and lumpy plant level investment dynamics

Do agents continually optimize dynamically? This is an important question because if so we would very likely observe them making small adjustments to their economic and financial plans based on publically available information that is continually updated. But this seems not to accord with what we observe in practice for most people. Intuition suggests that most people *choose* to ignore or not to use some freely available information when making decisions. More specifically, "rational inattention" models employ the idea that one's ability to translate external data into action is constrained by a finite Shannon" capacity to process information."⁴ An important question in this context is then whether we should abandon optimizing-based models of behaviour. Recent developments in economic theory clearly suggest that this is not the case.⁵

Models incorporating inattentiveness imply that the behavioural response of people to external information is both sluggish and erratic. This behavioural pattern is consistent with macroeconomic data in the sense that almost any set of macroeconomic variables will not display sharp and immediate responses to other macroeconomic variables. Of course, we do have macroeconomic models, mostly in the Keynesian tradition, that display inertial price level dynamics, but this specific form of sluggishness often implies strong responses of quantities to various shocks, including, in particular, policy shocks. Often in Keynesian models, price stickiness rests on the existence of simple (non-optimized) nominal contracts between the parties involved. Another explaining factor could be the physical costs of changing prices.⁶ Whatever the underlying reason, this implication of Keynesian models can be softened by introducing adjustment costs, but unless these adjustment costs introduce connections across variables in the degree and nature of the inertia, they find little support in one's intuition or in formal theory (Sims 2010, p. 2).

Instead of assuming that the imperfect adjustment of prices to news results from physical costs of changing prices or from the existence of nominal contracts, the inattentiveness approach acknowledges that people have limited information and limited ability to perform computations (Reis 2006, p. 793). This perspective emphasizes that there is a vast amount of information around us and that most of it comes with a cost, both in acquiring the information and in processing or interpreting it. The logic of this idea leads us to retain optimizing behaviour, but to introduce an additional constraint representing the cost agents must pay "to acquire, absorb and process information when forming expectations and making decisions" (Reis 2006, p. 294). Hence, agents rationally choose to be inattentive, only updating their information and plans at optimally chosen dates.

⁴ C. Sims (2010, p. 2), "Rational Inattention and Monetary Economics", *Wp June 22*, www.princeton.edu/~sims/

⁵ See e.g. R. Reis (2006), "Inattentive producers", *Review of Economic Studies* 73(3), pp. 793 - 821 and R. Reis (2006), "Inattentive consumers", *Journal of Monetary Economics* 53(8), pp. 1761 - 1800, G. Mankiw and R. Reis (2007), "Sticky Information in General Equilibrium", *Journal of European Economic Association* 5(2-3), pp. 603 - 613, R. Reis (2009), "Optimal Monetary Policy in an Estimated Sticky-Information Model", *American Economic Journal: Macroeconomics* 1(2), pp. 1 - 28.

⁶ One can think of physical costs covering also the case of costs of changing contracts.

Although the micro-level evidence on the price dynamics of individual products, ie that prices tend to remain constant even for extended periods of time and, once they change, to jump up and down among a few specific price points, appears to accord well with the logic of rational inattention, one can argue that lumpy plant level investment activity reflects a behavioural pattern particularly representative of inattentiveness. There is, however, a challenge for the inattentiveness framework, if we want it to successfully explain investment adjustment at both plant and aggregate levels. The relevant background literature on investment dynamics makes a sharp distinction between smooth and gradual investment adjustment at the aggregate level versus infrequent and large or lumpy adjustment at the micro-level.⁷ Evidence from plant level data points to low or zero investment activity even for extended periods of time, interrupted by large adjustments, often referred to as investment spikes.

Implicit in the above discussion on the aggregate effects on imposing price rigidities is the idea that we need adjustment costs to sustain smooth aggregate adjustment. Hence, to account for lumpy plant level and smooth aggregate investment adjustments, a segment of the relevant literature has considered different specifications of physical capital adjustment costs. However, while a simple model of investment with *convex* adjustment costs is able to explain the observed smooth aggregate investment behaviour, *non-convex* adjustment costs faced by firms is the most common assumption incorporated in these models to account for the lumpy plant level investment dynamics. Non-convex adjustment costs essentially mean that firms invest only when the difference between existing and optimal capital stock is sufficiently large to justify incurring the adjustment costs.



Fabio Verona

In his recently published Bank of Finland discussion paper⁸ (18/2013) *Investment Dynamics with Information Costs* Fabio Verona takes an alternative approach based on inattentiveness to explain lumpy micro-level investment adjustment. Motivated by the conjecture according to which costs of acquiring and processing information and of planning could make investment lumpy at the micro-level even in the absence of non-convex adjustment costs, Verona develops a new model of capital adjustment which draws on recent behavioural models based on the assumption of costly information. The author also tests whether data on investment bears out the implications of his model.

As explained by Verona, the paper draws on two branches of literature, the first on investment in physical capital and the second on informational frictions in macroeconomics. After reviewing the relevant background literature and motivating his approach, Verona describes the benchmark frictionless investment model and a model with non-convex adjustment costs. Besides providing benchmarks, these models also provide a sharper contrast to his new model, which is based on the R. Reis (2006) model of inattentiveness. Before concluding, the author describes the plant-level capital adjustment dynamics implied by the models, tests their implications against US plant-level investment data and, after aggregating across inattentive firms, evaluates the ability of the inattentiveness model to match observed macro-level investment dynamics.

⁷ See e.g. R. Caballero (1999), "Aggregate Investment", in J. B. Taylor and M. Woodford (eds.), *Handbook of Macroeconomics*, Vol. 1, ch 12, pp. 813 – 862.

⁸ Accepted for publication in *Journal of Money, Credit and Banking*.

As explained above information cost - in terms of money and time spent obtaining, absorbing and processing information or the opportunity cost of spending time to think about and compute optimal plans - underlies inattentiveness. That is, inattentiveness is the *optimal response to such information cost*, since, as Verona explains (p. 4), agents rationally choose to update their information sets and to make plans only sporadically at optimally chosen dates, and to be inattentive to new information in between those dates. Hence, expectations conditional on old information continue to influence current decisions and agents only react to news or shock with a delay.

In the model of investment dynamics with the information costs constructed by Verona, the representative firm maximizes the expected present value of operating profits net of information costs. Consequently, if these information costs are zero, the firm chooses to be attentive at all times. In presenting the recursive formulations of the firm's problem in the relevant models, Verona notes that the formulation of the model of inattentiveness (p. 13) looks similar to the one of the models of non-convex adjustment costs (p.10). However, as he rightly argues, the firm's optimal decision to adjust, ie the stopping time T in the model of non-convex adjustment costs, is *state-contingent* whereas, in the model of inattentiveness, the inattentive firm decides to adjust at optimally chosen dates *regardless of the state of the economy*. Adjustment in the latter model is thus (recursively) *time-contingent* and is independent of the current state, but does depend on the state at the last updating.

Verona introduces a set of propositions to characterize his model's (testable) implications. One of them shows the dependence of the inattentiveness interval on the key structural parameters of the model: higher information costs will lengthen the interval, while increases in the sensitivity of profits to changes in the capital stock or higher volatility of the profitability shock will shorten the interval. All these comparative statics results are intuitive: eg the last one essentially says that it is costly for a firm to be inactive in periods of increased volatility. Another proposition describes the optimal capital adjustment policy under inattentiveness, which then gives rise to optimal investment strategy under inattentiveness.

After comparing the micro-level adjustment dynamics implied by the different models and showing, in particular, how the size and timing of adjustment differ in the model with fixed adjustment costs versus fixed information costs, Verona takes the models with adjustment and information costs to the data. Using standard calibration values, he employs the model to generate simulated capital and investment data for a panel of 2500 plants over 17 years. The results suggest that the investment model with inattentiveness is able to capture most of the salient features of plant-level investment behaviour in the US: apart from the discrepancy between the sign of the serial correlation in investment in the model versus the data, the model does well with negative and positive investment as well as with negative and positive investment spikes, although it does underestimate the inaction rate. However, Verona rightly notes that overall the evidence on the serial correlation is still mixed.

As for the aggregate investment rate, Verona uses post-WWII annual data from the US economy to assess whether the aggregate version of the investment model with information costs matches the second moments of the data. Overall, the inattentiveness model at the aggregate level does not perform as well as at the plant-level. Although aggregation irons out investment spikes and helps to generate positive serial correlation of investment rates, the model underestimates the persistence

observed in the aggregate data. One reason for this underperformance, as Verona also mentions, could be the partial equilibrium nature of the framework. In fact, in his companion paper (Verona 2011)⁹ Verona shows that a general equilibrium model with inattentiveness unambiguously improves upon the corresponding partial equilibrium framework in this respect.

The line of research that Fabio Verona is pursuing is both highly interesting and highly relevant. Inattentiveness or limited information does not mean we have to abandon optimizing models of economic behaviour. The limited information approach actually "argues that following the hallmark of economics of studying choice subject to constraints, information should be treated as a costly good" (Reis 2006, p. 794). Hence, the emphasis is on *rationally choosing* to be inattentive. Given this background, it is natural to explore the micro- and macroeconomic implications of inattentiveness in models that we routinely use. Furthermore, if the hypothesis of inattentiveness is favoured by empirical evidence, we should re-specify our models accordingly.

Jouko Vilmunen

Liberalisation of financial markets in China

China is currently undergoing reforms which will bring about major changes in the country's financial markets. In the summer of 2013, they ceased regulating interest rates almost completely. In the minds of many Chinese officials this could be seen as a response to market participants' conduct: A significant quantity of funding is channelled outside the formal banking system through so-called asset management instruments and notary credit. Ultimately, this corporate funding outside the banking sector is financed by Chinese banks. This circumvention of funding through sources outside the banking sector reduces transparency and thereby increases risks. Small private enterprises in particular use these external informal sources, since large banks appear to favour state-owned enterprises in their lending activities.

BOFIT is currently carrying out several research projects through which it is trying to analyse the liberalisation of the Chinese markets and the subsequent effects. In the Discussion Paper 'Informal or formal financing? Or both? First evidence of the co-funding of Chinese firms' (BOFIT DP 14/2013) Hans Degryse, Liping Lu and Steven Ongena show that small enterprises can speed up their sales growth by turning to informal sources for their financing. If state-owned enterprises obtain funding from informal sources, their sales growth is not affected. It would appear that small enterprises also benefit from using bank loans. Loans from banks are generally cheaper. However, informal lenders seem to be able to sort sound projects from the bad better than the formal sector can. Should China's liberalisation of the financial system to continue, the formal sector would need to do the same.

As part of a phased liberalisation of capital movements, the People's Bank of China (PBOC, the Chinese central bank) has entered into so-

⁹ "Lumpy Investment in Sticky Information General Equilibrium", *CFF.UP Wp 2011-02, Universidade do Porto, Faculdade de Economia do Porto*

called bilateral swap agreements with other central banks. With the help of these contracts the PBOC has committed itself to providing the central banks of 19 countries with renminbi-denominated liquidity up to an agreed limit (the total value of these agreements comes to over USD 300 billion). The intention is to promote the use of renminbi, particularly in international transactions. In their research project on 'China's RMB bilateral swap agreements: What explains the choice of countries?' (BOFIT DP 12/2013) Alicia Garcia-Herrero and Le Xia show that the familiar gravity model of international trade explains the probability of different countries setting up a swap line with China quite well: The closer the country is geographically to China, and the more it trades with China, the more likely it is to establish a swap agreement. Free trade agreements with China also increase the probability of establishing a bilateral swap agreement. An interesting observation is that China has a tendency to establish such agreements with countries that have restrictions on capital movements. This leads us to think that the central banks of these countries have a greater need for the international liquidity China is offering. Should China's liberalization of their capital movements continue, the number of bilateral swap agreements and their respective size will certainly continue to grow.

likka Korhonen

Events

First Bordeaux Workshop on Agent-Based Macroeconomics

Bordeaux IV University, Pessac, France, November 7-8, 2013

Organized by: GREThA (UMR CNRS 5113) and Bank of Finland

Agent-based models have become an important framework for analyzing complex macroeconomic dynamics resulting from the interaction of heterogeneous agents with bounded rationality. This framework frees the modeler from the constraints imposed by the substantive rationality, equilibrium, and rational expectations assumptions, and naturally provides alternative micro foundations to the analysis of macroeconomic dynamics, the emergence of complex aggregate behavior, the effects of economic policies. A strong flow of models have been proposed during the recent years and this workshop aims to draw an account of the main contributions of these developments, as well to discuss the perspectives for future research. **The deadline for submission is September 25, 2013.** Please see the call at the [workshop website](#).

Third CInSt Annual Banking Workshop – Banking in Emerging Markets: Challenges and Opportunities

Moscow, November 15, 2013

The Center for Institutional Studies, National Research University 'Higher School of Economics' (CInSt HSE), with the support of **the Bank of Finland Institute for Economies in Transition (BOFIT)** organizes 3rd Annual Banking workshop "Banking in Emerging Markets: Challenges and Opportunities". The workshop will be held on **November 15, 2013**, in HSE, Moscow. It is aimed at bringing together scholars involved with various aspects of banking in emerging markets, including but not limited to those of Central and Eastern Europe, CIS countries, Latin America and China.

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3 Oct 2013	Prof. Kaisa Kotakorpi University of Turku	(Title to be announced)

Research seminars organized by the Bank of Finland's research unit are held on the first Thursday of the month at 13.30–15 in Rauhankatu 19, 3rd floor big meeting room (unless indicated otherwise). Research seminars are open to all interested parties. Please register in advance at seminars@bof.fi by noon of the preceding day. For further information please visit the [seminar site](#).

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15 Oct 2013	Marek Dabrowski CASE	Impacts of and policy responses to the global financial crisis (2008-2009) on CEE countries
8 Oct 2013	Peng Wang Hanken School of Economics	Big fish in a big pond: direct foreign institutional investment in Chinese A-share markets
1 Oct 2013	Jie Zheng Netspar	Export credit insurance and trade promotion
25 Sep 2013	Maria Semenova Higher School of Economics, Moscow	Market discipline and interbank market: The case of Russia
24 Sep 2013	Alexey Porshakov Central Bank of Russia	BEER and its fundamentals: The case of Russia

The seminars are open to all economists interested in the subject areas covered. You need to pre-register for the seminar with Ms India Roland (firstname.lastname@bof.fi, phone + 358 10 831 2268). For further information please visit the [seminar site](#).

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17/2013

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16/2013

Fabio Verona: [Lumpy investment in sticky information general equilibrium](#)

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