



UNSW  
THE UNIVERSITY OF NEW SOUTH WALES

LAW

**CLMR**

CENTRE FOR LAW, MARKETS AND REGULATION

**The implications of complexity for systemic risk in the  
superannuation system**

*Scott Donald, Bruce Arnold, Hazel Bateman, Ross Buckley, Kevin Liu<sup>1</sup>*

July 2014

**CLMR RESEARCH PAPER SERIES**

**WORKING PAPER NO. 13-3**

<sup>1</sup>

UNSW Law; Australian School of Business; Australian School of Business; UNSW Law; Australian School of Business respectively. The authors acknowledge the support provided for this research by the Centre for International Finance and Regulation under Grant EO33: *Identifying, monitoring and managing systemic risks in Australia's superannuation system*, and the University of New South Wales.

## **The implications of complexity for systemic risk in the superannuation system**

by Scott Donald, Bruce Arnold, Hazel Bateman, Ross Buckley and Kevin Liu

The funds, entities and regulators involved in the Australian superannuation industry together comprise a system that is complex and dynamic. The differentiation between roles and the distribution of responsibility offers the system as a whole resilience against local failure. However the interconnections that bind and constitute the system have the potential to create and transmit risks within the system. This undermines the system's resilience to exogenous shocks. This paper uses a new data set on 200 Australian superannuation funds to map and analyse those links as a first step towards assessing the nature and severity of the threat that the links pose to systemic resilience. It concludes by outlining some of the regulatory issues that arise.

## Introduction

The Australian superannuation system is rapidly becoming the centrepiece of Australia's financial markets. It is Australia's largest pool of investible capital and has most adult Australians as compulsory participants. It also enrolls a great many organisations, including funds, fund managers, custodians, administrators, actuaries and consultants in the delivery of investment vehicles specifically dedicated to facilitating the accumulation of retirement savings. The system is, as one of the key architects of the superannuation system described it, 'government sponsored but privately managed' (Coates et al., 2004: 12) The result is an interconnected and dynamic system of intimidating complexity.

Importantly, however, the lengthy roll-call of participants also suggests that the system may be diverse. Diversity, in turn, offers the prospect of resilience in financial markets, just as it does in ecosystems (Zolli and Healy, 2012, Kambhu et al., 2007, May et al., 2008, Haldane, 2009). Resilience is the capacity of a system to withstand external shocks and retain its essential characteristics; its identity (Buckley, 2009). Diversity within the system can assist the system as a whole to withstand shocks from exogenous forces even if individual component parts of the system fail in some way. That is to say, local perturbations need not translate into systemic failure. This is an important issue for a system with the social and economic importance of Australia's superannuation system.

On the other hand, linkages between component parts can mean that the impact of local failure can be felt on a much wider scale. Risks can propagate through the linkages. Risks may even in some circumstances be created or amplified by the linkages. This paper considers those possibilities. It starts to map how the structure of the system affects its ability to withstand different types of shock, by using a unique dataset from Australia in a rich sample of 200 superannuation funds, comprising approximately 98% of prudentially regulated assets in the system. In particular it demonstrates that the existence of different types of linkages between funds and their service providers reduces the diversity of the system in certain important respects. It also starts to consider the different types of regulatory responses that might be required to address these 'endogenous' sources of systemic risk. Importantly, the insights derived from the analysis, and the future avenues of research is inspired, extend well beyond the idiosyncrasies of the Australian superannuation system; they have potential application, adjusted for local conditions, in a wide range of other pension markets.

## 1. Constituting the superannuation 'system'

The superannuation system comprises a wide range of entities that interact in a variety of ways. These entities, and the interactions between them, can be said to 'constitute' the system in the sense that together they give it form.

The key institution in the system is the superannuation fund. A superannuation fund can take one of two basic forms: intermediated and self-managed. There are currently approximately 330 intermediated funds responsible for administering \$1,080bn on behalf of approximately 31 million member accounts, and approximately 500,000 self-managed funds holding \$496bn in assets on behalf of just under 1 million members (APRA, 2013e, APRA, 2013a). The excess of member accounts over the number of individuals employed in the workforce is attributable to individuals holding accounts simultaneously in multiple funds.

A modern superannuation fund is however a 'virtual' institution. In Australia it typically takes the form of a trust (Donald, 2011). It is of course axiomatic from a legal perspective that, unlike a corporation or a statutory body, a trust has no separate legal existence. Strictly it is a set of (equitable) obligations owed by an individual or individuals (the trustee or trustees) to another set of individuals (the beneficiaries, or in the case of a superannuation fund, the members) in respect of certain property held by the trustees. In the paradigm case, a trustee has responsibility for administering the trust personally. However the courts have for some time accepted that for practical reasons trustees may need to 'outsource' some of the activities required to administer the trust, so long as the trustee does not thereby purport to delegate its discretion (Lehane, 1995, APRA, 2012). As a result, the trustees of most superannuation funds today outsource at least some of these activities, especially those, such as member benefit administration, custody of the assets and investment management, in which there are economies of scale beyond the reach of individual funds or in which specialist skills are required (Bateman and Thorpe, 2007, Liu and Arnold, 2010). The typical superannuation fund, then, is not a discrete commercial entity, such as is commonly the case with a bank or insurance company in which core functions are vertically and horizontally integrated, but a collection of disparate entities, selected, directed and monitored centrally by the trustee of the fund.

Taking this a step further, analysis of the superannuation system, then, must encompass not just the trustees of superannuation funds but also the constellation of entities that assist the trustees to administer the funds. It is obvious that the relationships between the funds and these other entities create bilateral dependencies between the funds and their service providers. Importantly also, however, the prevalence of outsourcing creates indirect links between the funds, articulated through the links each outsourced service provider will most likely have with multiple other funds. This raises the possibility that a failure of some kind in one of the service providers, or even one of the funds, could have widespread and perhaps even systemic effects. As we shall see, though, assessment of this threat requires close attention not just to the existence of the linkages but to their nature. The mere fact of a connection between two entities does not say very much about how different types of risks will in fact be allocated or transmitted between them. To understand the internal dynamics of the Australian superannuation system it is necessary to understand and recognise the sometimes subtle role played by legal definitions, institutional form and operational practices in defining, locating and transforming risks at a local level.

A note of clarification is warranted at this point. The phenomenon under examination here has been characterised consistently in this paper as a 'system' rather than a 'network', 'industry' or 'market'. That is no accident. There are clearly a great many networks at play in the superannuation system, as in other commercial contexts. There are also a great many different types of networks. There are networks of trustee directors and networks of contractual relationships, for instance. It is also true that the information flows in the system and the financial markets in which superannuation funds invest could be conceptualised as networks. The various networks are overlaid on each other and interact with each other to constitute the system. Describing the phenomenon as a 'system' permits recognition of the simultaneous operation of these networks. It also permits consideration of the possible interaction between the various networks.

Similarly, the term 'industry' is inadequate in the context of this paper because the analysis presented here extends beyond an analysis of the private sector actors offering their products and services to individual consumers. It encompasses both those types of actors but it also encompasses the processes and interactions between them, and indeed the rules that guide the interactions between the participants.

Finally, to characterise the phenomenon as simply a 'market' would be to misconceive the nature of some, at least, of the motive forces that animate it. In particular, it underemphasises the importance of the public policy objectives underpinning the system. That is not to say that the competitive pressures that animate a 'market' do not play a role. They do. However there are other influences on the behaviour of the actors that are vitally important and must therefore also be considered.

What, then, of the notion of a 'system'? Meadows describes a system as 'an interconnected set of elements that is coherently organised in a way that achieves something' (Meadows and Wright, 2008). This description highlights that a system is constituted both by the elements present in the system as well as the interconnections between those elements. Moreover it is possible to distinguish between those interconnections that have the character of 'transactions' between the elements and those of a higher level of abstraction that govern the nature of those transactions, which might be termed 'meta-connections'. The term transaction here extends beyond its colloquial meaning to encompass a broader set of interactions, including, for instance, direct and indirect communication between the actors. The rules comprising the regulatory scheme governing the superannuation system, the social norms that influence participant behaviour and market modalities such as competition and innovation, are examples of such 'meta-connections'. As such, 'system' is a more accurate and fertile characterisation of the phenomenon under examination in this article than any of 'network', 'industry' or 'market'.

## 2. 'Systemic risk' in the superannuation context

The notion of 'systemic' risk in financial markets has attracted much attention in recent years (Allen and Gale, 2000, Gai et al., 2011). The global financial crisis of 2008 provided a stark reminder that risk cannot always be absorbed and distributed purely by price action on securities exchanges and other markets. For instance, limited liability means that debt interests simply disappear when firms fail for insolvency, markets fail to clear (at any price) when liquidity dries up and risks can be transmitted over time from one market to another by the institutions involved in them.

This latter sensibility is well described by Besar et al (Besar et al., 2011: 196):

'A systemic risk materialises when an initial disturbance is transmitted through the networks of interconnections that link firms, households and financial institutions with each other, leading as a result, to either the breakdown or degradation of these networks'

Notably, there is no reference to the size of the risk. Clearly there are some exogenous shocks that are of such a magnitude that their occurrence would affect the whole financial system. Default by a major sovereign borrower (as occurred in Argentina in 2002 or Russia in 1998), temporary closure of a securities exchange (as occurred following the terrorist attacks in September 2001) or removal of a currency from an exchange rate regime (as occurred when Sterling was removed from the ERM in September 1992), are examples of such shocks. They are inescapable simply because of their magnitude (Ladley, 2013 applies this to interbank lending). The primary focus here is however on the way in which the effects of a relatively small, local disturbance are transmitted across the networks that constitute the system in such a way that its ultimate effect is far greater than is suggested by its initial manifestation.

The other notable element of the definition offered by Besar et al is the criterion employed for identifying a risk as systemic: that it results in breakdown or degradation of the network. The focus then is not on fluctuations in securities prices, but on the functioning of the network itself. There may indeed be coincident price volatility, but a risk is systemic in the context of the analysis here when its occurrence threatens the functioning of the network and hence its ability to achieve its objectives.

What then is the objective of the superannuation system? Stripped to its essentials, Australia's superannuation system exists to administer the process of accumulation of capital by individuals. The various institutions collect and invest monies on behalf of individuals, and then return monies according to some pre-determined calculation (different depending on the nature of the scheme) to those individuals (predominantly) upon retirement. This is of course distinct from the policy objectives, such as nation building and the transfer of responsibility of providing retirement incomes to individuals, that underpin the measures taken by the government to promote use of the system by citizens and the economy. What we are concerned with here is the way that the system provides the instrumental capabilities required to administer that process of capital accumulation.

To examine systemic risk in the Australian superannuation system, we have constructed, for the first time, a database of superannuation linkages, by collecting and matching fund and service provider arrangement information for all superannuation funds from publicly available annual reports. The linkage data was extracted from each of the superannuation fund's annual report for the financial

year ending 30 June 2012. This results in a sample of 635 pair-wise linkages for 200 superannuation funds representing 98% of Australia's total prudentially regulated pension fund assets in 2012.

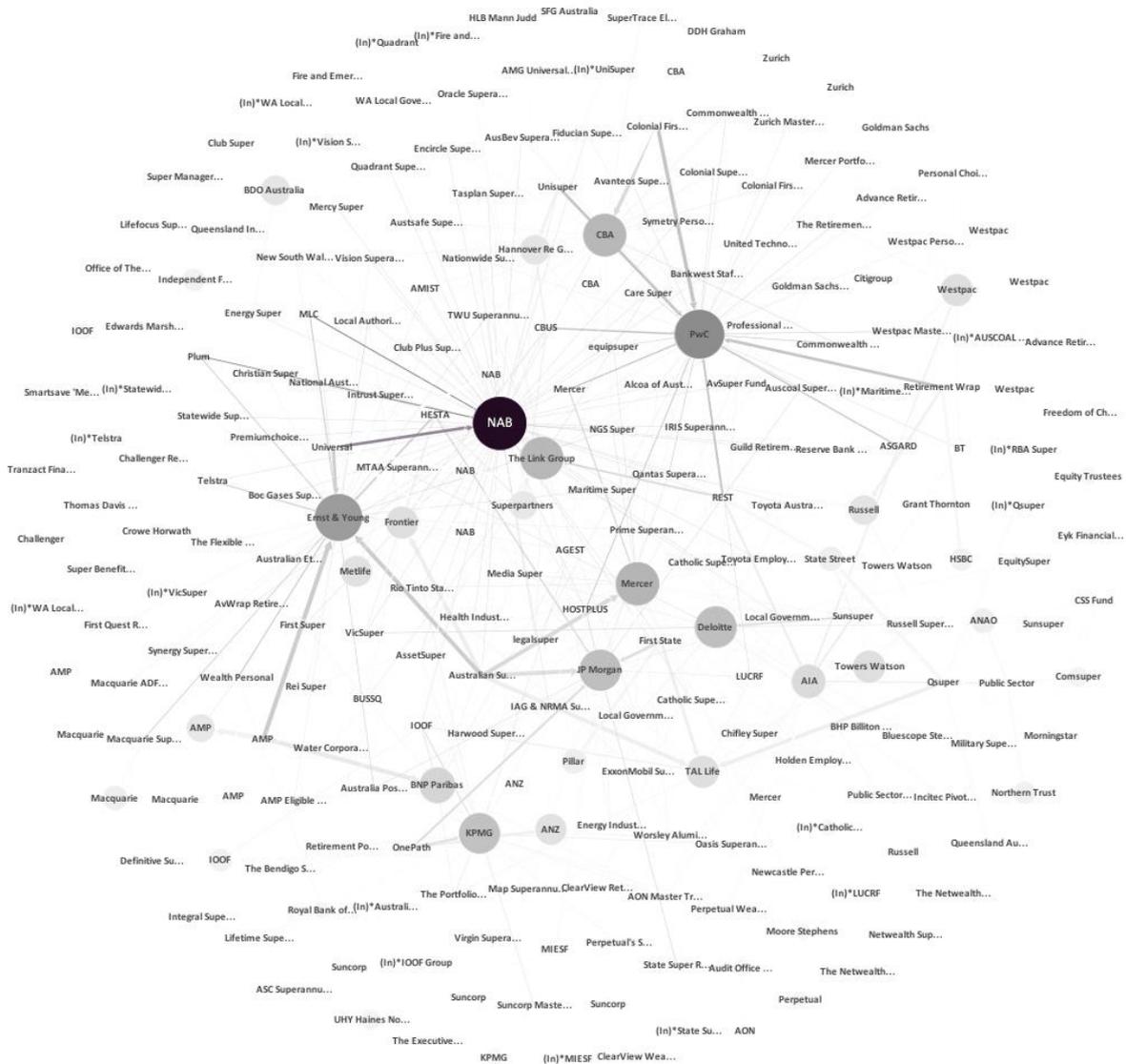
### 3. The types of linkages

The notion that modern financial institutions are linked in complex ways is hardly new. The literature in the banking (Dasgupta, 2004) and insurance (Allen et al., 2009) domains is extensive and extends back almost twenty years (Miranda and Glauber, 1997, Rochet and Tirole, 1996). The literature focuses primarily on the ways in which two types of risk, liquidity risk arising from a temporal mismatch of assets and liabilities and financial risk arising from a deficiency in assets compared to liabilities, can propagate such that local failures can pose a risk to the system as a whole. The development and proliferation of ever more intricate financial instruments is both a cause and a result of this complexity, which now exists on a cross-border and cross-sector scale (Anand et al., 2012, Adrian and Shin, 2010).

The superannuation system is in some ways a microcosm of this global phenomenon. There are, however, two factors that complicate matters further in the context of the Australian superannuation system.

The first has already been described: the majority of superannuation funds employ an operating model in which a large number of key functions are outsourced to third parties. This means that functional dependencies that might in a banking or insurance context be shielded from view behind a single corporate veil occur between entities. They are thus more readily identified by outside observers. However there is more to this than simply visibility. The likelihood that the third parties on whom the trustees rely themselves connect to a potentially wide range of other trustees and service providers means that distinct entities (two superannuation funds for instance) will share a single source of operational risk (such as a custodian or member benefit administrator). Indeed the web of subterranean connections constituting the system means they may share a number of sources of risk, at one or more steps removed. This can be seen graphically in Figure 1 below, which maps the contractual interconnections publicly reported between entities in the superannuation system. Estimates from the data set used in Figure 1 below suggest that few entities are separated by more than four degrees from all others in the system; a small world indeed.

Figure 1: Map of the Australian superannuation system (as at 30 June 2012)



The second factor complicating analysis of the linkages arises from the happenstance that the legal architecture for Australia’s superannuation system is provided by trust law (Donald 2011). The separation of trust assets from those of the trustee means that failure of an entity acting as trustee, though it would undoubtedly be disruptive to the practical administration of the trust, would not directly affect the interests of members in the way that, for instance, depositors in an insolvent bank would be affected. The court or a regulator may appoint a replacement trustee and the corpus of the fund itself, to the extent that it is not a creditor of the trustee for some reason, should (in theory) be unaffected. However, as has already been alluded to, the dependence of the trustee on a wide range of agents means that the administration of a fund can be disrupted in a variety of ways by various types of failures on the part of one or more agents. It is therefore worthwhile examining the nature of the linkages between entities in the system a little more closely.

One way to classify the links between entities is to group them according to the types of financial or informational transactions they represent. As such, they are readily recognisable to those familiar with the superannuation system. These transactions create the links between entities and, from a sociological point of view, can be said to constitute the system.

The first grouping may be termed 'operational links'. These links assist the trustee to administer the trust effectively. They include situations in which information required for administration of the trust, such as member balances and investment valuations, are provided to the trustee by third parties. They also include situations where the entity gives effect to processes that contribute to the administration of the trust, such as custody of the assets. These transactions are often recognised as sources of 'operational risks' and are regulated (APRA, 2013b) but usually only at a local, entity-by-entity level. Less often is the potential for such risks to be systemically recognised. There will for instance be circumstances where the service providers themselves are linked through another entity that serves each of them, such as a credit rating agency, a bank or a clearing house. It can readily be seen that failure or mistake on the part of an entity on which the trustee directly or indirectly relies would have flow-on effects on the trustee's ability to administer the trust. If that entity served a number of funds, the local failure would have a ripple effect across potentially a large number of funds. Importantly, a piece of rogue data, such as a misquoted currency exchange rate or security price, could propagate through the system without the source of the error strictly 'failing'. Moreover, not all data errors are inadvertent. The effects of the LIBOR scandal in which a number of parties deliberately misreported data are undoubtedly significant to the banking sector (Monticini and Thornton, 2013). It seems likely that they are also significant to systems, such as the superannuation system, in which the data is used for a multiplicity of valuation purposes.

The second grouping may be termed 'financial links'. This is the key focus of the flurry of recent research into systemic risk in the banking sector set out above. In the banking sector such links arise from cross shareholdings, interbank loans or cross-holdings of deposits (Dasgupta, 2004: 1049). However, as was alluded to above, the aetiology in the superannuation context is a little different. The use of the trust structure quarantines superannuation funds to a large extent from direct losses incurred by their trustees in non-fund related business. Moreover trustees are largely precluded by their fiduciary obligations from becoming debtors of the funds they serve. A replacement trustee may need to be found, which might entail short term disruption, but to the extent that the day to day operation of a fund is outsourced, such disruption is likely to be minor. On the other hand, the fine margins and thin capitalisation in the providers of member benefit administration services (Cooper, 2010: 170), combined with the administrative complexity of replacing a member benefit administrator, expose the system significantly to the risk of commercial failure in this sector.

The third group may be termed 'collaborative links.' They arise where funds co-invest with other funds and entities in legal structures, such as SPVs and JVs, in which their rights and expectations are to some extent enjoyed mutually. These arrangements can enable funds to participate in investment opportunities they might not be capable of undertaking alone but they can also result in contagion where difficulties in one fund can cause it to have to act with respect to the co-mingled structure in ways that adversely affect the healthy fund, for instance by seeking to liquidate its interest in the structure. Recent (but currently stalled) reforms to the regulatory disclosure of portfolio holdings by superannuation funds will improve the visibility of this type of risk across the system.

Fourth there are 'social links.' These links are distinct from the preceding three groups because they do not operate directly but rather indirectly through normative pressure. Examples include beliefs about investment markets (Kremer and Nautz, 2013) and the expectations of appropriate trustee-director behaviour (to the extent that they go beyond the strict letter of the law). These links cause the behaviour of individuals and entities to be correlated notwithstanding the absence of any formal direct link between the individuals or entities. This can undermine dramatically the apparent diversity of a system by causing component parts to act similarly and not in a diverse way.

Finally, it is important to recognise the potential for failures caused by one type of risk to transmit risks of the other types to other parties. For instance, an operational risk that had the impact of freezing cash-flows in one superannuation fund could cause collaborative risks on another fund if the first fund was unable to meet calls for capital from a jointly-held special purpose investment vehicle.

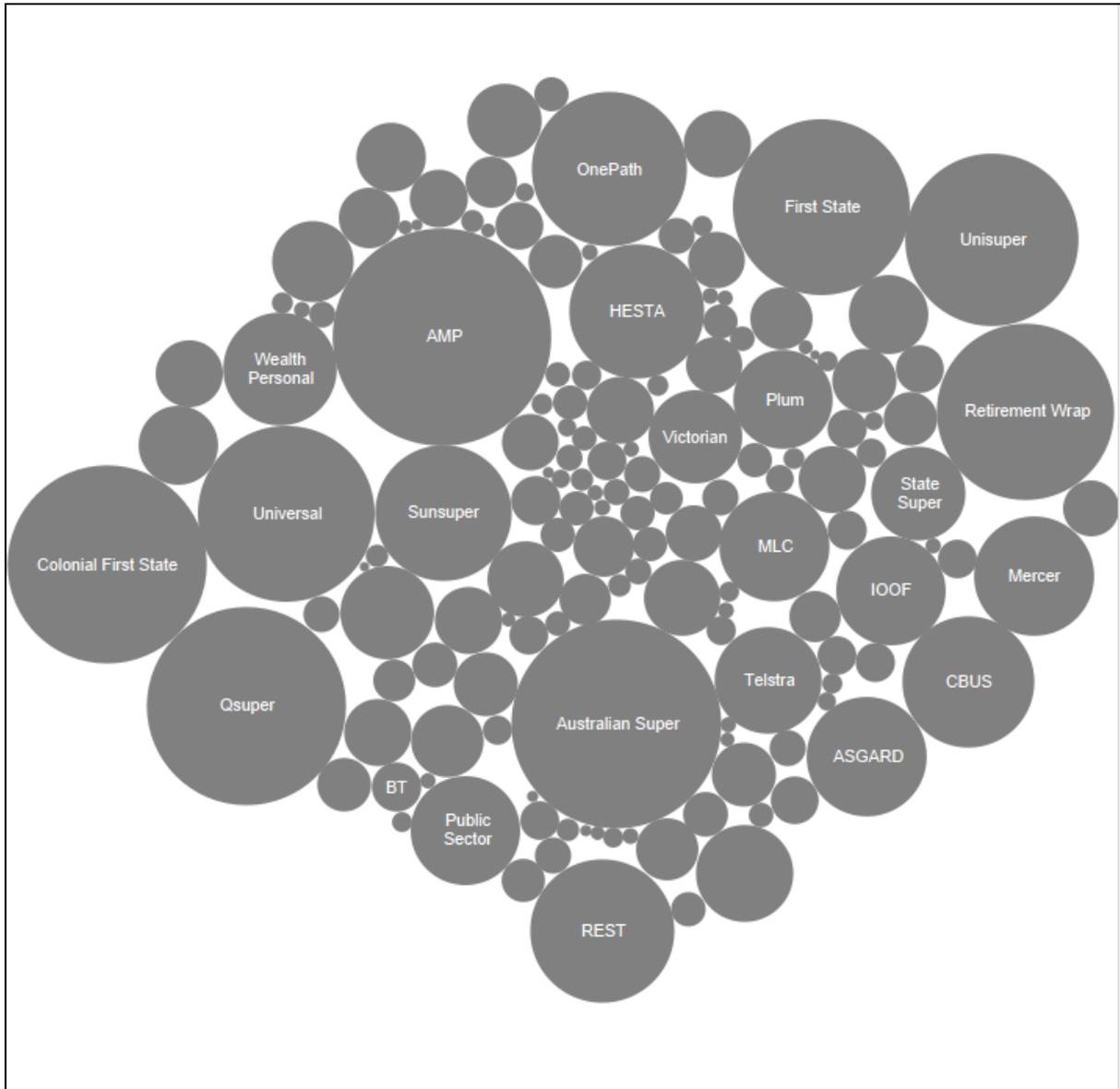
Attention to the nature of the links constituting the superannuation system is therefore clearly important. The findings of research into banking system crises are salutary because they highlight the complex way in which local risk can propagate (or not) across a system, but the nature of the links in the banking system are different to those in the superannuation system (and pension systems around the world). With this qualitative description by way of background, it is apposite at this point to turn to some preliminary analysis of the networks constituted by these diverse types of linkages.

#### **4. A diverse system?**

There is no doubt that the Australian superannuation system appears diverse when viewed from certain perspectives. For instance APRA reports that there were 336 registered superannuation entities on 31 December 2012 (APRA, 2013d). That is down over 90% over the past twelve years but still earns the industry an Herfindahl-Hirschman Index (HHI)(Hirschman, 1964) of less than 300 using APRA data (APRA, 2013a) and the methodology of the United States Department of Justice (DOJ and FTC, 2010). That is because the largest ten funds by assets comprise just 27 per cent of the market share of the superannuation industry. The largest fund, AMP Superannuation Savings Trust, administers approximately \$52bn on behalf of 2.9 million members. This represents a market share (by assets) of approximately 6.2% of all APRA regulated funds. The largest not-for-profit fund, Australian Super, administers \$47.8bn on behalf of 1.9 million members; a market share of approximately 5.7%.

This diversity can be seen in Figure , which depicts the 200 largest superannuation funds in terms of their assets under management.

Figure 2: Map of the Australian superannuation system (Funds by AuM as at 30 June 2012)



As has already been alluded to, the granular diversity illustrated in Figure 1 is potentially misleading. There are a range of features of the system that link the entities directly. The financial, operational and collaborative linkages required for each fund to function, and the indirect, social linkages, are numerous. Importantly the existence of these linkages is made more consequential by the lack of diversity in some of the sectors of the overall system. This is shown in the data reported in

Table 1 below.

Table 1: Market concentration of key service providers in the superannuation industry

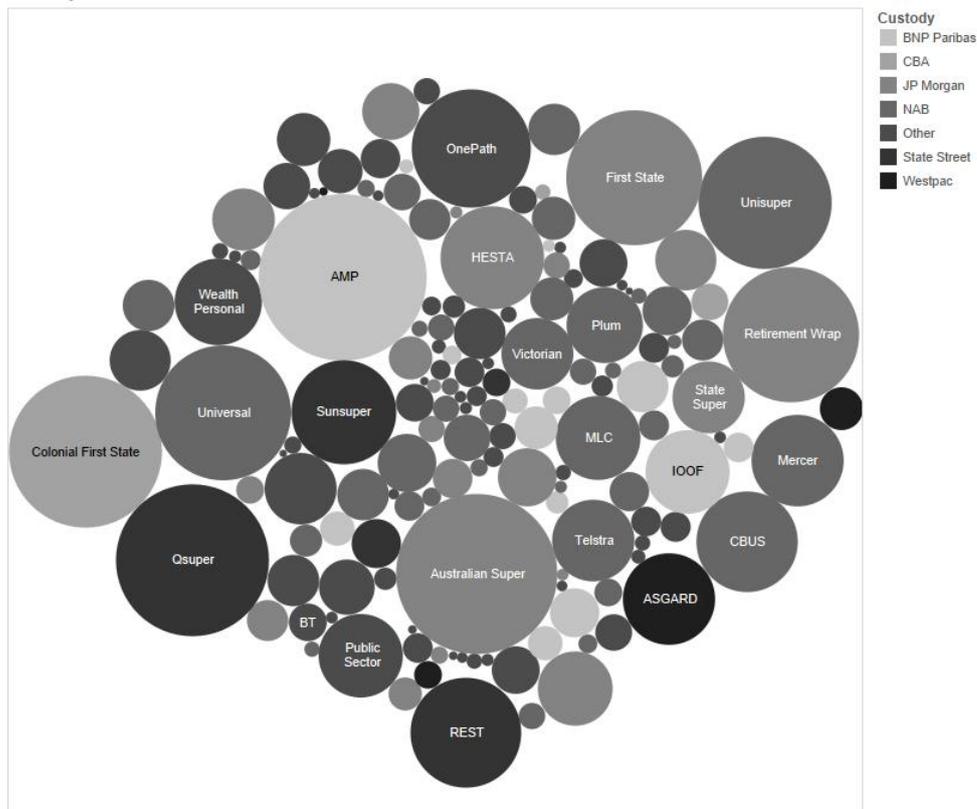
|                                      | No of providers | Market share |        | HHI     |      | Sample coverage |
|--------------------------------------|-----------------|--------------|--------|---------|------|-----------------|
|                                      |                 | Top 5        | Top 10 | Members | AuM  |                 |
| <b>Actuarial services</b>            | 20              | 71%          | 89%    | 2271    | 1268 | 52%             |
| <b>Member benefit administration</b> | 46              | 45%          | 73%    | 612     | 630  | 95%             |
| <b>Asset consulting</b>              | 10              | 96%          | 100%   | 2296    | 2358 | 57%             |
| <b>Auditing</b>                      | 16              | 92%          | 99%    | 1728    | 2469 | 95%             |
| <b>Custodial services</b>            | 16              | 84%          | 98%    | 2094    | 1982 | 96%             |
| <b>Insurance</b>                     | 12              | 74%          | 99%    | 1249    | 1379 | 85%             |

Table 1 shows the results of analysis conducted on publicly available information from the largest 150 superannuation funds in Australia. The data is drawn from annual reports, product disclosure statements and other regulated disclosures. All data is at 30 June 2012. Data was available in respect of between 85% and 95% of funds' service providers, with two exceptions. (Not all funds require actuarial services and retention of an asset consultant is not mandatory, so it seems fair to assume that some of those not reporting the identity of their actuary or asset consultant may simply not have appointed one).

Table 1 demonstrates quite clearly that there is considerably more concentration in the custody, member benefit and insurance industries that serve the trustees of funds, than in the list of superannuation funds themselves. Using the DOJ terminology, this level of concentration is associated with “moderately concentrated markets” and a change in the HHI of 100 as the result of a merger or exit would prompt concern (DOJ and FTC, 2010: 19).

Figure 3 portrays this from a different perspective. It depicts the same funds indicated in Figure 1, each coloured according to the custodian it employs. The large number of funds associated with each colour demonstrates the exposure of the system to a small number of global custodian banks.

**Figure 3: Map of the Australian superannuation system, coloured by custodian (Funds by AuM as at 30 June 2012)**



A similar pattern can be seen when funds are coloured by member benefit administrator, in Figure 4, and insurer, in Figure .

Figure 4: Map of the Australian superannuation system, coloured by administrator (Funds by AuM as at 30 June 2012)

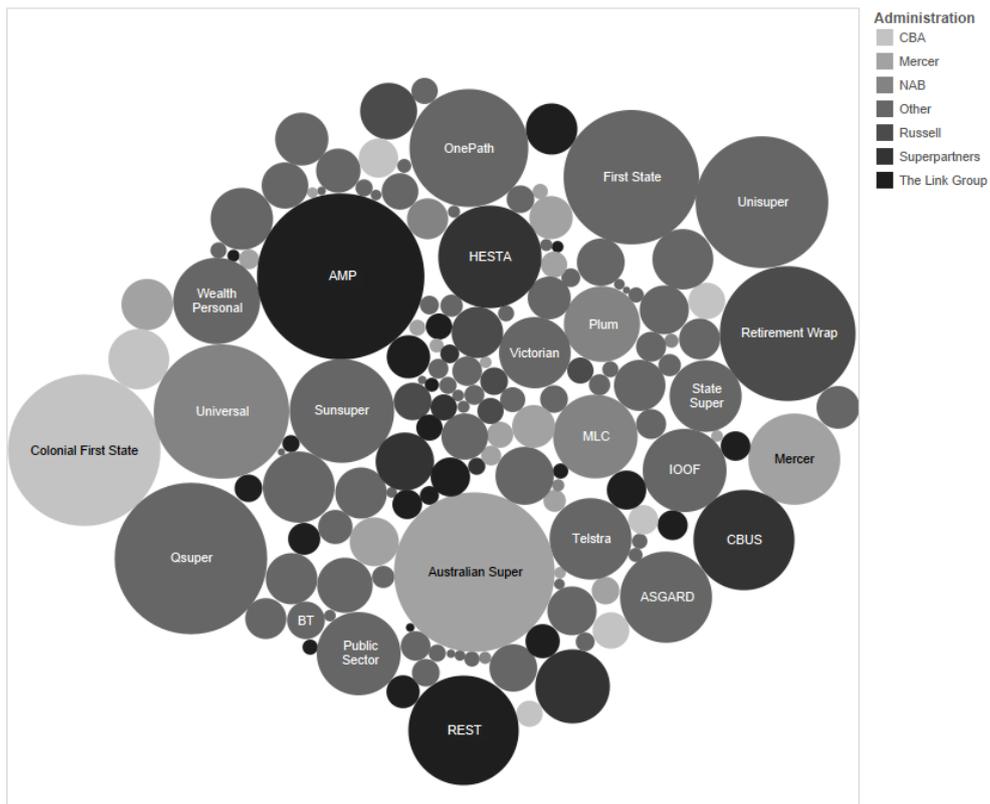
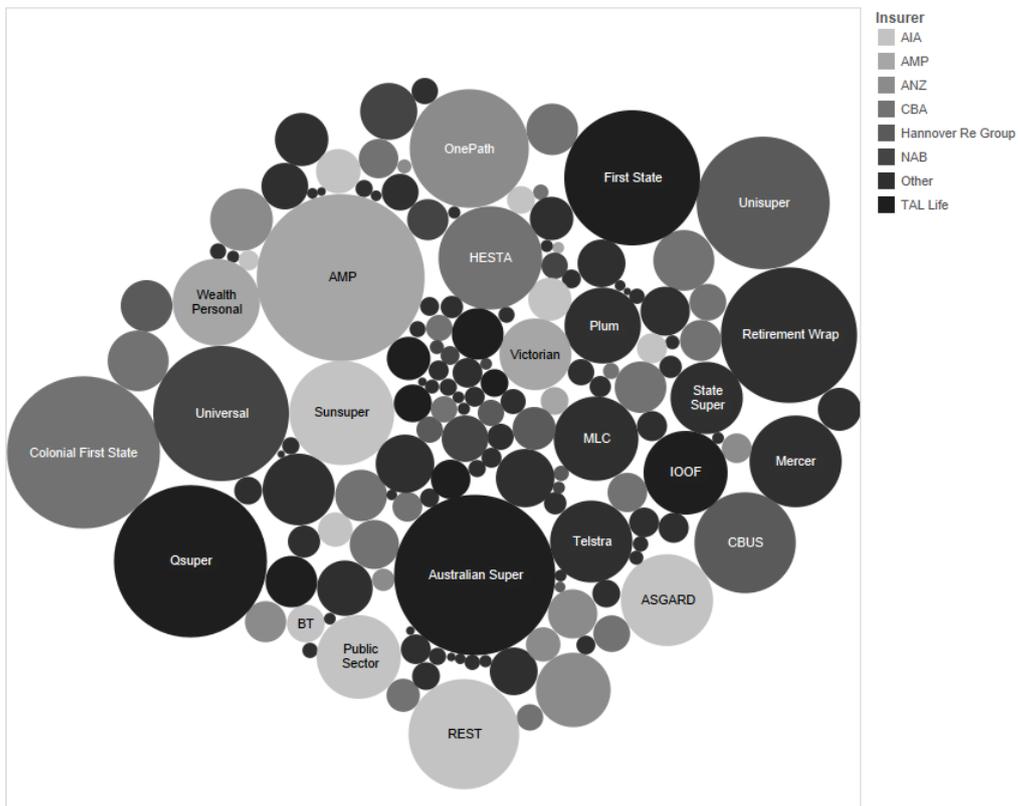


Figure 5: Map of the Australian superannuation system, coloured by insurer (Funds by AuM as at 30 June 2012)



There are other features, less easily illustrated in graphical form, that promote correlated behaviour and hence synchronous results. Regulation, industry structure, shared investment frameworks and behavioural factors can all influence decisions by trustees and their agents (especially investment managers and asset consultants) the net effect of which is to produce similar investment performance (Clements and Drew, 2004, Blake et al., 2002, Lütje, 2009). So too might overlapping directorships, which are a pervasive but declining phenomenon in the system (Sy et al., 2008, APRA, 2014).

This potential lack of diversity is important for two reasons. First it suggests the possibility that the system may not be as resilient as it appears: there are potentially vulnerabilities in the system that are not apparent from observation of the (still comparatively large) number of regulated entities acting as trustees of the funds. Second, it suggests that the system may not possess the synaptic wisdom that the early architects of the system expected would promote efficient capital allocation. A system comprised of independent, diverse decision-makers might be expected to pursue local optima in a highly granular way, such that the economic efficiency of the system (and the impulse for customisation and innovation) might be promoted. The correlation of belief structures across the superannuation system may mean that it does not in fact possess this synaptic wisdom. The enormous size of the asset pool collected in the superannuation system makes the prospect of allocative inefficiency very troubling.

## 5. Regulatory implications

Much of the responsibility for regulating the Australian superannuation system lies with two regulators. The Australian Securities and Investments Commission ('ASIC') is responsible for market conduct and consumer protection regulation. Prudential regulation of the superannuation system on the other hand is the responsibility of the Australian Prudential Regulation Authority ('APRA'). APRA describes its mission as to (APRA, 2010):

'establish and enforce prudential standards and practices designed to ensure that, under all reasonable circumstances, financial promises made by the institutions APRA supervises are met within a stable, efficient and competitive financial system'.

APRA's approach to supervision and regulation is risk-based, outcomes-focussed and principles-based (APRA, 2010: 8, Black, 2006). It is moreover expressly directed towards limiting the systemic risks associated with financial promises that are unfulfilled. The approach is however not designed to pursue a 'zero-failure' objective. Indeed the Government's Statement of Expectation in respect of APRA recognises that:

'a regulatory approach of that 'intensity would remove the natural spectrum of risk that is fundamental to well-functioning markets.'

For the most part, APRA's supervisory activities treat individual entities in the system separately. Supervisory teams are organised into teams responsible for a small list of institutions and the current reporting protocols do not elicit the types of information that facilitate close analysis of the sorts of linkages and shared exposures described in this paper. That said, APRA's attention to outsourcing risk (APRA, 2012) and investment governance (APRA, 2013c) signals that it recognises that the trust-law based legal architecture of the superannuation system means that risks need not

stem from the failure of an entity (a trustee for instance) but may arise from entities on which the trustee relies.

Nevertheless the descriptions and analysis in this paper represent a challenge to APRA's current approach to regulating the superannuation system on several fronts:

1. Criticality for the system may emerge from local disturbances that of themselves appear immaterial. Specifically, cascades and other forms of contagion could occur notwithstanding that the individual entities, viewed in isolation, satisfy standard prudential measures. This is particularly true of informational dependencies which may quickly propagate disturbances widely throughout the system, but also to issues arising from, for instance, co-investment.
2. APRA may need to calibrate its regulatory stance with respect to individual entities in ways that reflect those entities' importance to the system as a whole as has been documented for banking (Morris and Shin, 2008, Acharya, 2009). Systems such as the Probability and Impact Rating System ('PAIRS') used by APRA to focus its supervisory effort on entities posing the greatest risk need to have regard not just for the size of the entity (in assets or members), but also its multi-faceted connections with the rest of the system. The same may be said for the level of regulatory capital deemed appropriate for different prudentially-regulated entities.
3. APRA may also have to justify regulatory intervention in respect of an entity based not on characteristics or conduct peculiar to the entity seen in isolation, but on a more holistic basis. This in some ways resembles the mode of regulation sometimes required of competition regulators, such as the ACCC, when the need for regulatory intervention is inspired by changes to a market that are unrelated (at least directly) to the entity or entities left occupying an unacceptably dominant position. Indeed the analysis suggests that consideration of competition issues in the system, perhaps by ACCC, deserve a higher priority than they are currently accorded.
4. Many of the critical nodes in the system lie outside APRA's regulatory jurisdiction. Although APRA has jurisdiction with respect to superannuation funds and their trustees, as well as to the banks and insurance companies with which they interact, key service providers such as custodians, member benefit administrators and investment managers lie formally outside APRA's jurisdiction (Cooper, 2010: 76 and 170 respectively). As we have seen, failures of these service providers, or disturbances caused by them, can in certain circumstances represent a material systemic risk.

These challenges are not insurmountable. Some, such as the adjustments to the PAIRS system could be achieved through adjustment and re-calibration of APRA's internal models and operational structure. Others, such as the limits of APRA's jurisdictional coverage of the system may require legislative reform. Naturally, the costs and benefits of such changes need to be weighed and then compared against the wide range of other potential adjustments and reforms with a claim for attention. The risks should not however be disregarded or forgotten. The consequences for Australia's economy and its financial markets of systemic failure in the superannuation system are too great to permit risks such as those identified and discussed in this paper to go unmonitored and unaddressed by the regulatory regime.

## Concluding comments

The presence of complex interactions between the entities involved in Australia's superannuation system ought not to be a great surprise. The superannuation system is in many ways a microcosm of the global financial system of which, from a functional perspective, it is a part. This paper has highlighted, and started to explore, the consequences of that complexity for systemic risk and for the regulatory regime applied to the system. It is clear even on the basis of the preliminary analysis contained in this paper, that the risks to systemic resilience are real and that they have nuances that will require tailored solutions from policy-makers and regulators.

## Bibliography

- ACHARYA, V. V. 2009. A theory of systemic risk and design of prudential bank regulation. *Journal of Financial Stability*, 5, 224-255.
- ADRIAN, T. & SHIN, H. S. 2010. The Changing Nature of Financial Intermediation and the Financial Crisis of 2007–2009. *Annual Review of Economics*, 2, 603-618.
- ALLEN, F., BABUS, A. & CARLETTI, E. 2009. Financial Crises: Theory and Evidence. *Annual Review of Financial Economics*, 1, 97-116.
- ALLEN, F. & GALE, D. 2000. Financial Contagion. *Journal of Political Economy*, 108, 1-33.
- ANAND, K., GAI, P. & MARSILI, M. 2012. Rollover risk, network structure and systemic financial crises. *Journal of Economic Dynamics and Control*, 36, 1088-1100.
- APRA 2010. The APRA Supervision Blueprint. Sydney: APRA.
- APRA 2012. Prudential Standard SPS 231: Outsourcing. *Australian Prudential Regulatory Authority*. Sydney.
- APRA 2013a. Annual Superannuation Bulletin 2012. Sydney: APRA.
- APRA 2013b. Prudential Standard SPS 114: Operational Risk Financial Requirement. *Australian Prudential Regulatory Authority*. Sydney.
- APRA 2013c. Prudential Standard SPS 530: Investment Governance. *Australian Prudential Regulatory Authority*. Sydney.
- APRA 2013d. Quarterly Superannuation Bulletin, December 2012. Sydney: APRA.
- APRA 2013e. Quarterly Superannuation Bulletin, March 2013. Sydney: APRA.
- APRA 2014. Annual Superannuation Bulletin 2013. Sydney: APRA.
- BATEMAN, H & THORP, S, 2007. De-centralized investment management: an analysis of non-profit pension funds. *Journal of Pension Economics and Finance*, 6(1),21-44.
- BESAR, D., BOOTH, P., CHAN, K. K., MILNE, A. K. L. & PICKLES, J. 2011. Systemic Risk in Financial Services. *British Actuarial Journal*, 16, 195-300.
- BLACK, J. 2006. Managing Regulatory Risks and Defining the Parameters of Blame: A Focus on the Australian Prudential Regulation Authority. *Law & Policy*, 28, 1-30.
- BLAKE, D., LEHMANN, B. N. & TIMMERMANN, A. 2002. Performance clustering and incentives in the UK pension fund industry. *Journal of Asset Management*, 3, 173.
- BUCKLEY, RP, "Resilience and global financial governance", in Cork (ed) *Resilience and Transformation: Preparing Australia for Uncertain Futures* (Melbourne: CSIRO Publishing, 2009) 65.
- CLEMENTS, A. & DREW, M. 2004. Institutional Homogeneity and Choice in Superannuation. *Accounting Research Journal*, 102-.
- COATES, N., VIDLER, S. & STILWELL, F. 2004. Superannuation policy: commentary on an interview with Paul Keating, former Prime Minister. [Paper in: Special Issue on Superannuation. Coates, Nick; Vidler, Sacha; and Stilwell, Frank (eds.)]. *Journal of Australian Political Economy*, 9-16.

- COOPER, J. 2010. Super System Review Final Report: Part Two - Recommendation Packages. Canberra: Super System Review
- DASGUPTA, A. 2004. Financial Contagion through Capital Connections: A Model of the Origin and Spread of Bank Panics. *Journal of the European Economic Association*, 2, 1049-1084.
- DOJ AND FTC 2010. Horizontal Merger Guidelines. *US Department of Justice and Federal Trade Commission*. Washington.
- DONALD, M. S. 2011. What's in a name?: Examining the consequences of inter-legality in Australia's superannuation system. *Sydney Law Review*, 33, 295-318.
- GAI, P., HALDANE, A. & KAPADIA, S. 2011. Complexity, concentration and contagion. *Journal of Monetary Economics*, 58, 453-470.
- HALDANE, A. 2009. Rethinking the Financial Network. Speech delivered at the Financial Student Association, Amsterdam: Bank of England.
- HIRSCHMAN, A. O. 1964. The Paternity of an Index. *The American Economic Review*, 54, 761-762.
- KAMBHU, J., WEIDMAN, S. & KRISHNAN, N. 2007. New Directions for Understanding Systemic Risk. *Economic Policy Review*, 13.
- KREMER, S. & NAUTZ, D. 2013. Causes and consequences of short-term institutional herding. *Journal of Banking & Finance*, 37, 1676-1686.
- LADLEY, D. 2013. Contagion and risk-sharing on the inter-bank market. *Journal of Economic Dynamics and Control*, 37, 1384-1400.
- LEHANE, J. 1995. Delegation of Trustees' Powers and Current Developments in Investment Funds Management. *Bond Law Review*, 7, Article 4.
- LIU, K. Y. & ARNOLD, B. R. 2010. Australian Superannuation Outsourcing. *JASSA*, 6-11.
- LÜTJE, T. 2009. To be good or to be better: asset managers' attitudes towards herding. *Applied Financial Economics*, 19, 825-839.
- MAY, R. M., LEVIN, S. A. & SUGIHARA, G. 2008. Complex systems: Ecology for bankers. *Nature*, 451, 893-895.
- MEADOWS, D. & WRIGHT, D. 2008. *Thinking in systems*, Chelsea Green Publishing.
- MIRANDA, M. J. & GLAUBER, J. W. 1997. Systemic Risk, Reinsurance, and the Failure of Crop Insurance Markets. *American Journal of Agricultural Economics*, 79, 206-215.
- MONTICINI, A. & THORNTON, D. L. 2013. The effect of underreporting on LIBOR rates. *Journal of Macroeconomics*, 37, 345-348.
- MORRIS, S. & SHIN, H. S. 2008. Financial Regulation in a System Context. *Brookings Papers on Economic Activity*, 2008, 229-274.
- ROCHET, J.-C. & TIROLE, J. 1996. Interbank Lending and Systemic Risk. *Journal of Money, Credit and Banking*, 28, 733-762.
- SY, W., INMAN, C., ESHO, N. & SANE, R. 2008. Superannuation fund governance: trustee policies and practices. *APRA Working Paper* Sydney: Australian Prudential Regulatory Authority.
- ZOLLI, A. & HEALY, A. M. 2012. *Resilience: Why things bounce back*, London, Hachette UK.