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Let finance follow and flow

Essays on finance and innovation

Colofon

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Introduction

The fates of the world of finance and the real economy strongly depend upon each other. Financiers need entrepreneurs and business executives with profitable proposals to invest in. Entrepreneurs need funds to realize their ideas. The separation of these roles, and the specialisation thus made possible, is one of the defining features of modern capitalism.

Many feel, however, that financiers and entrepreneurs have grown too far apart in recent decades. The financial sector is said to have developed a logic of its own, losing touch with the real economy. Demands from financial markets are felt to be incompatible with the need to invest in new products and services. Criticism is directed at different parts of the financial sector and ranges from a short-term orientation of shareholders and financial managers to the danger of over-leveraging by private equity funds and the reluctance of banks to provide loans for innovative small and medium-sized enterprises.

Does finance follow?

We come from a period in which economists and policy makers simply assumed that the financial sector always serves the real economy. As illustrated by this quote of Joan Robinson: 'Where the real economy leads, finance follows'. The dominant view was that the financial sector responds smoothly to the needs of the real economy, with maybe high tech start-ups as the notable exception.

From the 1990s onwards however a growing empirical literature suggested that the state of the financial sector is as much a driver of economic development as it is the result of it. The financial sector is an important element of the innovation system in which firms operate. One in which frictions can occur that result in higher capital costs, or even the total absence of capital. The recent financial turmoil and its economic consequences have driven this discussion to the center of the policy agenda. The problems seem to be larger for investments in innovation than for other types of investment, due to their intangible nature, their high risk, the dynamic environment in which they have to be made and the long time it often takes for the benefits to materialise.

The Advisory Council on Science and Technology Policy (AWT) advises the Dutch government and parliament. It is currently working on an advisory report on 'Capital and Innovation'. For this, it requires insight into the complex interactions between financial decision makers and researchers and business developers within companies. To this end, a review of the literature was conducted to take stock, bringing together publications on frictions between the financial sector and the innovating real economy, as well as possible policy interventions to alleviate them

(Rens van Tilburg, Finance and Innovation, 2009). Parallel to this, three essays on the subject were commissioned from prominent economists.

This bundle contains these three essays. Like the literature review, the essays all confirm that the interaction between developments in the financial sector and the real economy is intense and has undergone quite severe transitions. All three essayists give an interesting and unique perspective on the relationship between the financial sector and the real economy. They all suggest institutional changes to put the financial sector back on track, such that it can again support the real economy and enable it to produce the innovations society needs. Finance needs to follow, so that investment can flow again towards real innovations. Hence the title of this publication. The AWT will take these findings into account in its advisory report to be released by the end of 2010.

Carlota Perez: making the transition

Carlota Perez of the Technological University of Tallinn, takes a historical perspective on the dramatic financial and technological developments around the turn of the Millennium. She argues that we are currently witnessing the transition from the so called installation to the deployment phase that characterises every technological revolution, in this case of Information and Communication Technology (ICT). In the installation phase of such a cycle, financial entrepreneurship dominates. Roles are reversed in the changeover to the deployment phase. Perez stresses that throughout modern history, finance has been instrumental in overcoming the vested interests related to the previous technological paradigm. During a period of financial frenzy, the infrastructure is being laid for the new technological paradigm to flourish. In the following deployment period the financial sector plays a more modest role.

For this deployment to materialize institutional innovations are needed. In her essay, Perez elaborates on the kind of changes that we need to see before the promise of ICT, or more broadly the sustainable knowledge society, becomes a reality. She specifically focuses on the role of what she calls SKIEs, small knowledge intensive enterprises, the champions of the new networked innovative environment. They are both active innovators themselves and serve as a technical infrastructure for other innovative companies. Financiers need to have intimate knowledge of these networks, the intangible capital of these firms and the experience and knowledge of the entrepreneurs. Financial casino behaviour should therefore give way to 'real investment', the kind of 'hands on' approach that venture capitalists have. The government will have to become a much more active player as well. By influencing the direction of innovation through strict environmental regulation and formulating 'man on the moon' projects like zero-emission, zero-waste goals. A new sort of 'industrial policy' may very well be needed as well. Not by having the government 'pick winners', but rather by building consensus through networking with business and science.

Hans Schenk: invest in R&D, not M&A

Hans Schenk of Utrecht University focuses on the growing market for mergers and acquisitions. He depicts this as a financial derailment that started in the '90s and kept going after 2000, harming the real economy by channelling funds away from productive investments like R&D towards the 'M&A-game'. Schenk forcefully argues that whereas financial markets are habitually looked upon as efficient channels for the allocation of funds towards productive deployment, in practice they tend to encourage speculative behaviour. At the firm level, this is apparent from the large number of failed acquisitions. Some firms play the merger game with an overload of opportunism, but many others feel forced to join merger bandwagons under the influence of ongoing deregulation. Expenditures on mergers and acquisitions drain resources that could be invested in economically and socially more productive projects, such as R&D. Besides, the 'acquisition-repair market' through leveraged buy-outs (LBOs) has become so vast and lucrative that private equity companies have virtually left the venture capital industry to focus on these LBOs.

Schenk concludes that generally it appears that a climate in which speculative behaviour is applauded tends to foster financial innovation rather than real innovation. From this it follows that fostering real innovation implies for governments that they should restrain the unfettered operation of financial markets, in particular the market for corporate control. Unfortunately, this is precisely what governments have disregarded during the build-up of the current financial and economic crisis.

Arnoud Boot: financial versus real innovation

This critical appreciation of a financial sector more interested in its own innovations, often of dubious social value, is echoed by Arnoud Boot of the University of Amsterdam. Boot asks whether the unprecedented level of financial innovation over the past decades has been good for economic growth. He notes that the financial sector more and more operates as a business in itself rather than just a facilitator for the 'real' economy. Whereas there is a literature that convincingly argues that financial innovations can – in principle – contribute to economic growth, financial innovations can also create instability. Especially when the innovation is directed towards facilitating marketability, as has been a core element of the most noteworthy innovations that have become infamous during the 2007-09 financial crisis. On the positive side one could say that financial innovations have brought bank-dominated intermediation closer to the financial market. This may hold benefits for especially the Netherlands where financial markets are dominated by banks and equity financing only takes a secondary role, a characteristic that has been found to translate into difficulty of financing more radical innovations.

Boot, however hints at a more negative conclusion. In the 2007-09 financial crisis European banks have arguably been hit hardest. One interpretation is that the

European financial sector started combining the worst of both worlds: it continued to be bank-driven with its negative effects on renewal and entrepreneurship, yet these very same banks became intertwined with financial markets and as a consequence volatility increased and the benefits of stability disappeared. Boots conclusion for the future is that we need to (learn to) deal with the instability that marketability brings. Particularly the continental European bank-dominated financial sectors need to find a new equilibrium in this fluid world.

2

The financial crisis and the future of innovation: a view from technology with the aid of history

Carolota Perez, Technological University of Tallinn

1. Introduction

The mixed consequences of major bubble collapses

Major bubbles in the market economy are complex processes with mixed consequences. The NASDAQ boom, the collapse of which brought a two year recession and permanently wiped out half the illusory value of the inflated technology stocks, facilitated enough over-investment in telecommunications and fibre optic cables to interconnect the global space digitally and bring hundreds of millions of people into Internet use.¹ The 2008 meltdown is having and will have a much deeper and more widespread negative impact on the global economy. The upside of that is made up of two very different consequences: One is the fact that from 2004 to 2007 there was a definite impulse to global growth. At the center of it were the Asian economies, especially China and India, which through their lower costs for products and services increased the buying power of salaries in the already industrialised world and also gave a respite to the energy and materials exporting countries through a major increase in prices. This had as a counterpart, though, that the boost in consumption in the more advanced economies that facilitated this global growth was fed by the export surplus funds coming back from Asia. This inflated the housing bubbles that enabled growing consumer credit on the back of the asset price gains. The bursting of those bubbles has brought the whole network down and turned the positive feedback loop into a vicious downward spiral. Nevertheless, globalisation is a fact and the new emerging economies will change the shape of the world to come.

The other consequence of the bust, which could in some sense be defined as 'positive', is that by revealing all the crooked ways of the financial world during the boom, it has broken the myth of an ideal 'free market' and brought back the state into an active role in the economy. Such a come back is not limited to restraining the abuses of finance but extends to favouring the expansion of production and job creating activities over speculation and to spreading the benefits of growth more widely across society. This happened in the past after each of the major technology bubbles, with different intensity and in varying manners depending on the historical moment and on the specific technological revolution that underlay the boom.

¹ The Internet really only began in 1994 but by 2000 there were already more than 300 million people using it. The estimate now is one and a half billion. From <http://www.internetworldstats.com/stats.htm> downloaded April 13, 2009

The most recent and strongest case of State intervention in these directions is, of course, the Welfare State and the Bretton Woods agreements and institutions, after the war and the long depressive years of the 1930s. The set of institutional innovations adopted then was very well adapted to the requirements of the mass production technologies of the time, which were able to bring consumer prices down to the level of workers' wages, as long as the market was large enough to reap the full economies of scale.

The current meltdown will require, after the initial rescue of finance, an equivalent set of institutional innovations at several levels: global, supranational, national, regional, local and community. The governance structure of societies is likely to experience changes as profound as those that turned the rigid pyramidal and strictly hierarchical and compartmented organizations of giant corporations into relatively flat, highly flexible and dynamic networks spanning the globe. Rather than strictly separate single-function departments with interaction only at the top, these nimble giants now count on innumerable single-purpose (though often multi-function) units that are small, agile, creative and empowered to pursue the defined objectives in their own chosen manner and to respond immediately and autonomously to changes in context or in clients' demands. A transformation of equivalent magnitude and direction is now in order for the State at all levels, though taking into account the difference in criteria, guiding principles and goals.

This essay begins by briefly summarizing the path followed by the operation of the market system in the process of installing and deploying successive technological revolutions and locating the current historical moment in that recurring sequence. A second section examines the sources of criteria to 'foresee' the directions of innovation in the next two or three decades and the final section discusses the policy challenges posed specifically by the need to foster the pursuing of those directions.

2. Great surges of development

Two different periods in the propagation of technological revolutions and their paradigms

Technical change in the market economy is constant but not continuous; it takes place by massive surges of change. The current Information and Communications Technologies (ICT) revolution is the fifth such upheaval experienced by the capitalist system since the 'industrial revolution' at the end of the 18th Century. Each of these *great surges of development* (GSDs) has given rise to a whole set of new industries along with a set of new organisational principles and externalities of infrastructure and knowledge that enable the modernisation of practically all of the existing industries. The vehicle for this upgrading is a new *techno-economic paradigm* (TEP) or best-practice model, emerging from the practical implementation of the new technologies and embodying new and wide-ranging common sense criteria for the most efficient, effective and profitable products, processes, business organisations and market behaviours.

Table 1 indicates the five surges, with the industries and infrastructures that constitute the technological revolution that drives them and with a selection of the most salient common sense principles of each paradigm.

Table 1. Five Great Surges of Development: Main technologies, industries and infrastructures and prevailing techno-economic paradigm

Technological revolution	2. New technologies and new or redefined industries	3. New or redefined infrastructures	Techno-economic paradigm 'Common-sense' innovation principles
FIRST: The 'Industrial Revolution'	Mechanized cotton industry Wrought iron Machinery	Canals and waterways Turnpike roads Water power (highly improved water wheels)	Factory production Mechanization Productivity/ time keeping and time saving Fluidity of movement (as ideal for machines with water-power and for transport through canals and other waterways) Local networks
SECOND: Age of Steam and Railways	Steam engines and machinery (made in iron; fuelled by coal) Iron and coal mining (now playing a central role in growth)* Railway construction Rolling stock production Steam power for many industries (including textiles)	Railways (Use of steam engine) Universal postal service Telegraph (mainly nationally along railway lines) Great ports, great depots and worldwide sailing ships City gas	Economies of agglomeration/ Industrial cities/ National markets Power centres with national networks Scale as progress Standard parts/ machine-made machines Energy where needed (steam) Interdependent movement (of machines and of means of transport)
THIRD: Age of Steel, Electricity and Heavy Engineering	Cheap steel (especially Bessemer) Full development of steam engine for steel ships Heavy chemistry and civil engineering Electrical equipment industry Copper and cables Canned and bottled food Paper and packaging	Worldwide shipping in rapid steel steamships (use of Suez Canal) Transcontinental railways (use of cheap steel rails and bolts in standard sizes). Great bridges and tunnels Worldwide Telegraph Telephone (mainly nationally) Electrical networks (for illumination and industrial use)	Giant structures (steel) Economies of scale of plant/ vertical integration Distributed power for industry (electricity) Science as a productive force Worldwide networks and empires (including cartels) Universal standardization Cost accounting for control and efficiency Great scale for world market power/'small' is successful, if local
FOURTH: Age of Oil, the Automobile and Mass Production	Mass-produced automobiles Cheap oil and oil fuels Petrochemicals (synthetics) Internal combustion engine for automobiles, transport, tractors, airplanes, war tanks and electricity Home electrical appliances Refrigerated and frozen foods	Networks of roads, highways, ports and airports Networks of oil ducts Universal electricity (industry and homes) Worldwide analogue telecommunications (telephone, telex and cablegram) wire and wireless	Mass production/mass markets Economies of scale (product and market volume)/ horizontal integration Standardization of products Energy intensity (oil based) Synthetic materials Functional specialization/ hierarchical pyramids Centralization/ metropolitan centres-suburbanization National powers, world agreements and confrontations
FIFTH: Age of Information and Telecommunications	The information revolution: Cheap microelectronics. Computers, software Telecommunications Control instruments Computer-aided biotechnology and new materials	World digital telecommunications (cable, fibre optics, radio and satellite) Internet/ Electronic mail and other e-services Multiple source, flexible use, electricity networks High-speed multi-modal physical transport links (by land, air and water)	Information-intensity (microelectronics-based ICT) Decentralized integration/ network structures Knowledge as capital / intangible value added Heterogeneity, diversity, adaptability Segmentation of markets/ proliferation of niches Economies of scope and specialization combined with scale Globalization/ interaction between the global and the local Inward and outward cooperation/ clusters Instant contact and action / instant global communications

Note:* These traditional industries acquire a new role and a new dynamism when serving as the material and the fuel of the world of railways and machinery

The assimilation of such profound changes by the economy and society is a very difficult process that must overcome both human resistance to change and institutional inertia. The success in achieving this becomes in turn an obstacle for the adoption of the next revolution, which tends to occur as soon as the potential of the previous one approaches exhaustion.²

It is due to these inertial forces that each great surge, rather than propagating smoothly, exhibits two very different periods of about two or three decades each. The first is the turbulent battle of the new against the old; a time of Schumpeterian creative destruction, of intense free market experimentation and exploration of all the possibilities of the new technologies. It is a time when financial capital joins forces with the new entrepreneurs to unseat the established giants and to dismantle the institutions that had facilitated their growth and expansion. This is the *Installation period*, which begins in the midst of a mature economy in decline and ends with a frenzied prosperity characterised by the triumph of the new paradigm, the emergence of new giants and the development and collapse of a major financial bubble. During this time, the short-term objectives of financial investors become prevalent and guide production investment and decisions through their control of the sources of funds and of stock market values.

The second period brings to fruition all the potential opened up by the new technologies. It is the *Deployment* period when the new production giants serve as engines of growth. It is a time of 'creative construction' involving the expansion of both the new and the rejuvenated sectors and usually spreading the benefits of growth much more widely than during Installation. Production capital is then at the helm of investment decisions and finance adapts (or is induced to adapt) to serve those longer-term objectives and benefits from them.

The Turning Point and the need for institutional innovation

Such a shift in conditions and leadership does not happen easily or automatically. It requires a radical institutional recomposition (of which Bretton Woods and the Welfare State are the outstanding example) in order to modify radically the business context, favouring real production and employment creation over speculation and start reversing the income polarisation process that characterises installation periods. That redressing is important as much in the name of social justice as for overcoming demand constriction. These institutional changes tend to occur as a response to the intense political pressures that follow the recession or even depression and other socially painful consequences of the major bubble collapse at the end of Installation. At this transitional point, the role of the State in the economy is a determining factor and the capacity to innovate boldly in government policy is crucial.

² A complete discussion can be found in Perez (2002) and a briefer summary in Perez (2007). Readers familiar with the model presented there can skip this section..

The years between the bust and the unleashing of Deployment (from two years to as much as thirteen, as was the case in the 1930s) constitute the *Turning Point*, referring to the shift in conditions and leading role from one period to the other.

Figure 1. Two different prosperities and a break in each great surge of development.

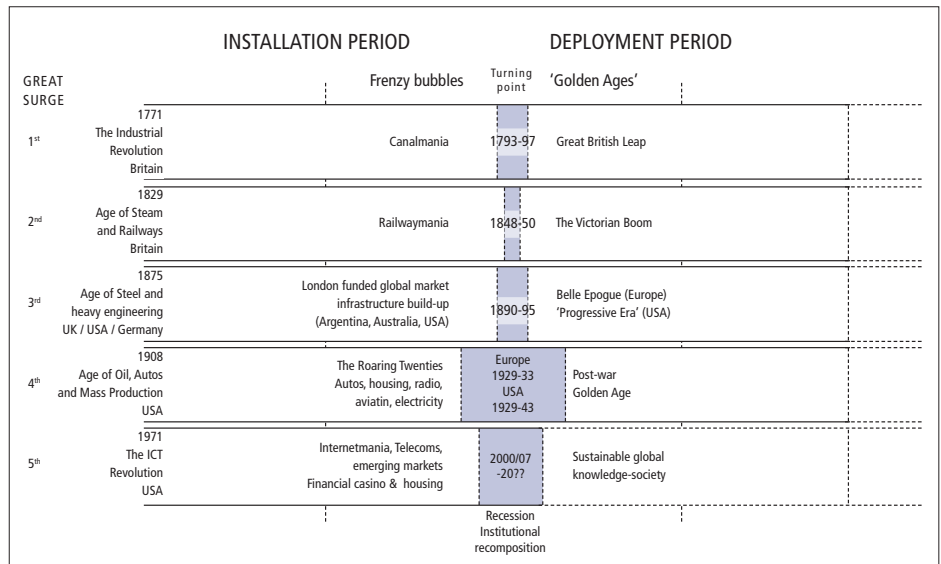


Figure 1 presents the five surges in parallel, indicating the Installation bubbles, the dates of the Turning Point recessions, and the Golden Ages that characterise early deployment (leading later to maturity and the irruption of the next technological revolution).

In 2009 the world is going through the Turning Point and deciding the global and national context for the full Deployment of the ICT surge. Understanding the nature and direction of the changes required is a crucial input for designing institutional and policy innovation and increases the probability of taking best advantage of the new wealth creating potential of the new paradigm. The elements likely to define that orientation are (1) the need to switch from Installation to Deployment conditions, (2) the characteristics of the current ICT TEP and (3) the new forces likely to shape its application. The first can be gleaned by analysing the faraway past with the lens of historical recurrence; the other two by examining the trends of the past few decades with a 'paradigm lens'.

The rest of this section will look at what the switch to Deployment has regularly implied for conditioning innovation and its relationship to investment decisions. The section after that will discuss the specific directions that might be taken by innovation in this particular surge.

Installation and Deployment: different drivers of innovation

Distinguishing between innovation in the core new industries themselves and in the industries or activities that apply the new technologies to innovate is important for understanding the main differences between Installation and Deployment as regards the rhythm and direction of technical change. Installation is basically an experimental period for trying out in the market the innovation space opened by the technological revolution and defining the shape of the new industries, the new production and distribution methods, and the new consumption patterns. The extraordinary profits exhibited by some of the young companies lead to an increasingly biased allocation of funds towards these novel industries and in particular to the new infrastructures that are destined to provide the main externalities for the users of the emerging technologies.

At the peak of the boom of the second surge in 1847, investment in railways represented 55% of gross national fixed capital formation in the U.K.³ During the first globalisation, at the end of the 19th Century, in the third surge, between 30 and 50% of British investment went overseas mainly to finance infrastructures, especially in the Southern hemisphere (Australia, Argentina, etc.) for counter-seasonal trade as well as in the strongly emerging countries of North America (US and Canada) that were building transcontinental routes for their mining and agricultural products.⁴ In the US, during the whole of the recent Installation period, between 85 and 90% of venture capital went to ICT companies.⁵ The high and growing valuations of telecom and Internet-related companies during the NASDAQ bubble facilitated the completion of a global fibre optic network that has become the foundation of the globalisation process.

This bias towards the new technologies enables the novel entrepreneurs to test their strength in the market and allows for the potential users – be they producers or consumers – to express their demand preferences. As a result, the new leaders emerge, the new industry structures are basically defined and the economy can count on a set of new and powerful engines of growth.

At the same time, the Installation period facilitates the emergence of the new paradigm. Even the funding granted to the traditional industries is usually biased towards modernisation assimilation of this new paradigm or preparing to take advantage of the new infrastructure. This is done through the incorporation of the new organisational models, the updating of equipment, the use of the new infrastructures, the change in product profile to fit the new consumption patterns and so on. As a result, by the time of the major bubble collapse, the whole of the economy is ready to innovate along the lines of the new paradigm or can adapt to do so; industry structures of both new and renewed industries have more or less

³ Mitchell (1964)

⁴ Davis and Gallman (2001)

⁵ Gompers and Lerner (2001)

defined their new borders and forms of competition and the techno-economic paradigm has been incorporated as common sense and as the common language of producers, engineers, bankers, investors, consumers and all the other agents active in the economy. Yet while the paradigm shift is basically complete, the institutional context is lagging.

In order to achieve this transformation, not only had the world of finance led the reallocation of funds towards the new technologies and practices, but it had also become an intense innovator in its own right, taking advantage of all the possibilities offered by the new technologies. This means that both – the real and the paper economy – produce good and bad innovations, successful and failing ones. The actors in the Deployment period, in a context shaped by government policy, will end up selecting those that survive and thrive and will also stimulate new ones adapted to their newly defined needs.

The deployment period is the time when the modernised companies across all sectors innovate using the power of the technologies of the revolution and of the new – by then, established – paradigm. It is a time of expansion, extension and multiplication of possibilities in the whole spectrum; it is also a time for social innovation in order to spread more widely across society the benefits of the vast wealth creating potential.

In sum, there is a changing of the innovation guard with the Turning Point. During Installation the innovation drivers are the new technological entrepreneurs and the financiers while the State has a service and facilitating role with a *laissez faire* attitude. During Deployment, the State comes back actively and serves as innovation driver together with production capital, which takes the helm of investment while financial capital serves as support.⁶

What this means in terms of financial innovation is that it moves from a 'supply push' behaviour to learning to respond to 'demand pull' from the production sector. And that is also what happens with the revolutionary industries. In this Deployment, ICT will also move towards fulfilling the demands of innovation across its user industries. Both companies and consumers are now savvy in terms of what ICT can provide and they have multiple ways of making known what their specific demands and expectations are. And the same can be said about governments, NGOs and other innovating organisations.

6 During the third surge deployment (the Belle Époque) finance remained at the helm but not from the stock market but from the boardrooms of the gigantic companies they supported. The core industries of that revolution required major investments up front: steel, heavy engineering (chemical, electrical, civil, naval), transcontinental railways, steamship companies and the major producers of raw materials and agriculture that were the main products of that first globalisation. So the likes of Morgan in the US and the German banks actually played the double role of production and financial capital. The case of the UK was different, but this is not a discussion for this essay.

Although it is indeed possible to identify recurrence in history, it is crucial to recognise the uniqueness of each manifestation. In this sense, it is very important to note that the major bubble of the current surge occurred in two episodes: the Internet boom at the end of the 1990s, based on technological innovation, and the boom of 2003-08, based on financial innovation.⁷ This peculiar separation of what in the past had been a single bubble has many implications, some of which have to do with the direction of innovation, others with the timing of certain recurring processes.

One of the typical consequences of each bubble bust is a comprehensible avoidance of risk in the particular objects of speculation that fed the boom. In the aftermath, investors tend to steer clear of mortgage-backed securities and any other synthetic instruments. Similarly, after 2000, investors had become wary of Internet and dot.com projects. Many private equity funds moved from venture capital to buying, transforming (or stripping) existing companies and reselling them; ICT entrepreneurs were more likely to aspire to a generous acquisition by Google or Cisco or Microsoft than to an IPO in the stock market, (although Google itself was one of the brilliant exceptions to this climate).

Thus, some of the phenomena that characterise the aftermath of major technology bubbles were already present during the casino boom of the 2000s. Some of the new innovation spaces that were made possible by the installation of the ICT technologies began to flourish, especially those that multiplied the uses of the Internet, those that responded to environmental concerns and those that aimed at alternative market segments. Even the ailing automobile industry can already boast multiple new directions, from the all-electric luxury Tesla, through various hybrid models,⁸ to the Tata Nano aimed at lower income buyers. Silicon Valley itself has moved strongly towards clean-tech since 2000.

The other process typical of the aftermath of technology bubbles that was already taking place during the second boom is the restructuring of one industry after another and the definition of new boundaries through mergers and acquisitions. This was very much facilitated by the easy credit that characterised the second boom. The process is far from being completed – indeed, it is never really final. There are still many industries in search of a stable structure with complementary profitable strategies, between industry leaders and followers, between vertical, horizontal or diagonal integration, between giants and medium and small firms, between global and local players. The airline industry, for instance, is still very much in flux and trying to cope with an uncertain future.

⁷ For a full discussion see Perez (2009)

⁸ Though Toyota's efforts at energy efficiency and oil avoidance date from 1977, the first generation of Prius hybrids arrived in the US in 2000. At that time, oil prices were still very low but by 2008 the various automakers had launched more than 30 different models to compete in the hybrid market.

The historical tendency, as conditions switch from Installation to Deployment, has been to moderate ferocious survival competition and to tend to establish some form of oligopoly that will restrict competition to certain variables and will allow long-term investment in technology or expansion, risking neither the anger of an impatient stock market nor a price war with competitors.

As will be discussed below, though, the hyper-segmentation of markets and the flexibility of ICT is likely to change the way of defining industries and the markets in which they compete, in order to focus on the demand sectors rather than on the supply ones. Sports & leisure, clean-tech, health, third age, education, etc. are already more useful for identifying the real competitors than textile, shoes, clothing, food, etc. This might have consequences for the space to be occupied by eventual oligopolies. Such sectoral redefinitions have occurred with every paradigm shift and the trace is kept – with delay – in the changes of statistical categories across history. Since such changes take time and occur as a result of trial and error strategies and competition, they can only be recognised in the statistics when they have already become the norm in practice. But being alert to these processes is crucial both for companies and for governments, because they provide important signals for innovation and growth paths.

All these transformations in industrial and market structures are very relevant for understanding the likely direction of innovation in the next couple of decades. During Installation, the engineers are best placed for seeing where innovation is likely to go. Technological trajectories of individual products and of whole systems indicate a logic of improvement that is an essential part of the paradigm and serves to guide progress in each area. But with Deployment comes a fundamental shift of focus. Rather than looking at the potential of technologies, the focus switches to the opportunities defined by markets and by growth possibilities. Thus, in technical and business innovation also, decision-making behaviour moves from ‘supply push’ to ‘demand pull’. Therefore, modern policies for supporting innovation need also to understand the shift and to incorporate knowledge about changing market and business structures into policy design.

3. The new directions for innovation

Sources of criteria for gleaning the trajectories of technical and social change

Each techno-economic paradigm emerges through a trial and error process while experimenting and learning to use the new technologies and their infrastructures. Moving from the giant IBM computers of the 1960s-70s to the personal computer of the 1980s to the laptops and blackberries of the 2000s has not only meant that ‘smaller and more individual is better’ but also that networks are the more adequate organisational structure to take advantage of the ICT technologies. Giant organisations – through the mediation of Internet – can now grow much larger

than before but as relatively flat networks gaining all the flexibility and agility of small companies; small organisations in turn can gain the advantages of scale by joining with others to form dynamic networks.

The flexibility of computer-aided design and equipment has liberated manufacturing from the need to pursue identical products. It is now possible to make model changes and to have a mixed product profile with high productivity, even as production volume of this varied and changing mix is several times greater than was possible under the mass production paradigm. The resulting hyper-segmented markets, catering to more and more market niches, have made it possible for innumerable small firms to offer highly specialised products or services with high profitability. It has also encouraged global firms to decomponentise their activities across the value network and to out-source them locally, to other countries or at-a-distance through Internet. This has transformed the relationship between users and suppliers from arms-length to collaborative and has allowed the valuing of expertise, creativity, human capital and other knowledge and experience inputs, which were previously shrouded in the impersonal workings of the old hierarchical pyramids.

Another major transformation is the new value placed on intangibles and human capital. Whereas in the previous four surges technology was usually embodied in tangible equipment or manufactured products, the area of intangible products, from services to information itself is now an increasing part of value added, of investment and naturally of innovation. The fact that the notion of *human capital* is replacing that of *human resources* is itself a signal of the deep change that has already occurred and is likely to intensify in the Deployment period. That will not only gradually transform the composition of world production, but will require significant innovation efforts in both finance and policy to deal with an unaccustomed form of value, when it comes to determining its price and/or treating it as collateral.

Thus, when there is a massive change in the prevailing technologies, there is an associated transformation not only in production and consumption patterns but also in the forms of organisation and competition, in the structure of markets and in the way the fabric of the economy is woven. Let us examine some of the consequences of this paradigm and their implications for the shaping of markets and company structures and consequently for influencing the direction of innovation.

The hyper-segmentation of markets: differentiation and adaptability

Variety and differentiation in all industries and services distinguishes the flexible production logic of the ICT paradigm from the homogenising logic of mass production. Rather than the traditional three-tier structure – of big, medium and small; luxury, middle income and low income – characterising markets, there is now a hyper-segmented structure, broken in kaleidoscopic fashion to cater to every

difference in needs or preferences, counting on the versatility and modularity of information technology at every stage of the process from design, through production to marketing and distribution.

Two complementary processes have been occurring spurred by information technology. On the one hand, all basic products can be produced in enormous volumes (several times what was considered 'mass production' in the past) with very high productivity. Together with the impact of low cost Asian labour, this has led to such an impressive deflation in the prices of standard manufactured goods – especially those related to ICT – that they can be considered 'commodities'. Price competition has become the characteristic of these basic goods and they tend increasingly to be marketed and distributed by supermarkets like Wal-Mart and Tesco.

At the same time, there has been a growing differentiation away from the commodity segments to multiple specialised niches and to what has been called 'mass customisation',⁹ adapting commodity components to the preferences of the clients. Both processes have been enabled by the power of information technology to reduce the costs of design, of flexible production (changing models and product mix) and the capacity to market and distribute relatively small quantities to targeted audiences. Both processes reduce the vulnerability of the producers to excess competition and provide much greater profit margins.

Figure 2 maps the hyper segmentation of markets in both dimensions and figure 3 gives some illustrative examples from various sectors. It should be noted that the clear separation between raw materials, manufacturing and services, or primary, secondary and tertiary sectors is less and less a valid or useful classification. It is particularly obsolete when distinguishing between the more or less advanced and more or less profitable industries or segments. It could easily be more profitable and require more sophistication and expertise to offer a specialised service or a niche material than to produce standard mobile phones or hard drives.

An implication of this way of defining new market segments is the hyper-segmentation of the technologies that are present in the market at the same time. During the mass production surge, it was common for less productive technologies to be competed right out of the market. Once you could produce the perfect red and plump tomato without spots and all the same size at a relatively low price, you excluded from the market all producers of organic, varied-sized tomatoes with blemishes. Today, they are both sold in the same super-market in different shelves and the 'ugly' ones command premium prices. And in that same super-market, there will be shelves for diabetics and for people suffering from various allergies. In the previous surge, when a section of a copper mine had too low a tenor to justify extracting the ore with advanced technology, it was left unused. However, developments in biotechnology have allowed productive mining of low grade ores

⁹ The term was introduced by Davis (1987)

through bacterial leaching methods. These methods can now coexist in the same mine, in the same company or handled by different ones. Many software packages are offered in a simple version for free (for occasional users and testing) while the professional version is sold at a profitable price. Even more surprising is the coexistence of the open-source movement with the fully paid software in many of the same product areas. This variety in supply is likely to expand and become the norm in all cases where the market segments targeted can be clearly defined and where the distribution channels are capable of handling small quantities of varied products.

Figure 2. Market segmentation and its differing conditions from raw materials to all manufacturing and services.

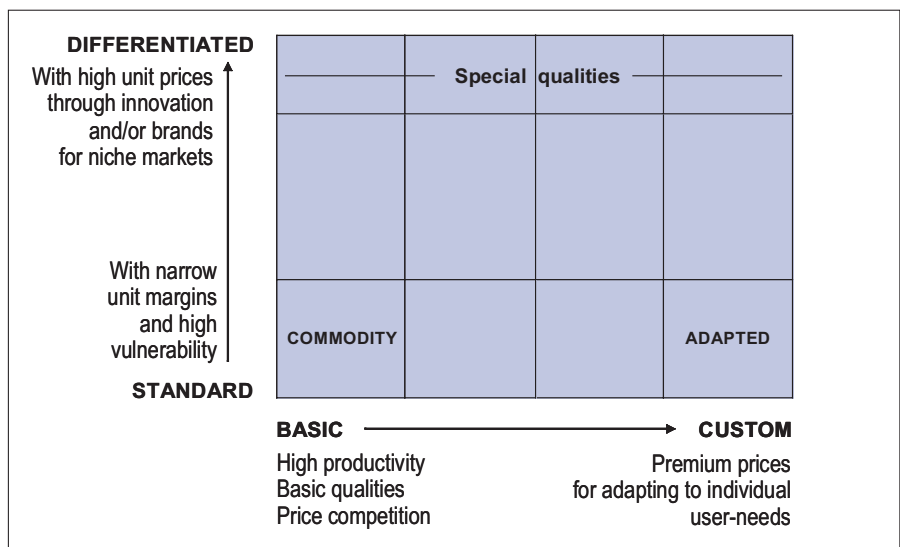
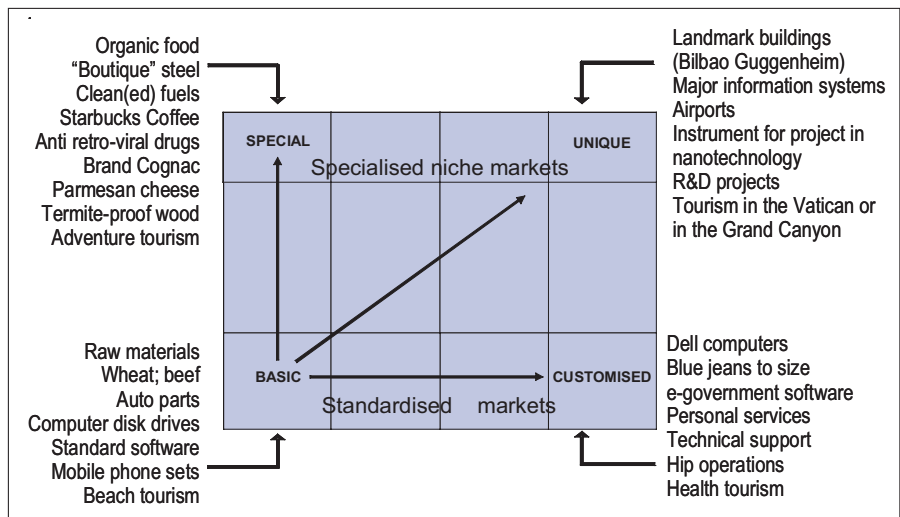


Figure 3. Some examples of products in different market segments.



Based on Perez (2006) p. 45

Another consequence of the hyper-segmentation of markets is what was mentioned before about how the traditional supply-defined sectors, such as textiles, shoes, etc., are gradually being fragmented and rehashed into demand-defined agglomerations of specialised firms. A textile company that makes canvas for sailing boats and awnings would belong to the Sports and Leisure sector, as would Adidas. Yet the one that makes sheets and curtains for hospitals would be in the Health sector together with those who make special shoes for diabetics or invalids. Already pharmaceutical outlets such as Walgreens and Locatel are encompassing the whole range of health products from aspirin and cosmetics to wheelchairs, medical instruments and home care services.

In practice, the choice of a successful direction of innovation for each entrepreneur is likely to be influenced both by the company's own capabilities and by the networks to which it belongs (or can belong), including suppliers, competitors and clients. The Israelis, for instance, have highly developed and dense networks in the health sector, involving medical services, high-level science and technology research, innovation in diagnostics and equipment and production of all sorts of medical supplies. The network synergies are very great as are the externalities for any new producer in that area. The advantages include the local interaction with knowledgeable potential users and the possibility of learning to confront highly specialised competitors.¹⁰ Of course, specialised innovators can also be connected to global networks where some of the synergy advantages also apply.

A final aspect to mention in relation to segmentation is related to the spaces of innovation opened by the possibility of catering to the differences in national, religious, educational and other cultural identities within a country or region. There are also age segments, such as the growing 'third age' markets of some of the advanced countries, and income segments, such as the 'bottom of the pyramid' markets in most developing countries. The mobile phone industry, for instance, has learned to replace the wired telecom services in the poor and relatively isolated villages of the world and in the shanty towns of the large cities.

All this suggests that the evaluation of innovation projects in relation to feasibility may well benefit from information about network externalities, segment definition, depth of knowledge and experience of the entrepreneur and other such aspects not customarily taken into account in the forms to fill out at the bank or the government agency (though they are in part typical of VC fund evaluation). The uncertainty of innovation can never be eliminated, no matter how much the projector or the banker may construct net present value models, but serious assessment of qualitative information relevant to networks and market conditions may be of great help for a higher success rate.

¹⁰ User-producer interactions are a central feature of what has been conceptualised by Freeman (1987) and Lundvall (1988) as *national systems of innovation*.

The hyper-segmentation of production units: networks and specialisation

Networks are the key structure in this paradigm; isolated firms do not fare well in an ICT-shaped world. Arm's length relationships with suppliers, clients and competitors, as in the mass production paradigm, no longer yield the best results and can endanger the survival of the company. This fact is at the heart of the strategy of every modern *global corporation* (GC).¹¹ It is also at the root of the success of the clustering strategies all over the world and of the various programmes undertaken by governments and international agencies to promote diverse forms of association for cost sharing or joint world marketing or training, as well as the formation of stable clusters or consortia.

There are multiple types of network and an even greater variety of possible roles in them. The global corporations themselves are often a network that coordinates the action of different networks. The specialised clusters find ways of sharing costs and externalities while maintaining the individuality of each participant, and so on. The question is in what ways network structures tend to shape the direction of innovation and entrepreneurship.

A basic principle applied by corporations when disaggregating all their activities into separable components is distinguishing between core competences and complementary ones.¹² The guiding idea is that the core competences are what gives the strength and the competitive edge as well as the long-term value to the company, while the other activities can in principle be outsourced without jeopardising the future. Yet, this notion of outsourcing is not about separating innovating activities from non-innovating ones. On the contrary, it is about deciding who will innovate in each area. When outsourcing the production of batteries or the fault detecting service or the custom software, for instance, the assumption is that by giving the job to specialists in each case you expect them to concentrate on innovating in that area with much greater expertise and success than an internal department could have done. In addition, the other clients of the specialists and the other members of their network, will provide extra information that would not have been available to the internal department. The final result is that the whole network becomes an innovating machine with each part maximising its contribution and improving the whole at a much faster rate.

This practice of global corporations has very important consequences for the fabric of the economy. It induces the proliferation of *small knowledge intensive*

¹¹ The use of the term global corporation (GC) rather than multinational corporation (MNC) conveys a fundamental conceptual and practical difference. The MNC had a headquarters and subsidiaries in other countries that were often a smaller version of the head company or of a whole department of it (perhaps a production or a sales unit); the GC is a single complex planetary organisation with fuzzy borders. It coordinates a widespread network of semi-autonomous or specialised units in various locations each with many types of close or loose links with multiple suppliers of goods and services, on site or at-a-distance. Depending on their nature, the units tend to adapt to the country or region where they operate and frequently conduct R&D or engineering to cater to the specificity of that location. For a view of the GC as a federation of semi-independent units see Mourdoukoutas (1999)

¹² The concept of core competencies was introduced by Prahalad and Hamel (1992)

enterprises (SKIEs) which are active innovators at the same time as they serve as a sort of technical infrastructure for attracting further user investment. The denser the fabric of SKIEs in an economy the greater will be the externalities for growth and competitiveness of the user firms. In addition, SKIEs themselves, in whatever field, are typically intense users of ICT services and of highly skilled human capital. They are also natural networkers with universities and other sources of information within and outside the country of operation. Finally, they are likely to participate in export markets, either through global corporations for whom they are suppliers or through their own efforts. That makes them key actors in the deployment of the knowledge society in each country.

A major consequence of this is a radical redefinition of the role of SMEs. Without ignoring the importance of the traditional small and medium firms, it would seem that the treatment of SKIEs and the catering to their support requirements, being fundamentally different from those of SMEs, will demand a different set of policies.

Next to SKIEs (and with some overlap) we find the creative industries and services, the proliferation of which is also a natural consequence of the ICT paradigm. These industries comprise a whole range of activities from software design, through architecture or advertising, through all forms of art. Each of them has been radically expanded and modified – at least, potentially – by computer-aided design and by the possibility (to a certain extent) of trading and distributing digitally. This transforms the economics and the market potential of all these industries and turns them into an important component of the domestic product of any country.¹³

Relating to art, there is another aspect worthy of note. Obviously, the various art forms have always been part of the cultural scene, but they have also been influenced by the appearance of new technologies. Lower cost printing in the Victorian boom facilitated the wide diffusion of newspapers, cartoons and novel reading; photography and colour printing encouraged the posters of the Belle Époque and probably influenced the impressionists while radio, recorded music, the movies (and then the 'talkies') and television created major new inter-related industries in the fourth surge. They also massified art and divided it into high- and low-brow; for the masses and for the elite. Yet throughout those changes, however spectacular, the essence remained the same: the artist was on one side and the public on the other. What the ICT paradigm does is to blur that difference for a whole range of activities; blogging makes everyone into a writer or a journalist, uTube into a film maker, Second-Life into an active novelist (Japanese *karaoke* into a singer) and so on. There is also the massive participation in the Open Source movement as software designers and there are already several corporate web-sites and other enticements that encourage people to give ideas and even offer new

¹³ See Freeman, A. (2008)

products to some of the major companies for some sort of reward.¹⁴ All of this opens the channels that can make creativity an integral part of the quality of life and that allow the fusion of consumption and production in important aspects of personal experience. Just as leisure is more and more outdoor sport and physical activity rather than the passive TV watching of the fourth surge, so the enjoyment of creativity is becoming more of an active endeavour.¹⁵

Just as it was said above that a thick web of specialised services increases the competitiveness of a locality, so it can be said that fostering this sort of creative-productive-consumption increases the value of human capital. Young people that participate intensively in such activities will be tomorrow's innovative entrepreneurs.

Finally, there is the world of face-to-face personal services that can include everything that requires direct human interaction from local tourism, through chiropractors to much training and education. They also include many NGOs which perform community services or protect weaker individuals in the community. All of these are likely to proliferate as induced activities during deployment, to absorb some of the managers and workers displaced by globalisation, to complement digital services (delivery of tangible internet purchases, for instance) and to enhance the quality of life in the knowledge economy. Since relatively few of these are likely to require R&D-based innovation, it is easy to dismiss them as just standard businesses to fund through the banks and not included in innovation policy. There is however a whole range of business-model and organisational innovations to be fostered in these sorts of services, the importance of which becomes greater the more advanced the economy. That is because they are stable employment creators (face-to-face services cannot be off-shored) and because they are possibly those that would most directly influence the quality of life in any particular locality.

Although some of the companies in the creative and face-to-face categories may be SKIEs (and even GCs), it is important also to recognise the role played by the SMEs in these sectors in increasing *social innovativeness*. To enable their proliferation and support their success could do more to 'boost the entrepreneurial spirit' than many apparently more targeted attempts.

Thus, the hyper segmentation of markets, technologies and activities, is giving rise to an emphasis on the small business unit, be it as a direct part of a GC, as an independent or semi-independent supplier, as a start-up that can some day become a giant, as a franchisee, a member of a specialised cluster, a local provider of services or an independent expert unit in interaction with other global players in that particular niche. This not only implies giving particular importance to fulfilling the needs of SME innovation but truly paying particular attention to the different

¹⁴ See Von Hippel (1988 and 2007) and Franke et al. (2006)

¹⁵ This phenomenon can become a non-trivial contributor to overcoming the consumerist mode of satisfaction that so strongly characterised the mass production times.

types of small companies and their specific requirements. This is part of what will be discussed in the final section.

The shaping power of the energy and environmental challenges

The fabrication and consumption patterns of the mass production surge were strongly shaped by the abundant supply of cheap energy (in the form of oil derivatives) and cheap materials (petro-chemical plastics and energy-intensive aluminium, steel, cardboard, etc.). The consumerist style of satisfaction established by the 'American Way of Life' was based on that cost structure and on the cost advantages of economies of scale.

The IC technologies with their low cost provision of information and communication have slowly been modifying production and life-styles in the direction of taking advantage of less expensive intangible values. It is part of the capabilities provided by ICT to be able to make products smaller, with no materials waste, serving multiple uses (thus potentially replacing, say, three products by one), monitoring energy use and several other environmentally friendly possibilities.

The fact that companies have not yet sufficiently taken advantage of these possibilities needs an explanation. There were two main circumstances that facilitated the conservation of the energy- and materials- intensive mass production strategies of the previous paradigm: the opening of the ex-socialist countries to the market economy and the very low cost of oil in the 1990s. Both of these happened precisely when the ICT industries were defining their strategies. This made it possible to take advantage of cheap energy and cheap labour to continue along the path of non-durability and planned obsolescence (quick discarding of physical products to be replaced by the next model) and to ignore the costs of global transport (which were coming down with increasing scale and cheaper energy).

This began to change when energy and primary commodity prices shot-up brusquely, changing the relative costs of labour, transport and materials. The current recession, by restricting production and world trade has made those prices collapse again. Nevertheless, one can expect them to rise once more when Deployment takes off. It is true that the extremely high prices of oil and other materials at the peak of the boom were due in a certain proportion to financial speculation with 'futures', but the basic fundamentals have to do with limited – and more costly – supply not being able to keep up with the pace of increasing demand as globalisation continues.¹⁶ Thus the pressure for materials and energy conservation and for the introduction of alternative energies due to the high price of oil can be expected to come back.

¹⁶ See for example Tertzakian (2006)

However, that is only one of the forces that are likely to shape the way in which the ICT paradigm is to be deployed. The likelihood of overcoming the 'mass production syndrome' and exploiting the 'green' potential of ICT stems from the conjunction of three powerful sets of trends: (1) the limits of supply in energy, materials, food and water, (2) the increasingly convincing threat of global warming and (3) the various geopolitical tensions that endanger globalisation (tensions with the oil and gas exporting countries, economic and political migratory pressures and the diverse forms of violence both within each country and in the form of international terrorism). These forces will act as selection mechanisms for the direction of innovation within the range of the possible and – most importantly – may also be expected to reshape the current patterns of globalisation.

The coming redesign of globalisation

There is a fundamental tension in the logistics of globalisation. While the infrastructure for coordination, administration, interactions, decision making, financial transactions and other information-based operations are processed and 'transported' by ever faster and more powerful 5th paradigm ICT, all the tangible elements of production are still being transported by 3rd and 4th paradigm technologies (ships, airplanes, trains and trucks) that however much they are modernised and upgraded by 5th paradigm technologies, are increasingly confronting inevitable limits.

The most important limit is perhaps their contribution to global warming. All those transport vehicles are moved by oil-based fuels. If one takes the full carbon footprint of a product assembled in China, it comprises bringing the raw materials from a faraway country, probably by ship, moving it to the materials processing region and then to the manufacturing one – probably by truck, perhaps by train – doing the same with the cardboard and plastic (themselves highly energy-intensive) to package the product safely for long journeys, moving the product again to the port or airport and on to the ships or planes that will take them to the shores or airports of the consumer countries, where once more they will be put on trucks or trains to reach the central depots and from there to the final destinations at the stores.

If a carbon tax of one form or another were to be imposed, it would soon change the economics of the current pattern of globalisation by making business weigh both the cost of labour and that of transport in their decisions. Even without taxing, the inevitable rise in the cost of energy and materials when the recovery comes will gradually change the relative cost structure.

There are also other limits that are augmenting the cost of transport, one is the restricted size of the Panama canal (built a century ago); the other is the piracy threat on the route to the Suez Canal. Both are likely to take several years to be

overcome and, in the meantime, they both increase the time, the length and the cost (including insurance) of the voyages that would now have to be made around the respective continents.

All of this means that the obvious economies of the current path of globalisation, based on very cheap labour in Asia and decreasing costs of transport, are destined to change. The multiple decisions made by the globalisers and by the various governments are bound to end up in a completely different pattern that might combine the faraway production of somewhat higher value lower-volume products with a greater use of nearer locations (Eastern Europe and Northern Africa for Europe; Mexico and Latin America for the US) to produce heavier and higher volume products as well as the return of some production to the advanced world, some of it as near as possible to consumers as may perhaps be the case of hydroponic vegetables and other light perishable items around the cities. It could be that processing materials *in situ* near the point of extraction of the ore may become the more cost-effective way of reducing the total cost, by transporting lighter and more valuable cargo, directly to the manufacturers of the final products.

These relocations are likely to be accompanied by a strong drive to overcome those limits through innovation. Apart from the obvious pressure to develop alternative forms of energy and methods of energy conservation in transport and carbon capture, there will gradually be more and more interest in alternative materials and materials-saving methods, other means of transport, new forms of packaging, cost-effective logistics, etc.

Global warming, especially if the natural catastrophes can be ascribed to it, is also increasing the cost of risk insurance and threatening to weigh heavily on government budgets and hence would increase the pressure for regulation, carbon trade or taxes, intensifying the feed-back loop.

Apart from the impact on transportation and the shape of globalisation, there might be an even more fundamental change in the offing. The environmental limits may result in a gradual but radical transformation of consumption patterns. The change in the proportion of needs satisfied with intangibles rather than with products may intensify, but especially, a trend towards maximum quality and durability of physical products, minimising energy consumption, maximising modularity for refurbishing and recycling, preferring the 'healthy' alternatives in food and leisure, etc.

This implies the complementary shift in production and marketing strategies. Without globalisation and the incorporation of additional millions of consumers every year, that change of strategy would be impossible. When limits to market growth were being reached in the 1960s and early 1970s, 'planned obsolescence'

and constant fashion change became the way to keep production rhythms in saturated markets with low demographics, making the same people buy the same products over and over again. When globalisation resumes at a brisk pace – and if investment prone policies are set up in all countries – incorporating new consumers can be an alternative and highly profitable strategy.

For the moment that sounds utopian and unrealistic. But it is just the global version of what sounded utopian in the 1930s. Saying then that the way to increase markets for automobiles, refrigerators and houses was to incorporate the great majorities (including the low-skilled workers) into consumption would have been deemed unrealistic. Yet it was achieved by raising wages with productivity increases and by setting up a Welfare State that subsidised mortgages; helped keep monthly payments going with unemployment insurance; covered all or part of the costs of health and education, freeing incomes for consumption, etc. Today that seems absolutely normal.

What cannot be done, because we do not have seven planets, is to incorporate all the inhabitants of China and India into the 'American Way of Life'. Neither can the advanced world expect to stop them from aspiring to 'the good life'. It is only by redefining the good life from the top that the aspirations of the rest of the world can be reoriented and made feasible and this redefinition will increasingly be imposed on the world as the response to environmental limits.

In any case, the rising costs of materials and energy and the restrictions of supply will put pressure on markets to increase the efforts to find and develop alternative energies and materials, new modes of transport (including urban design that reduces or eliminates the need for transport), recycling and recovery of all effluents in the processing industries and other innovative means of coping.

Social pressure on the other hand, facing the threat of global warming, is already creating dynamic and profitable markets for environmentally friendly products, 'green' alternatives, 'organic' agriculture and clean-tech in general, while gradually accepting the change in lifestyles. All this opens market opportunities for testing the new directions.

Whether the deployment period will see the world gradually leaving behind 'conspicuous consumption' to embrace durability, recycling, high quality and eco-friendliness is yet to be seen, but much is going to depend on the political will of governments to regulate in order to tilt the playing field in that direction and on the understanding that 'going green' is probably the best hope for innovative dynamism, investment, jobs and growth in the advanced world and for making possible a sustainable global golden age.

The gestation of the next revolution

The historical experience with previous revolutions shows that the various components that will eventually come together to transform the production landscape of the next surge develop gradually under the previous paradigm. At first, there can be little or no connection between them and they are more likely to grow in association with the industries of the prevailing paradigm. Transistors were mainly used to make radios portable while typewriters and calculators were still mechanical machines that gradually incorporated electricity. At that time, even if they may have used transistors, control instruments were still analogue and had needle – rather than digital – displays. Telephones and computers had little in common in the 1960s. The same had happened with the steam engines in the first surge. While horses pulled the barges along the canals, steam engines were stationary and helped operate the locks.

Using the lens of recurrence, one can foresee that biotechnology and/or nanotechnology are likely to produce the breakthroughs that might lead to the next revolution. Both these technologies are still very expensive and relatively restricted in their impact but their promise is extremely wide-ranging.

The results of R&D and innovation efforts in these industries can lead to successful companies and products, but perhaps the most important goal when supporting their development is ensuring a good positioning for the future, through being part of the global networks woven around them and through accumulating the sort of knowledge that could be crucial in order to guarantee a place in the front ranks early in the next surge.

4. The policy challenges

Taking the paradigm and the period transition into account

As in previous cases, one of the consequences of the financial crisis is the breakdown of the quasi-religious faith in the virtues of unrestrained free markets and the re-entry of the State into the economic scene as a valid actor. In the early aftermath of the bust, the basic roles that are expected of government refer to regulation, bailouts and economic stimulus in different proportions depending on the country. However difficult, though, it is probably wise to begin the fundamental redesign of the economic space and the regulatory framework to clearly favour real investment and discourage casino behaviour in the financial world. Institutional restructuring is what would really unleash a healthy period of prosperity, fundamentally different from that of bubble times. Whether and how such a redesign is done on the national and supranational levels, the likelihood of a successful outcome is much greater if the debate is on the table from early on and if enough concrete and viable proposals and innovative solutions are there when the decision makers are ready to act.

Regarding finance, the new architecture will probably require global institutions with power of enforcement due to the borderless nature of financial flows and operations. Refusing supranational supervision and a standardised regulatory 'floor' may seem like protecting sovereignty but is in fact surrendering it to the power of supranational finance.

At the same time, national level financial policies are going to be crucial for the medium-term future of any country. It is not merely a question of financial health but essentially of pro-production bias. The motto of 'don't work for money, let money work for you', so popular in recent time, needs to sound completely unrealistic in a world where economic policies, be they regulatory, fiscal, monetary or whatever, resolutely favour working for money – and making abundant profits – through innovation, investment and job creation in the real economy.

The come-back of what could be considered 'industrial policy'(in this paradigm, increasingly a question of technology and innovation policy) can be expected and probably needs to be recognised and accepted as essential for a full recovery and for a better performance in a globalised world. The intense debates about the demise of the national state that were so common during the Installation period have moved on to discussing what the government should do for the economy. In practice, globalisation has proceeded with greater success wherever the State has been actively defining its preferences, enhancing the advantages and creating the enabling mechanisms.

The Chinese government has been exercising industrial policy with great success and with the quiet acceptance of both the participating companies and their governments. At first salaries were kept low and the currency devalued in order to attract labour-intensive manufacturing industries, destined for export markets. The foreign companies accepted all sorts of government conditionings, including the obligation to transfer technology to local personnel and the lack of effective patent protection, in order to reap the cost benefits for a few years. The government has now radically modified its policies to strongly favour clean-tech industries and energy saving technologies.¹⁷ Since they have an official procedure for evaluating and approving every single investment in terms of technology and location, they are once more steering production according to their national interest.

17 See the Chinese government site on the new strategy, published Dec. 2008, downloaded April 13, 2009 http://www.fdi.gov.cn/pub/FDI_EN/News/Focus/Subject/wzgzxe/wzfzjj/t20081204_99876.htm. It basically decided that foreign capital will be encouraged 'to go to sectors like high-tech, energy conservation and environment protection, high-end manufacturing, modern services and modern agriculture, especially new energy development and application: it is also directed to original innovation, integrated innovation, and re-innovation by means of technological introduction, digestion and absorption, as a way to promote the industrial restructuring... [and to] set strict limits on transferring resource-extensive industries with high consumption and high pollution to China'

This is not necessarily a model to follow in an advanced and fully capitalist country, in fact, in this paradigm it would make much more sense to construct a consensus vision between government, business and society to make the actions of all the agents converge in agreed directions. What the Chinese case shows is that in the fastest growing country during the *laissez faire* period, it was not the free market that decided what and where to produce, but a set of official guidelines and some government offices approving or disapproving each project. Like Saint-Exupery's king in *The Little Prince*, who suggested waiting towards the end of the night – when conditions were more favourable – before asking him to order the sun to rise, the most effective conditioning policies are those that (1) are rooted in the specific advantages and interests of the country or locality in question, (2) aim at the dynamic technological opportunities of the time and (3) establish a positive-sum game with the strategies and interests of the decision agents – be they foreign or domestic companies.

Understanding the forces shaping such opportunities and interests is an important input for policy design (as well as for business strategies). Examining them was the purpose of the previous section. Let us now explore the specific area of government policies to facilitate the financing of innovation.

The implicit innovation policies

The explicit policies that directly fund research or innovation projects can be a relatively small proportion of the set of policies that influence technology and innovation across society. Most government decisions, including those that seem far from technology, have an influence on markets and technical change. During the unquestioned reign of the free market in the early 2000s, the invasion of Iraq tilted the playing field in the US in favour of military technologies (which the end of the Cold War had diminished in importance) and by influencing the supply of oil, unwittingly contributed to the rise in prices, which in turn changed the conditions in the energy markets and revived interest in energy saving technologies (which had been dormant since the low prices in the late 1990s). So, there is no vacuum where “free” markets operate unhindered. There is every reason to suppose that tilting the conditions for competition in the market in a socially agreed direction is likely to yield better results than either bureaucratic decisions or an illusory even playing field.

From the discussion above, there is every reason to suppose that strict environmental regulation (possibly enhanced at first by favourable tax treatment or subsidies) could be much more effective for stimulating innovation and investment in ‘green-tech’ and ‘clean-tech’ than any amount of project money for entrepreneurs in the area. Equally, finding a way of guaranteeing that oil prices will not go below a certain threshold can be a stronger incentive for investing and innovating in alternative energies than any amount of grants or subsidised loans.

The obligation to recycle a growing proportion of an industry's products moves companies to innovate in materials, in assembly and disassembly processes, and in the products themselves in ways that may give them a competitive edge in global markets, while creating jobs and improving the local environment. Of course, in some cases, being ahead of the pack in what is going to be a trend is an advantage (if it indeed becomes generalised), in others, the ideal is for regulation to encompass as many countries as possible so that global trade doesn't have to face a variety of conditions that make compliance costly.

Another way of tilting the playing field towards innovation is through facilitating access to infrastructure. Full provision of optical fibre to the home would not only be a policy to widen Internet access to all citizens (thus a form of income redistribution). It would also increase the conditions for innovativeness across society – in or with ICT – and multiply the possible consumers of many services and products. One of the central tasks of the famous Tennessee Valley Authority in the New Deal of the 1930s was to construct a hydroelectric dam to provide all the inhabitants of the valley with electricity. That radically changed the consumption and production possibilities for the population of the region.

The provision of government demand for tested new products that do not yet have enough market scale is another way of facilitating innovation and accelerating the path along the productivity curve. Using solar energy for schools or electric cars for the postal service (if it is public) or other similar decisions can create enough of a local market to even foster competition and rapid learning for eventual export. Another useful route for making it possible for important innovations to converge upon a coherent market and be tested are the equivalent of "man-on-the-moon" projects such as zero-waste, zero-carbon footprint cities or other such demanding goals.

Hypothecated taxes are also ways of creating demand. A tax on CO₂ emissions that is destined for funding the development or purchase of clean-tech alternatives is a self-feeding mechanism for innovation in that area, or a tax on automobiles destined for public transport innovation.

Finally and most importantly, under conditions of deployment, if both tax policy and regulation induce the financial world to move away from short-term speculation and capital gains and to focus once more on funding investment in the real economy, we can expect the private sector to come up with new financial instruments that respond to the specific expansion and innovation needs of the economy as it revives. If conditions are such that the main source of financial gain – be they dividends, interest or service fees – are the profits of the production sectors, investors and financiers are likely to turn to innovation as one of the most lucrative options.

Sometimes the innovations in the private sector require complementary actions on the public side. An obvious example from the previous surge is consumer credit. It began with the automobile companies themselves in order to expand their markets to people that could only pay by monthly instalments, it went on to be offered by other durable goods producers and finally by the banks. Equivalent developments happened in the housing market. These private innovations were accompanied by public ones such as unemployment insurance, which guaranteed that payments could continue to be met, the legislation that enabled savings and loan associations and mortgage support (the now notorious Fannie Mae, in the US, was set up by Roosevelt's New Deal in the 1930s) to facilitate a regular increase in the number of households buying durable goods.

Essentially then, attention to what is shaping market conditions and taking consensus decisions to tilt the field in directions that will stimulate market expansion in innovative directions may sometimes be more effective than simply making funding available for innovation, however intelligently this is done. Not taking account of this can make business and government act in diverging directions and risks seeing different government departments work at cross purposes, hindering the possible positive results.

The direct policies: innovating in the financing of innovation

The safest way to approach the financing of innovation in the deployment period is to assume that the instruments that worked in the installation period may now be inadequate. Many of the debates of the time may be obsolete, many of the empirical proofs for one position or another may be dated (and the same analysis conducted five years from now is likely to yield different results). Just as business strategies are fundamentally dynamic and shaped by a changing context, so government policies need to take into account the fundamental shift in business climate and, in the case that occupies us, the change in the direction of innovation. It is advisable then to re-examine all existing instruments and policies putting special attention on what might have been shaped by the specific conditions of the time.

The context may change quite radically even in very short periods. The abundance of private equity going into venture capital funds and facilitating start-ups, innovation and multi-million dollar IPOs in the technology boom of the late 1990s pretty nearly dried up in the easy-credit boom of the 2003-08, when private equity turned massively to leveraged buy-outs of existing companies and in some cases to hedge funds.

Neither set of conditions is likely to hold in the next decade. The opportunities for innovation are manifold, both in existing companies and for new ones, if the potential installed in the territory (and in the minds) by ICTs and their organisational paradigm finds a favourable financial and regulatory atmosphere in which to flourish.

But innovating within a paradigm is much easier and less risky than doing so using the paradigm in another sector. This was learned by the venture capitalists in the 1990s when they tried to apply the same criteria and expectations to innovators in biotech as to those in ICT; both sides ended up frustrated and disappointed. When technologies are in their gestation period they are groping and their trajectories are far from defined; suppliers are not yet adequate or sufficient; markets are uncertain and time lags are very common. In the particular case of biotech, given the bias towards the human health sector, the regulation on medical trials and the difficulties for government approval lead to very protracted processes, often lasting more than ten years.

Even without having to confront the specific hurdles of medical biotech, a good proportion of the range of innovations open across sectors in the coming deployment will also be exploring unknown territories and facing significant levels of uncertainty. New and custom materials, alternative energies, new forms of transport, waste disposal and recycling, carbon capture, water purification, alternative food sources (or significant productivity increases), metal and materials recovery and the many other solutions to environmental limits do not yet have clearly defined trajectories and are likely to make unpredictable breakthroughs in unpredictable time periods. Some will be more dependent on S&T research, others in solving engineering problems, still others in a business model that will make them cost-effective and so on.

A large set of innovative opportunities is in the area of small knowledge intensive enterprises (SKIEs), where the intangible nature of the products and of the human capital involved presents complex issues for the traditional methods of the financial system.

It is probable that only a combination of multiple forms of public and private support in the different stages of the process – depending on the type and size of company, the type of innovation and the target markets – will be required to optimise the innovative capabilities in any country or region. Observation, experience and intense interaction with the actors involved, identifying the hurdles to remove as well as the type of direct or complementary help needed at each turn, may be the most effective route for reaching a set of satisfactory instruments.

Some of the issues requiring particular attention are the increasing importance of small innovative firms, the question of intangible value, the need for continuity of support and the role of R&D.

SKIEs, SMEs and networks

There are at least two major consequences of the fact that the global corporations and the large firms increasingly achieve flexibility and higher competitiveness by

outsourcing a significant part of the peripheral and of the highly specialised (non-core) activities. This practice is bound to result in much greater proportions of (1) the working population receiving irregular incomes and (2) the part of the economy without a cushion to withstand downturns. These problems directly affect general economic policy and the social security model while they indirectly condition innovation policy.

It is no longer realistic to apply the classic unemployment insurance model as a one-size-fits-all recipe. It will probably be convenient to think about a series of different schemes for different conditions. Free-lancers, whether in cleaning or in highly sophisticated new materials design, have irregular income all year and will need some sort of income stabilising system, providing automatic credit in short-falls and automatic interest in surplus months. Innovation in banking and insurance should be able to cover most of this and the public sector could provide some social security compensation when necessary (combined with adaptation of the tax system).

This is relevant to small firms in general, because they tend to apply the part-time employment model for high demand periods. But it is particularly relevant to SKIEs (and therefore to innovative firms) because they generally have a very uneven flow of income through irregular contracts. A much higher proportion of small units in the economy, taking care of a greater share of employment as well as of profits and national product, will require similar stabilising instruments to those discussed above and possibly new insurance schemes tailored to those special needs.

A characteristic of SKIEs is the very high ratio of working to fixed capital. Given their knowledge intensive nature, their main "fixed" investment is in human capital and their working capital is mainly the relatively high salaries of their highly qualified staff. With the exception of companies specialising in biotech or nanotech or special materials, which may need high precision equipment, the other high cost is usually also intangible. It is the specialised software and the information services that they need to acquire to perform their job. Not meeting any of those payments can mean losing irreplaceable personnel or cutting-off the lifeline services. Giving the contracts as guarantee for working capital loans does not always work in these cases, except when it is a question of delayed payment, not of a truly irregular flow of contracts. The frequently used solution of making personnel become partners, paid irregularly according to the work coming in, merely shifts the burden to the individual persons and to society without changing its nature.

Innovative firms suffer from that problem in various ways. Specialised suppliers of GCs are expected to constantly do minor improvements and sometimes more significant ones. It can be that the user company is a partner in the innovation and jointly funds it with the supplier (it can also be a group of users) or that the supplier

takes the initiative and seeks the funds. There are also suppliers whose speciality is to do development work i.e. they are innovators under contract. All those cases and many other situations can involve periods of no receipts at all (depending on the funding or contract arrangements) and also the risk of unpredictable delays. Of course, SKIEs are high profit companies and under normal circumstances would have reserves for these situations. But new forms of insurance and running lines of credit will need to appear as the number of companies with these characteristics grows.

It might be interesting to look at the network as the possible route to solving many of these new (or intensified) needs of small companies. There is already a tendency of similar companies to flock together to gain advantages of scale for certain activities that can be funded jointly such as training courses, international marketing, specialised software development, etc. The idea of collective insurance of groups of companies – in a sector or in a region – or even networks of networks, in order to increase the volume and reduce the risk premium could be an adequate direction to explore.

Recognising intangible value

Naturally, the most vulnerable of all SKIEs and innovative companies are the start-ups. In the absence of venture capital, they are also the least likely to be able to obtain loans from banks, given the intangible nature of what they can usually offer as collateral. That is one of the reasons why individual “angels” and venture capital funds are the most appropriate providers of funds in those circumstances. They are often as knowledgeable as the innovators in the field of endeavour and can evaluate the likelihood of technological success and the capabilities of the project leaders. They can also complement the entrepreneurial capabilities and judge the market risk and the likely returns. It would, however, be legitimate to doubt the survival capacity and the profitability of small VC companies, once we are past the “easy” innovation space related to the technological revolution as well as the frenzied stock market promising multi-million dollar IPOs. It could be that those that are larger and can cast the net more widely are more likely to have the waiting capacity; perhaps having specialised units in large banks would serve to balance out the risks within the organisation. But policy innovations may be needed for stimulating venture capital and/or providing some other forms of direct or indirect support for innovators.

Another way to look at innovator entrepreneurs, their risky projects and their intangible collateral, is to consider pools of possible innovators and to provide collective collateral. One could think of imitating the practices of the Industrial Districts or Northern Italy, with their collective guarantees to banks for the loans that are taken out by their members (and are recognised as serious and reliable by the approval of the association).

Maybe prestigious universities can harbour pools of innovators connected with their research and back their fund applications with an agreement with the VCs, a collective insurance and a stake in the successful companies. It could also be a joint-fund managed by the university, the alumni and a partner bank.

Whichever solutions prove to be practical, as knowledge capital becomes more prevalent, society will have to find a way of evaluating and recognising it. A good practice that would contribute to this would be to require of public companies – in the disclosure rules – that they inform about all intangible capital, calculating its value and its contribution. This would eventually establish norms of assessment and would gradually create conditions for judging the value of intangibles in the stock market and in banks.

Providing continuity of support along the life-cycle

It is true that innovation requires patient capital; it is equally true that it needs continuity of support. Although it has been shown that the linear model of innovation is not valid, that the continuous flow from science to technology to engineering to innovation only holds in a few cases, there is indeed a sort of “linear model” from innovation to stable success. The sequence followed by the venture capitalists – from seed money, along various stages, through to the IPO – does reveal the changing nature of the support needed to nurture inventions through the innovative introduction in the market, the production and distribution learning, the company growth process and the final entry into the world of established companies.

Each one of those stages is of a different nature, requires different skills and contains different risks of failure. The various funding and support mechanisms, be they public or private or mixed, need to provide the appropriate type of service for each stage (in some cases those stages can also diverge depending on the sector). This is generally acknowledged and incorporated into the policy design of VCs and government agencies. What does not always happen is the “chaining” of the support stages, including the switch from public to private.

In the case of VCs, the constant evaluation of the project's progress allows continuous decisions about further outlays and about the type of complementary skills required at each stage. When the company is ready to stand on its own feet and has a promising future, it is prepared for an IPO by experts in these processes and the costs are also covered. Perhaps patents have been acquired and their cost funded; perhaps other legal support has been provided.

Support from government is often “coordinated” by the innovator, who applies to the appropriate national or international agency at each stage, not always benefitting from the automatic referral from one agency to the other. Worse, still,

when the entrepreneur “graduates” from government support to private loans or perhaps the possibility of a stock market offering, there might be no way of profiting from the successful completion of all the previous stages through an automatic recommendation from those who nurtured the process. One could imagine the advantages of networking across financial agents. There could be information sharing across agencies to speed up processes and at the end an agreement with a group of banks to send them an evaluation of the completed projects. This could unleash an active interest – and a sort of competition between banks – for financing the budding companies (a sort of IPO, not bidding up the stock but bidding down the interest rates and improving the conditions).

There is, of course, an overlap between the support offered to traditional SMEs and that offered to SKIEs, especially to innovative start-ups. Yet, it could be important to either expand the existing services or introduce new ones in order to further cater to the special needs of more knowledge intensive firms. Legal (and financial) support for copyright and patent protection, for instance, is likely to be a growing need, but others will be appearing and may warrant separate attention.

A final thought on continuity is about rewarding success with trust. Just as banks have credit ratings that facilitate the approval of loans for reliable creditors; funding agencies could automatically approve the next project of a company that successfully completed the previous. The forms to fill out could be much simpler and the evaluation and approval process much quicker. Naturally, if that project fails the entrepreneur would go back to the end of the queue. But such a system would relieve some of the pressure from the funding agencies, would stimulate serial innovation (the fear of going through long bureaucratic hurdles again can discourage promising companies from going ahead with the next project) and would reward responsibility and good judgment in the companies involved.

Of course, the very nature of knowledge intensive services makes it possible for these companies to expand into global networks and to eventually become global corporations. It is to be assumed that private finance would be able to easily handle the needs of such processes. It would be wise, however, to be alert and remove any hurdles along the way.

The roles of R&D in the present and for the future

There are multiple questions to examine in relation to the most appropriate way to facilitate the financing of R&D in this particular deployment period. This essay will cover only those aspects that should be examined in the light of the current paradigm and of the switch in business conditions from installation to deployment. Global corporations are now conducting R&D across the globe, wherever they find advantages in capabilities and costs, as well as possibilities for interacting with knowledgeable potential users or benefitting from local university research. This

trend is likely to continue. Governments in high cost advanced countries can influence all these elements through their education, research and specialisation policies. Establishing a consensus process to define these policies-especially those that imply some form of concentration of resources to create powerful poles of attraction-may build advantages for the country in maintaining local R&D and in attracting more. Trusting free markets to do the job may be a regrettable choice. Another trend to reconsider is the insistence on getting university researchers to find an interested industry user in order to have the project approved. This can continue to be appropriate for a certain proportion of research. It was in part necessary during installation in order to reconnect research with the real world and to inject novelty into an economy that had to abandon the old paradigm and incorporate the new. But in the next couple of decades we are likely to see three major directions of innovation with different connections between industry and university research.

One is the continuation of the development of the world of ICT products and infrastructure. Much of this is being funded by the new giants themselves in their own laboratories or in those they have endowed in universities. The start-ups in this area are not likely to require scientific inputs but are mainly engineering and are done by the innovators themselves.

Another is the flourishing of innovation across all sectors, in particular, but not only, the whole range of technologies that will cater to environmental requirements and constraints as well as those that cater to the 'bottom of the pyramid'. Those multiple areas will certainly require research results and solutions and much collaboration between universities and industry as well as much government support, directly and indirectly. However, since many research directions are uncertain and there can be serendipitous discoveries, it would be unwise to insist on a direct industry interest in all possible research projects.

The third area is the gestation of radical new technologies. It includes biotechnology, nanotechnology, bio-electronics, custom materials, etc. It is not easy to draw any clear limits, as it is obviously connected with both the previous groupings. But it is useful to distinguish it because it needs to be seen as insurance for the future rather than as an input to short term innovation and growth. Some products and technologies will indeed find immediate use, often in connection with some of the fast growing industries in ICT or in the pro-environment efforts; others can be isolated success stories as IBM was in the 1950s and 60s, but they are basically a sort of investment in the future. They are essentially a bet. Advances in particular aspects of those radical new technologies can locate a country at the heart of the breakthroughs that will define the next technological revolution. Nobody can predict which these breakthroughs will be or which technologies will define the next paradigm. But if history is a guide, those technologies are already in

gestation around us and the biological and materials sciences seem poised to play that role.

This suggests that a reasonable proportion of R&D should be completely free. What today's companies see as interesting and probably profitable are technologies that are within the known trajectories and following the current paradigm. Insuring the future is preparing to nurture tomorrow's companies.

5. Conclusion

Recent experience in shifting business climates suggests that adequate support for innovation may crucially depend on understanding the changing context, the varying conditions for competition, the nature of the guiding paradigm and the moving opportunity spaces available. This paper has endeavoured to discuss those aspects in order to provide criteria to better gear the design of policy instruments to promote innovation in the coming years.

If history is a guide, the global financial meltdown of 2007-08 marks a period transition from a world guided by financial criteria to a world guided by production, growth and welfare criteria. It also signals the return of the State as an active participant in guiding the economy. It is a decisive moment when institutional innovation crucially defines the conditions faced by the markets in the coming decades. The capacity of a new global and national regulatory framework to induce finance out of short-term speculation and towards concentrating on the real economy will determine the shape and the extent to which a global sustainable golden age can flourish.

The potential is already installed for vast innovation across all sectors using the power of information and communications technologies (ICT) and that of their organisational paradigm, which has become the shared logic – the 'common sense' – for most successful business practice. Sharing and understanding this logic is crucial for adequate government policies.

The hyper-segmentation of markets, technologies and activities that increasingly characterises the innovation space gives growing importance to small companies, in particular to knowledge intensive services. Together with the speed, band-width, low cost and coverage of the communications infrastructure, the density and the quality of the service networks have an important role in defining territorial competitiveness.

Energy and the environment are strongly signalling the direction in which that installed potential will be developed. Under the previous mass production paradigm the aspiration of suburban living became a focusing device for innovation across the

economy – from construction, through electrical appliances, to refrigerated foods. Similarly, the ideal of healthy and eco-friendly lifestyles is gradually taking shape as the focusing device for wide-ranging innovations in the coming decades.

Tilting market conditions in favour of “green” innovation and in support of small knowledge intensive business units is an essential part of the range of required policy innovations.

In finance, in particular, both the private and the public sector will need to modify or create new instruments in order to tailor them to the nature of the changing needs of innovators. Viewing networks as valid interlocutors, recognising and learning to assess intangible value, providing adequate and continuous life-cycle support and strengthening local R&D for present and future needs is in the national interest of each country and in that of the business community located on that territory.

In a context of global competition, where the conditions of each national space define what investment is attracted, kept or rejected, it is particularly important to guarantee the coherence in all instruments of economic policy. Neither technology nor innovation policy can be truly effective if the general policy framework does not converge towards the same vision. The Deployment period of the ICT surge can deliver a highly productive and innovative society in a global context, guaranteeing environmental sustainability and increasing social well being and satisfaction for all.

Once the market and the State are no longer seen as alternatives in a dichotomy but as natural allies in a shared prosperity goal it becomes possible to construct a consensus vision. Such an agreement, based on understanding the nature of the opportunities and the national specificities, is the best guarantee that all actors in business, society and government will converge towards the best possible outcome.

References

- Davis, L. and Gallman, R. (2001), *Evolving Financial Markets and International Capital Flows: Britain, the Americas and Australia 1865-1914*, Cambridge: Cambridge University Press.
- Davis, S. (1987: 1996), *Future Perfect*, Harlow, England: Addison-Wesley.
- Dosi, G. et al. (eds.) (1988), *Technical Change and Economic Theory*, London and New York: Pinter and Columbia University Press.
- Franke, N. et al. (2006), "Finding commercially attractive user innovations: A test of lead-user theory", *Journal of Product Innovation Management*, Vol. 23, pp. 301-315.
- Freeman, A. (2008), "Culture, creativity and innovation in the internet age", MPRA No. 9007, http://mpra.ub.uni-muenchen.de/9007/1/MPRA_paper_9007.pdf.
- Freeman, C. (1987), *Technology Policy and Economic Performance: Lessons from Japan*, London: Pinter.
- Gompers, P. and Lerner, J. (2001), *The Money of Invention: How Venture Capital Creates New Wealth*, Boston: Harvard Business School Press.
- Gompers, P. and Lerner, J. (2004), *The Venture Capital Cycle*, Cambridge Mass.: MIT Press.
- Lundvall, B.A. (1988), "Innovation as an interactive process: from user-producer interaction to the national system of innovation", Ch. 17, pp. 349-69 in Dosi et al. (eds.).
- Mourdoukoutas, P. (1999), *The Global Corporation*, Sta. Barbara, CA: Quorum.
- Mitchell, B.R. (1964), 'The coming of the railway and United Kingdom economic growth', *The Journal of Economic History*, Vol. 24, No. 3, September, pp. 315-336.
- Perez, C. (2002), *Technological Revolutions and Financial Capital: the Dynamics of Bubbles and Golden Ages*, Cheltenham: Elgar.
- Perez, C. (2006), "Re-specialisation and the deployment of the ICT paradigm: An essay on the challenges of globalisation" in *The Future of the Information Society in Europe: Contributions to the Debate*, IPTS-European Commission, EUR 22353 EN, Ch. 2, pp. 27-56.

Perez, C. (2007), "Finance and technical change: a long-term view" in Hanusch, Horst and Andreas Pyka (eds.) *Elgar companion to Neo-Schumpeterian Economics*, Cheltenham: Elgar, Ch. 49, pp. 775-99.

Perez, C. (2009), "The double bubble of the turn of the century: technological roots and structural consequences", *Cambridge Journal of Economics*, Vol. 33, No. 4, pp. 779–805.

Hamel, G. and Prahalad, C.K (1990), "The core competence of the corporation", *Harvard Business Review*, Vol. 68, May-June, pp. 79-91.

Tertzakian, P. (2006), *A Thousand Barrels a Second*, New York et al.: McGraw-Hill.

Von Hippel, E. (1988), *The Sources of Innovation*, New York: Oxford University Press.

Von Hippel, E. (2007), "Horizontal innovation networks by and for users", *Industrial and Corporate Change*, Vol. 16, No.2.

3

Corporate predilections, rational speculation, and innovation

Hans Schenk, Utrecht University

1. Introduction

During recessions firms economise on expenditure and investment. Cash flows diminish, at least in most industries, putting firms in a situation in which existing plans have to be reassessed. Firms subsequently do what everyone else would do in similar circumstances. As the saying goes, they simply “cut their coats according to their cloth”. Obviously, such economising behaviour applies to R&D investment expenditures too. This must have a negative effect on innovation output. However, since all affected firms are forced to adopt such economising behaviour at approximately the same time, it does not materially affect their competitiveness (which, after all, is a relative thing). The same applies at the level of economies as a whole. Especially since recessions have become increasingly aligned across national borders – arguably as a result of increasing globalisation – declining competitiveness cannot be an issue.

However, this is no reason to shrug shoulders. First, it is possible that some firms, or some countries, when a recession is over, succeed in getting their innovation processes in shape again more quickly than others. Obviously, this *does* address the issue of competitiveness. For a particular country, it is therefore important to have some idea about how it could prepare itself for this possibility.

Second, the severity of the financial and economic crisis of 2007-2009 allows us to rethink the modalities of innovation systems more easily. This crisis has exposed certain economic mechanisms that were neglected for decades, especially with respect to the modus operandi of free markets, permitting us now to approach issues of innovation with less ideologically informed thought than was possible only a few years back.

This paper will therefore explore some of the most relevant factors that could, or should, inform us on these questions. In particular, it will try to demonstrate that financial markets typically encourage speculative behaviour – not simply amongst professional and private investors, which one would expect, but also amongst firms, at least amongst those quoted on the stock market and/or big enough to evade immediate market penalties for suboptimal behaviour. Such behaviour has a crowding out effect on innovation.

A system which allows speculative behaviour is bound to generate financial crises, often with an economic crisis in their wake. If society wishes to minimise this risk, it will have to encourage investors as well as firms to focus on non-speculative projects, i.e. on research and development as much as on other elements of the public purpose.

The first task for this paper, therefore, is to demonstrate that firms under specific circumstances display behavioural preferences that have to be qualified as speculative. I have chosen to do this by focusing on the analysis of one of the most important – frequently *the* most important – category of corporate behaviour, i.e. mergers and acquisitions.

1. First, the paper will demonstrate that the most expensive business decisions, i.e. those concerning mergers and acquisitions, are void of positive productive and/or dynamic returns.
2. Second, the paper will argue that the determinants of such mergers and acquisitions are to be regarded as what I call ‘rational speculations’, or more specifically, as the results of ‘minimax-regret’ behaviour.
3. Third, the paper will argue that a liberalised market for corporate control rather than encouraging efficient mergers and acquisitions, encourages perverse behaviour among firms, i.e. an economically unjustified predilection for acquisitions.
4. Fourth, the paper will argue that the market for corporate control uses private equity firms as a repair mechanism, but that this mechanism itself is defective because it too is of a speculative nature.

Evidence on these factors will subsequently be used to make inferences concerning the position of innovation within the totality of firm decision making in an environment of liberalised financial markets.

2. The performance of acquisitions

Since the early 1900s, Western economies have gone through six merger waves. The fifth, which had its rising tide from 1995-2000, required worldwide investments of no less than about US\$ 12000 billion. With about US\$ 9000 billion, American and West-European firms took the lion’s share (for more details, see Schenk 2006). At the time, by way of comparison, acquisition expenditures by American and European firms were about seven times larger than Britain’s annual Gross Domestic Product. On average, they amounted annually to about one-fifth of US GDP.

Put differently, American and West-European investments in mergers and acquisitions were approximately equal to sixty per cent of gross fixed capital formation and they easily outpaced those in Research and Development (R&D).

Business enterprise investments in acquisitions were no less than about eight times higher than business enterprise expenditures on R&D.

The sixth wave, while aspiring to similar numbers as the fifth, however, had different characteristics. Similar to the fourth wave (which took place during the 1980s), a disproportionately large number of its acquisitions were Leveraged Buy Outs (LBOs), or in more modern parlance, Private Equity Leveraged Buy Outs (PELBOs). Many, if not most, of such buy outs do – or are supposed to – create value from demerging previously formed concentrations, indicating a sort of continuous stop-go process, or as I will elucidate further below: indicating a *restructuring wave*, or perhaps more appropriately, a *restructuring carousel*.

If buy outs are directed at undoing earlier mergers, this suggests that those mergers were inefficient. The importance of this should be immediately clear. Given the sheer size of merger waves, they may have a crucial effect on the fate of the economies in which they take place. If they improve the way in which society generates wealth, economies will noticeably benefit, even apart from the question to which parties the benefits will accrue. If, on the other hand, they do not generate wealth, or even destroy it, then economies will noticeably suffer.

Let us briefly examine the evidence on this. By now, the performance of mergers and acquisitions has been the subject of many dozens of studies, both in terms of real value effects and in terms of shareholder value effects (for a synopsis of the most important studies, see Schenk 2006). By far most studies have estimated shareholder value effects, mostly using readily available stock market data, and using predicted normal returns as controls. Although the findings of the various studies are not completely consistent, the general tendencies are clear. Since both shareholder value and real value studies – under certain restrictions – reach similar conclusions, the various findings must be regarded as robust.

Real value effects

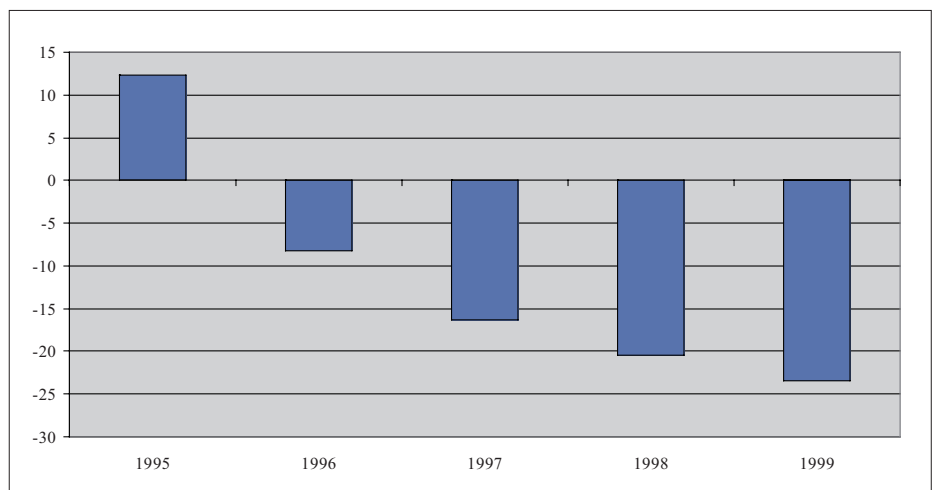
The most common result of merger performance studies is that profitability and productivity, variously measured, do not improve as a result of merger. In many cases efficiency does not improve or in fact *declines*, while in other cases it improves, though not faster than would have been expected in the absence of merger. Since it is unlikely that the market power of merging firms declines after merger, any decline in profitability can be taken to indicate a decline in efficiency. Mergers and acquisitions appear to lead to less product variety while market share growth slows down. Acquired firms lose market share against control groups of firms that remain independent (Mueller 1986). For instance, among the world's 18 largest pharmaceutical firms, 11 out of 12 that participated in mergers lost combined market share between 1990 and 1998 whereas all six of those that had not merged gained market share (*The Economist*, 22 January 2000).

Shareholder value effects

Similar results are obtained when the focus is on shareholder instead of real wealth. A review of 33 earlier studies by Mueller (2003) finds that while target shareholders usually gain from acquisitions, acquirer shareholders almost always lose, especially in the long run. Generally, the longer the post-merger assessment period, the more negative shareholder returns appear. Usually, positive abnormal returns are only evident for a few days around the event (and even then only when pre-event build-ups of share prices are underestimated), but taking this as evidence requires a very strong belief in the Efficient Market Hypothesis. Another review confirmed Mueller's findings before testing it for a sample of 110 very large acquisitions undertaken during 1993-2001, thus including years that preceded the beginning of the fifth merger wave and followed its demise (Schenk 2006). It found that for several different models – varying only in terms of event windows – the outcomes were all negative in terms of cumulative abnormal returns on the acquirer's side, running from minus 3,4 per cent to minus 8,5 per cent.

Interestingly, when taken together the data suggest the possibility of inter-temporal (rather than inter-sector) variations in merger performance. One of our own studies, focussing on European mergers, divided a sample into five year-cohorts (the first one starting in 1995, and the last one starting in 1999). For 400 post-merger days each, the study revealed that 'earlier' acquisitions perform better (or less badly) than 'later' acquisitions.

Figure 1. Shareholder Returns of European Mergers, 1995-1999 (Annual cohorts; CAR %).



Source: Schenk (2005)

As is shown in Figure 1, the 1995-cohort reached positive results but all others were in the negative, the 1999-cohort performing worst of all; it saddled its shareholders with an average cumulative loss of almost 25 per cent. Similarly, in a study of about

12000 (American) acquisitions from 1980 to 2001, Moeller *et al.* (2003) found that while shareholders lost throughout the sample period, losses associated with acquisitions after 1997 were 'dramatic'.

Finally, and although one might have justified doubts with respect to the specifics of meta-analyses, it is worthwhile to refer to a recent study that assessed the added effects of 93 studies with 852 effect sizes (i.e. germane bivariate correlations) with a combined n size of 206910, where n was derived from adding the number of companies on which each of the 93 studies relied (King *et al.*, 2004). Observed zero-order correlations between the variables of interest were weighted by the sample size of the study in order to calculate a mean weighted correlation across all of the studies involved. The sample included both shareholder and real value studies (with the latter limited to studies of the effects on return on assets, return on equity and return on sales). Abnormal (shareholder) returns for acquiring firms appeared to be only positive and significant at day 0. Except for an insignificant positive effect for an event window of 1-5 days, all others were negative and significant (i.e., for event windows of 6-21 days; 22-180 days; 181 days-3 years; and greater than 3 years). Similarly, all results for the acquiring firm's return on assets, return on equity, and return on sales were either insignificant or negative.

Innovation effects

Although unlikely, deteriorating productive efficiency, profits and/or shareholder value may occur simultaneously with zero or even positive effects on dynamic efficiency, i.e. on innovation. Effects on innovation have also been estimated, unfortunately only in a few studies. From these, it appears likely that mergers and acquisitions have a negative effect on R&D investments, R&D investments relative to the industry average, and R&D output except for some industries, most notably the chemical industry (Scherer, 1984; Ravenscraft and Scherer, 1987). Hitt *et al.* (1991) studied the effects of 191 US acquisitions on both R&D expenditures and results. Total R&D expenditures were divided by total sales and adjusted for average industry R&D-intensity. R&D performance was expressed as the number of patents registered divided by total sales. The results show that the acquisition variable, after size, leverage, return on assets, and liquidity were controlled for, was a statistically significant, negative predictor of R&D intensity adjusted for industry. The results for patent intensity were similar, so that it was possible to conclude that mergers do not necessarily have synergetic effects in terms of innovation. In a follow-up study, Hitt *et al.* (1996) confirmed this for a sample of 250 firms for which R&D data were available for 1985-1991. Again, a significantly negative relationship between acquisition and innovation was found.

Similar, but mostly insignificant results were found by Hall (1999) in a study of 6000 quoted firms. This somewhat weaker result can probably be explained by the fact that Hall's sample included many fourth-wave mergers that were strongly leveraged.

Indeed, she did find a strong, negative connection between leverage and post-merger R&D investments. According to Hall, her results demonstrate that mergers do not by definition have positive economies of scale or scope effects on R&D. The results applied for classical as well as so-called R&D intensive industries. Private, mostly small firms appear to be able to escape from this regularity, however (Moeller *et al.* 2003; Weitzel and McCarthy 2008).

Implications

Taking into account that most merger performance studies concern quoted firms – at least as acquirers – and that most quoted firms are large to very large firms, and generalising over a great many studies, the verdict would be that, depending on the industry, between 65 and 85 per cent of mergers and acquisitions fail to create wealth. I call such mergers ‘uneconomic mergers’.

The most robust discriminator of success and failure seems to be intertemporality: the further down the merger wave, i.e. when acquisition incidence rises steeply, the more disappointing the economic results become. The evidence must be seen as confidently suggesting that large firms are not good at creating efficiencies of whatever kind through merger.¹

It is important to notice that the results found are not just a coincidence, not just a feature of mergers in a particular era, or a particular industry. Rather, these results are common and recurring whenever a merger wave develops (for earlier merger waves, see Dewing 1921; and Borg *et al.* 1989).

3. Minimax-regret behaviour

The evidence on merger performance effects raises a fundamental question. Assuming that executives are aware of the extremely small chances for success (which they should), why do they nevertheless – sometimes – pursue this investment priority so vigorously?

Unfortunately, the answer is uncertain. The fact that failure appears widespread and endemic implies that one cannot simply assert that we have observed aberrations from normal practice. If anything, uneconomic mergers and acquisitions are normal practice. From a neoclassical point of view, widespread and recurrent failure would be inconceivable – it would not fit in the functionalist view of the economy as a system that if left to itself would automatically generate wealth-maximising equilibriums.

Another fundamental question concerns the efficiency of the system in which merger firms are functioning. The neoclassical idea of an economy is built upon the

¹ Interestingly, they are not good at creating monopoly rents through merger either—because in that case one would expect to find some superior profitability performance at the least.

² The idea was elaborated for the first time in Marris (1964).

disciplinary force of the market mechanism, more specifically the market for corporate control mechanism. Allegedly, underperforming firms will become targets of more efficient firms so that the new management will be able to perform its task of maximising efficiency (in the interests of the shareholders and thus in the interest of the economy).² It now appears, however, that this system of external control is incapable of preventing uneconomic mergers.

Target firms in this view have incumbent management teams that are either not fit for their task or are focusing on managerial goals. Especially the latter have received attention in the literature. A lack of sufficient internal control mechanisms encourages agents (i.e. managers) to undertake uneconomic mergers in order to maximise their own goals, such as personal wealth, status and power. Executive income, for example, has been found time and again to be positively correlated with firm size (Otten 2007). Since mergers are the quickest and easiest route to larger size, executives would be willing to sacrifice efficiency in return for a private wealth boost.

It is somehow hard to believe, however, that managers are structurally able to disguise and distort information and to mislead or cheat their principals (i.e. the shareholders) on a scale large enough to explain the incidence of uneconomic mergers. On the contrary, managers may on average be just like ordinary people, i.e. they may enjoy performing responsibly in the interest of the owners because of a personal need for achievement, while interpreting responsibility as something that is defined in relation to others' perceptions (such as has been put forward in the 'stewardship theory', see Davis *et al.* 1997).

If the principal-agent relationship is conceived in terms of enlightened self-interest, it may be difficult to decouple an agent's goals from those of her principal (see Wright *et al.* 2001). Also, there is not much evidence that managers would only cheat their principals when they are faced (or are expecting to be faced) with rising profits that could be kept away from them. In fact, many of the most proliferate cases of cheating occurred when profits were decreasing rather than increasing (see Brenner 2002). More generally, it is unclear how the inadequacy of internal controls would relate to the dynamics of merger waves.

Similarly, it would seem implausible that hubris is to blame for uneconomic mergers, as has been argued in a classic paper by Roll (1986). Hubris, indeed, is positively correlated with height of bid premiums, which is a reliable predictor of merger failure (see e.g. Raj and Forsyth 2003), but intertemporal variations in the merger rate cannot be accounted for.

An adequate theory would need to be able to address the dynamics of mergers as well as their high failure rate. I have argued elsewhere, that such a theory requires elements from the behavioural theory of the firm (particularly as developed by Cyert and March 1963), from information theory (as developed by especially Scharfstein

and Stein 1990; Banerjee 1992; and Bikhchandani *et al.* 1998), as well as from the theory of regret (see Schenk 2006). More in particular, rather than requiring a logic of consequence, it requires a logic of appropriateness, the latter offering a perspective that sees human action as driven by rules of appropriate or exemplary behaviour, organised into institutions (see Olsen and March 2004). Rules are then followed because they are seen as natural, rightful, expected, and legitimate. An adequate theory must include a mechanism of diffusion that is able to cope with sudden multiplications of a phenomenon and a sense of counterfactuality, that is an idea about how one would have felt if another option than the actual one had been chosen.

According to behavioural theory, uncertainty or lack of understanding with respect to goals, technologies, strategies, payoffs, etcetera – all of them typical for modern industries – are powerful forces that encourage imitation. DiMaggio and Powell (1983) have suggested that when firms have to cope with problems with ambiguous causes or unclear solutions they will rely on problemistic search aimed at finding a viable solution with little expense. Instead of making decisions on the basis of systematic analyses of goals and means, organisations may well find it easier to mimic other organisations. Most eye-catching mergers are undertaken by large firms. These firms normally operate in concentrated industries and are usually active in several of those industries at the same time. In the typical situation of multi-market oligopoly, which involves both interdependence of outcomes and strategic uncertainty, adopting mimetic routines is therefore a likely way for solving strategic decision-making problems. Moreover, organisations with ambiguous goals are highly dependent upon appearances for legitimacy.

Dietrich and Schenk (1995) have suggested that one way of expressing this is by adopting a minimax-regret routine. Let us assume that a decision maker knows the payoffs for each decision alternative but that she is completely ignorant as to which state of nature prevails. The minimax-regret routine then prescribes that she should select that strategy which minimizes the highest possible regret assuming that the level of regret is linearly related to the differences in payoff. The minimax-regret criterion thus puts a floor under how bad the decision maker would feel if things go wrong. Moreover, doing so will protect her against the highest possible reproach that can be made by those stakeholders who assess the decision's utility on the basis of the true state of nature. The model explains why conventional wisdom teaches that it is better for reputation to fail conventionally than to succeed unconventionally – as was already proposed by Keynes (1936).

When put into a framework of competitive interdependence this develops as follows. Given that firm A announces the acquisition of firm B, and that this acquisition for some reason attracts attention of her peers (rivals), then firm C will have to contemplate what the repercussions of this initiative for her own position

might be. Suppose that there is no way that C can tell whether A's move will be successful or not. A's move could be genuinely motivated by a realistic expectation that her cost position will improve, or by a realistic expectation that her move will increase her rating with stakeholders or her earnings. That is, A's competitiveness position vis-à-vis her peers might be improved as a result of that move, say in terms of a first mover advantage. But then again, it might not. For example, A's move might be purely motivated by the pursuit of managerial goals, or it might simply be a miscalculation caused by hubris. What is firm C to do?

Suppose that A's move will be successful, but that C has not reacted by imitating that move herself (which we will call scenario α). To what extent will C regret not having reacted? Alternatively, suppose that A's move will not be successful but that C has imitated it, solely inspired by the possible prospect of A's move being a success (scenario β). To what extent will C regret this when the failure of A's move becomes apparent? Within a minimax-regret framework, it is likely that C's regret attached to scenario α will be higher than the regret attached to scenario β . For in scenario α , C will experience a loss of competitiveness, while in scenario β her competitive position vis-à-vis A will not have been harmed. Of course, C could have realised a competitive *gain* in scenario β had she refrained from imitation, but in terms of the minimax-regret model her regret of having lost this potential gain is likely to be relatively small. The implication is that under conditions of uncertainty a strategic move by firm A will elicit an imitative countermove by her rivals – even if the economic payoffs are unknown.

We conclude that a decision maker who is using a minimax-regret routine will imitate actions of earlier decision makers that are regarded as significant. Thus, if – for some reason – a first decision maker within a strategic group has decided to undertake a merger, a second decision maker may follow suit even if her own information suggests that another alternative would be preferable from an economic point of view. Evidently, such imitation may lead to cascades that will last very long. In a sense, mergers and acquisitions have then become “taken-for-granted” solutions to competitive interdependence. It implies that firms may have become locked into a solution in which all players implicitly prefer a non-optimal strategy without having ready possibilities for breaking away from it.

Even if some firms do not adopt minimax-regret behaviour, it will be sensible for them to jump on a merger bandwagon too. For cascading numbers of mergers and acquisitions imply that the likelihood of becoming an acquisition target increases. Thus, given the finding that relative size is a more effective barrier against takeover than relative profitability (Dickerson *et al.* 2003), firms may enter the merger and acquisition game for no other reason than to defend themselves against takeover. It is needless to say that such defensive mergers will amplify the prevailing rate of mergers and acquisitions. The cascade will inevitably stop as soon as (a) the number

of potential targets diminishes, which is a function of the intensity of the cascade, and (b) the disappointing merger returns decrease the chances for obtaining the financial means that are necessary for further merger investments.

Mergers that have been undertaken for minimax-regret or defensive reasons can be designated as *purely strategic mergers*. These are mergers that are intended to create strategic comfort when faced with the uncertain effects of a competitor's moves, rather than economic wealth (or, for that matter, monopoly rents). It is precisely for this reason that it would be futile to wait on the so-called learning capacities of organisations to improve economic merger performance. Firms may learn very quickly – but the system in which they operate teaches them the 'wrong' thing. In a system that is dominated by the few, such purely strategic mergers are simply part of the game. Meanwhile, a whole industry of investment banks and advisors has sprung up to facilitate a smooth working of this merger and acquisition process. These parties have a direct interest in maximising the number and size of deals.

Minimax-regret behaviour can also be labelled as *rational speculation*. In finance, speculation is defined as a financial action that does not promise safety of the initial investment along with the return on the principal sum. Speculation typically involves the lending of money or the purchase of assets, equity or debt but in a manner that has not been given thorough analysis or is deemed to have low margin of safety or a significant risk of the loss of the principal investment. Speculation contrasts with the term investment, which is a financial operation that, upon thorough analysis, promises safety of principal *and* a satisfactory return. In the current case, such speculation is, however, generated by circumstances, i.e. by similar actions of peers. In a liberalised market for corporate control this is a rational act.

4. The restructuring wave

It is now possible to derive the different stages of the restructuring wave, of which the merger wave is an integral part, see Figure 2. We do have a logic of appropriateness (reputation), a diffusion mechanism (imitation) and a sense of counterfactuality (regret). The existence of strategic interdependence under uncertainty, under certain conditions such as concerning the availability of funds and investment bank expertise, will compel managements to undertake mergers even if these will not increase economic performance.

Inertia may prevail for possibly long periods, but as soon as an initial, clearly observable move has been made by one or a few of the major players, it is likely that other players will rapidly follow with similar moves. With multi-market oligopoly omnipresent, and given the increasing weight assigned to stock market performance appraisals, the ultimate result can be an economy-wide merger boom.

Figure 2. The restructuring wave.

Stage 1	Preconditional Stage A booming economy provides the necessary means (cash; stock appreciations; borrowing facilities), but is not sufficient
Stage 2	Event Stage A single (random) merger ignites the game
Stage 3	Response Stage Minimax-regret and defensive routines lead to bursts of merger activity
Stage 4	Depletion Stage The merger boom levels off as a result of lacking and/or lagging productivity/profitability gains, and prices rise for targets
Stage 5	Recovery Stage Reconstitution management sets in (sell-offs, divestitures, demergers; lay-offs); private equity setting in
Stage 6	Normalisation Stage The pool with targets is refilled

Source: adapted from Schenk (2006)

Eventually, many firms will find themselves stuffed with acquisitions that were neither meant nor able to create wealth. As a consequence, after the strategic imperatives have receded, firms will start undertaking repair work. In the short run, they are likely to look for cheap and easy alternatives, like economising on all sorts of expenses (e.g. labour; R&D). In the medium run they will spin off many of the acquisitions done during the boom – sometimes at great cost. Indeed, it has been estimated that as much as half of all mergers and acquisitions will be undone within a period of ten post-merger years (Porter, 1987).

Thus, the booming merger years now turn into a period in which mergers are relatively rare. In fact, it is likely that mergers that still happen during these depressed years have a relatively high chance for success (refer back to Figure 1). First, the strategy pressure is relatively low so that the economic pros and cons of a merger or acquisition can be thought through carefully. Secondly, prices at the stock market are less inflated and premiums need not have deterrence quality so that they can be relatively low.

5. Private equity

Meanwhile, starting with the fourth merger wave in the 1980s, a complete new industry has grown up that has specialised in facilitating spin-offs of previously acquired subsidiaries or divisions through leveraged buy-outs (LBOs). Sometimes labelled locusts, these private equity companies (PECs) help acquisitive firms getting rid of their uneconomic acquisitions or make a profit of dissolving unsuccessful amalgamations altogether. Firms, or parts of them, are taken private so that they are no longer subject to the same rules of the game that have been adopted by

quoted firms. It is only natural, that these PECs have been able to flourish especially during 2003-2007. For apart from low interest rates until mid-2007, the fifth merger wave (1995-2000) created many merger jalopies, thus many opportunities for restructurings at low cost. Since borrowers receive a pre-defined compensation that is tax-deductible – i.e. interest – all profits are, in principle, available for the equity owners. Returns on equity in the industry therefore are (or rather: were) extremely high, despite the fact that loans typically are high-yield, thus carrying relatively high interest rates. For example, against an average annual return of 8,7 per cent on Standard & Poor's listed companies, leading PECs were generating returns of 30-40 percent during the first half of the first decade of this century.

Not everything that glisters is gold, however. LBOs appear to be a risky means to correct the failures of the market for corporate control. Schenk (2007) found for all US LBOs with transaction size larger than \$ 200 mln, done between 1990-1997, that almost 16 per cent had ended up in bankruptcy by 2007. For the control group, consisting of size and industry matched targets of non-LBO takeovers, this appeared to be less than 5 per cent. Attevelt *et al.* (2009) studied whether sample bias might have had an influence on these results. For LBO targets might have had a larger ex ante bankruptcy risk, thus biasing the ex post bankruptcy findings. It turns out, however, that LBO targets, if anything, display a better ex ante expected performance than non-LBO targets. They appear to have a higher EBIT/Total Assets ratio and similar working capital, Retained Earnings/Total Assets and operating revenue ratios.

This suggests that on average LBOs have a weakening effect on the targets. It is likely that this effect is the result of the famed financial discipline that PECs introduce into the firms that they acquire. On average, more than 75 per cent of the takeover funds are borrowed in an LBO. The senior debt generally is secured with fixed assets, inventory, and accounts receivable, whereas the subordinate debt is in the form of high-risk bonds (or junk bonds as they came to be known in the 1980s). According to Jensen (1986), buy outs put much pressure on incumbent management to focus more, or even exclusively, on wealth generating investment projects. More in particular, buy outs are devices the financial markets use to discipline corporate managers and pressure them to increase cash flows and to pay out more money to shareholders and other investors. The idea is rather novel (Blair 1993). Before the 1980s, debt and equity were simply regarded as alternative means of raising capital, albeit with different costs and risks. The problem rather was that it seemed impossible to derive an optimal capital structure (Baxter 1967). As a consequence, it was not possible to define the thresholds that would determine significant changes in the risk of default. Yet, researchers as well as practitioners realised that reliance on debt might be excessive.

Highly leveraged firms underinvest when they economise on investments that would be necessary for sustaining firm growth. Such a course may be accentuated by conflicts that can arise among the firm's different claimholders (Barclay & Smith 2005). To illustrate this conflict, consider what might happen to a high-growth company that is having trouble servicing its debt. Since the value of such a firm will depend heavily on its ability to carry out its long-term investment plan, what this company needs is an infusion of equity. But the investors who would be asked to provide the new equity in such cases recognise that much of the value created (or preserved) by their investment would go to restoring the creditors' position. In this situation, the cost of the new equity could be so high that managers might forgo both the capital and the investment opportunities, thus would underinvest.

During the 1980s, debt and equity were increasingly seen as ways in which the suppliers of capital could influence more directly or control the decisions made by management. Debt contracts in particular put management at risk of losing control to the creditors if the firm failed to meet its contractual obligations to service its debt or to maintain its liquidity ratios. Profit distribution contracts in this sense are much more indirect, thus of plausibly smaller impact. Thus, increasing debt would have a relatively strong disciplinary impact on managements wishing to retain control. More in particular, it would prevent firms that have free cash flows – defined as cash flows in excess of that needed to fund investment opportunities – to use these for all sorts of emoluments, luxury expenditures, high executive incomes and perquisites and management's pursuit of empire building. As Mueller has noted, one of the first things that a buy out sponsoring firm does when it takes over a company is to sell the company plane and close the executive dining room (Mueller 1993).

However, it is perhaps difficult to establish where luxury expenditures end and necessary expenditures begin. Whereas studies like Harris *et al.* (2005) suggest that post-buy out productivity increases, this appears to be caused by measures undertaken by the new owners to reduce the labour intensity of production via outsourcing of intermediate goods and materials. Long and Ravenscraft (1993) found that approximately 60 percent of companies in their sample of some 90 leveraged buy outs over the period 1981-1984 improved operating performance, much of the improvement coming from savings of non-plant operating expenses. However, whereas firms reduced capital expenditures by 9 percent they reduced R&D by no less than 40 percent. A US National Science Foundation study concluded that R&D expenditures declined by an average of 12,8 percent after an LBO (NSF 1989).

If expenditures were abnormally high or wasteful before the buy out, these cuts surely would be beneficial. If not, however, they might jeopardise long-run performance for short-term gains. Williamson has suggested that redeployable

assets would be more effectively financed by debt, as it restricts discretionary power, but that nonredeployable assets such as R&D should be financed by equity (Williamson 1988). To the extent that buy outs are financed by debt, investments in nonredeployable assets would suffer. Long and Ravenscraft (1993) found some support for the latter possibility indeed. Especially a sample pertaining to 1985-1987 had a negative average change in performance, suggesting that deals pursued later in the buy out cycle were more marginal. More generally, Eriotis *et al.* (2007), using a panel data format to study the effect of capital structure for a sample of 129 listed Greek firms, find that there is a negative relation between debt ratio and firm growth.

All in all, it therefore seems likely that a mechanism which should pressure firms to focus on efficiency only, in fact pressures them to economise on investment projects that are necessary for survival.³

6. Implications

The costs of rational speculation in the area of mergers and acquisitions are likely to be substantial. First, it has direct effects on the availability of funds for 'real' investment, i.e. investment in equipment, R&D and human resources. Similarly, it pulls managerial attention away from 'real' investment projects. It is likely, moreover, that it also draws upon the best human resources available. Indeed, it has been documented that financial management has been given more and more esteem within firms until recently, ultimately pulling managerial talents away from R&D towards merger exuberance (and other speculative investments, particularly in securitised products).

Secondly, speculative mergers may have substantial effects on the economy, provided that the phenomenon is sufficiently sizable. Ravenscraft and Scherer (1987) estimated welfare losses from failing mergers by assuming that profitability movements are reflections of changes in operating efficiency relative to industry norms. They studied the efficiency effects for 634 manufacturing acquisitions done in 1968, 1971 and 1974, separating out those acquisitions that were sold-off later from those that were retained. Calibrating the results for 1975-1977, they came up with total efficiency losses per annum of between 2,41 and 3,32 bln U.S. dollars, i.e. after having taken into account the gains that were generated by successful

3 Cao and Lerner (2006) examined whether almost 500 firms that went public again after a buy out showed performance differences when compared with almost 6000 other offerings (Initial Public Offerings, IPOs). They found that buy out offerings (Reversed Leveraged Buy Outs, RLBOs) outperformed other IPOs as well as the market as a whole in the first, fourth, and fifth year after going public. They found no evidence that more leveraged RLBOs perform more poorly than their peers. Studies like Cao and Lerner's are seriously flawed, however. They examine only the firms that went private and that, subsequently, went public again. These firms constitute a small and probably biased sample. Only successful buy out firms are likely to go public again. Unsuccessful buyouts are not in a position to exercise this option. The data with respect to the firms that remain private cannot be easily assembled because these firms do not have to make the data publicly available. One of the main advantages of being private is not having to file 10-Ks and other public reports with the SEC (Fox & Marcus 1990).

mergers. Relating these losses to expenditures on mergers in the years mentioned, amounting to about US\$ 57 bln, gives negative returns on merger investments of between 4 and 6 per cent annually during 1975-1977. Total (cumulative) efficiency losses will have been higher, but it is not possible to say by how much.

Hypothesising a bit further on this, one can also take failure estimates as an opening wedge. For the years 1995-1999, this would imply that out of total merger investments of about US\$ 9000 bln between roughly US\$ 5500 and 7500 bln would have been invested with either zero or negative returns. Including the last year of the rising part of the fifth wave, 2000, adds merger expenditures of more than US\$ 2000 bln. In turn, this leads to losses as a result of merger failure amounting 7000-9250 bln US dollars. Part of this is a real (efficiency) loss; another part is mainly opportunity cost. Unfortunately, the distribution is unknown so that it is near to impossible to estimate which gains might have been generated by alternative deployments of investment funds.

However, applying the same proportions as used above (after having eliminated the gains from mergers of equals as we are now exclusively dealing with failure, leading to 5,2 and 6,8 per cent, respectively), we would get estimates of annual efficiency losses of somewhere between US\$ 350 and 600 bln. The fifth merger wave might therefore have implied efficiency losses to the amount of US\$ 2100-3600 bln, with the lion's share falling towards the last two years of the previous century. Since these losses would be real efficiency losses rather than numbers that are based upon perceptions of failure, they would seem quite impressive.

Losses of this size may be large enough to have recessionary impact, certainly for the leading countries, the United States, Great Britain, and the Netherlands. Obviously, applying proportions that were valid in the 1970s to the 1990s requires some quite heroic assumptions. Especially in view of the inflated stock prices during the latter part of the fifth merger wave, however, returns on merger investments are likely to have been even worse.

The estimations thus far have referred to real (and opportunity) effects. Can we also estimate the macroeconomic impact from the effects mergers had on stock prices? Moeller *et al.* (2003a) have calculated the shareholder value losses for a sample of 12023 domestic acquisitions within the U.S., spanning 1980-2001, at about US\$ 219 bln. There were about 44250 mergers in the U.S. during the fifth merger wave (1995-2000), so that by extrapolation we would find a total loss in shareholder value of approximately US\$ 800 bln due to mergers. The effects were calculated, however, using a short event window (three days) so that the true loss of wealth is underestimated significantly. Again, quite heroic assumptions are necessary. We have found in our studies that three-year losses are typically seven times larger than 2-day losses. If it would be justified to use this ratio here, the estimate of true

wealth losses would amount to roughly US\$ 5500 bln. In terms of U.S. GDP, this would be approximately ten per cent.

In a more recent paper Moeller *et al.* (2003b) demonstrate that almost all of these losses appear during 1998-2001, that is, when the fifth merger wave was peaking. From data supplied to me by the authors, it can readily be seen that 3772 mergers lost US\$ 240 bln for the acquiring shareholders, for an average loss of US\$ 64 mln per merger. When the gains to target shareholders are subtracted, the net effect appears to be a loss of US\$ 134 bln. Again by extrapolation, I find that US\$ 1290 bln was lost in the 36350 mergers that took place in the U.S. during 1998-2001. Evidently, when multiplied by seven, the wealth losses for the fifth wave mergers appear dramatic, at about 16 per cent of GDP.

It is uncertain, however, what a wealth loss implies in terms of real effects. It is likely, that investors, be they firms, institutional investors, or private investors, will react in some way to such a dramatic change in wealth but whether such reactions are significant enough to provoke a recession, for example, is an open question. However, if reactions to these losses were as severe as they were to the wealth gains that were realised when the stock market was booming, then the answer would be affirmative. Bulmash (2002), for example, estimated that the effect of the wealth gain of US\$ 6000 bln over the period 1997-1999 on consumption spending in the U.S. was more than US\$ 120 bln in 1998 and 1999. Over 40 per cent of the growth in consumer spending in 1999 was attributable to gains in the stock market in 1997 and 1998. The wealth losses reported above may have had similar real effects. Assuming gain/loss symmetry, the real effect of wealth losses due to merger on American consumer spending would have been between US\$ 110 and 180 bln annually. Generally, however, the regret attached to losses is much higher than the joy attached to gains (Kahneman & Tversky 1979) so that it is likely that the effect on consumption spending has been higher. Notice, that in order to reach correct conclusions these losses must be added to the efficiency losses estimated above, to opportunity costs and to retardations in investment spending.

In this respect it should perhaps be recalled that opportunity costs are important. If funds do not generate wealth, this implies that they do not create economic growth. It could be argued that the billions expended on mergers do not vanish from the economic process. Indeed, it may be so that shareholders at the receiving end instead of creating a consumption bubble, or overindulging themselves in Veblen-type conspicuous consumption, will reinvest their newly acquired pecuniary wealth in investment projects that do create economic wealth. If so, then we would merely have to worry about a retardation effect. Still, such an effect may be significant, since an accumulation of retardation effects – and this is exactly what is likely to happen during a merger wave – is what is called a recession. In any case, all six merger waves have been followed by rather severe economic recessions. The

second merger wave ended up in the largest pre-World War II crisis; the sixth in the largest post-World War II crisis.

7. Conclusions and policy implications

This paper has brought to the attention that innovation, and innovation policy, cannot be separated from what is going on in the economy at large. If restructuring waves have recessionary impact, and if recessions have a mitigating effect on innovation, then obviously innovation policy should extend towards merger policy. If mergers appear to frustrate innovation growth, then obviously the same applies. More specifically, such policy should be vigorously aimed at preventing rational speculation in mergers. However, looking back at the 1990s and the first part of the current decade, public policies in the merger domain have either directly or indirectly encouraged mergers and acquisitions – irrespective of these mergers being speculative or not. There are two basic fields of policy in this respect: merger control policy and takeover policy.

Merger control has become almost superfluous, both in the US and the EU, in terms of enforcement as well as principle, where changes in the latter have weakened the former. In terms of principle, the focus of merger control has changed from protection of the public interest to protection of the consumer's interest. Assessing mergers and acquisitions from a consumer interest viewpoint is not an easy task, some would say: as a result of both conceptual and measurement problems an impossible one (Dewey 1996). The problems are related to delineating the relevant product and geographic market as well as to estimating demand substitutability, the likelihood of new entry, and the power of potential competition. Merger policy does not take into account that mergers may be motivated neither by the prospect of productive or dynamic efficiency gains nor by the prospect of monopoly profits and still be dangerous. The underlying presumption is that mergers that are not motivated by the prospect of financial gains will not occur or, if they do, will only be short-lived. As we have seen, this presumption cannot be sustained. The current standard therefore contains a much too narrow interpretation of wealth to be able to deal with mergers and acquisitions that might be harmful to the economy by pushing it into recession.

The possible occurrence of speculative mergers and acquisitions has also benefitted from recent changes in takeover policy. In the EU, the Takeover directive that came into force in 2004 has made it rather difficult to raise barriers against takeover. This directive was explicitly based on the idea that the market for corporate control should be as free as possible. The impetus of this paper is that this is an erroneous idea. The theory of the market for corporate control does not take into account that firms in the real economy may display behaviour that from a neoclassical theory point of view is to be regarded as perverse and yet sustainable. The market

mechanism is not able to discipline firms because there are so many of them that undertake uneconomic mergers and acquisitions – as we have seen. Among large firms that are quoted on stock exchanges, undertaking strategically rather than economically rational mergers is normal behaviour. The collectivity of the phenomenon is precisely what allows firms to shift the burden of their uneconomic mergers to the shareholders, and ultimately to society in the form of a recession, or worse, a crisis. Shareholders will normally not revolt because doing so would be revolting against their own behaviour 'back home' (recall that the lion's share of stockholding is with institutional investors and other financial or industrial firms). In conclusion, the implicit wider message of this paper is twofold:

- a. The first is that policy in one domain (technology and innovation) cannot succeed without matching policies in other domains, in particular the domain of mergers and takeovers. One might even hypothesise that if we were to reach a state of economically efficient mergers we would be close to solving many problems in the domain of innovation. Obviously, this applies *mutatis mutandis* to policies towards financial markets generally, i.e. to banking regulation, to the regulation of private equity and hedge funds, to the regulation of cross-border capital flows, and in particular to the regulation of fashionable derivatives and structured finance. Eliminating the drivers of speculation that are so immanent in these markets in particular would help us enormously with directing society's resources to the more fruitful purposes of innovation.
- b. The second message applies to economic theory. This paper has discussed two instances of policy, merger control and takeover regulation. Both policy sets have been found defective because they are lodged into economic ideas that cannot be substantiated in the real practice that they are supposed to apply to. Merger control presumes that firms would never deviate from efficiency maximisation, except if profits could be increased more, or more easily, by building up market power. Since an economy is presumed to consist of producers and consumers only, merger control takes the impact of mergers on consumers as the hinge point for intervention. However, next to the consumer's interest, perhaps more importantly, the economy also has a general or public interest. Similarly, current takeover control regulations presume that firms are efficiency-driven, or at least that they must be so. If firms cannot honour this principle, for whatever reason, they are likely to become a target for takeover. Policy must, therefore, encourage such takeovers. These ideas share functionalist and voluntarist models of society in which furthermore homogeneity of rational investors is necessarily assumed to make them work. Fundamentally speaking, these are the same ideas that underlie such milestones in the profession's history as the Modigliani-Miller framework which is still very popular, at least until the current crisis: financial markets

are atomistically competitive, investors are unaffected by emulation effects and other interpersonal spillovers, information is costless, widely available and capable of being processed rationally (Spotton and Rowley 1998). In such a world, the debt level of any firm affects neither the unit cost of debt service nor the value of collateral assets potentially sold to repay the debts. The threat of a credit crunch is thus effectively removed by assumption.

Finally, let us return to innovation. Schumpeter (1939) already stressed how dependent innovation is on the availability of credit. He described the assimilation of innovations and their financing as a dynamic process associated with successive expansions and contractions of bank credit. The process is driven by the prospects of innovations being capable of generating increased earnings from which the debt can be serviced. It is correct that innovation processes may also end up in disappointment – but at least, those that do end up in success, end up in real rather than virtual success.

References

- Attevelt W.J., Hamans R., Hassink W., Schenk H. (2009), 'Are LBO targets a special class?', *Mimeo*, Dept. of Economics, Utrecht University (forthcoming).
- Banerjee A.V. (1992), 'A Simple Model of Herd Behavior', *Quarterly Journal of Economics* CVII (3): 797-817.
- Baxter N.D. (1967), 'Leverage, Risk of Ruin and the Cost of Capital', *Journal of Finance* 22 (3): 395-403
- Bianchi P., Labory S., eds. (2005), *International Handbook of Industrial Policy*, Cheltenham: Edward Elgar.
- Bikhchandani S., D. Hirschleifer and I. Welch (1998), 'Learning from the Behavior of Others: Conformity, Fads, and Informational Cascades', *Journal of Economic Perspectives* 12 (3): 151-170.
- Blair M.M. ed. (1993), *The Deal Decade*, Washington: Brookings Institution.
- Blair M.M. (1993), 'Financial Restructuring and the Debate about Corporate Governance', in: Blair M.M. (ed.): 1-17.
- Borg J.R., Borg M.O., Leeth J.D. (1989), 'The Success of Mergers in the 1920s. A Stock Market Appraisal of the Second Merger Wave', *International Journal of Industrial Organization* 7 (1): 117-131.
- Brenner R. (2002), *The Boom and the Bubble. The US and the World Economy*, London/New York: Verso.
- Bulmash S.B. (2002), 'A new paradigm: the wealth effect of the stock market on consumption, in a context of interacting bio-systems', *Journal of Socio-Economics* 31: 75-100.
- Cyert R.M., March J.G (1963), *A Behavioral Theory of the Firm*, 2nd ed. 1992, Cambridge, MA: Blackwell.
- Davis J.H., Schoorman F.D, Donaldson L. (1997), 'Toward a Stewardship Theory of Management', *Academy of Management Review* 22 (1): 20-47.
- De Gijsel P., Schenk H., eds. (2006), *Multidisciplinary Economics*, Dordrecht: Springer.

Dewey D. (1996), 'Merger Policy Greatly Simplified: Building on Keyes', *Review of Industrial Organization* 11: 395-400.

Dewing A.S. (1921), 'A Statistical Test of the Success of Consolidations', *Quarterly Journal of Economics* 36: 84-101.

Dickerson A.P., Gibson H.D., Tsakalotos E. (2003), 'Is attack the best form of defence? A competing risk analysis of acquisition activity in the UK', *Cambridge Journal of Economics* 27: 337-357.

Dietrich M., Schenk H. (1995), 'Co-Ordination Benefits, Lock-In, and Strategy Bias', *Management Report* 220, Rotterdam: Rotterdam School of Management, Erasmus University Rotterdam.

DiMaggio P.J., Powell W.W. (1983), 'The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields', *American Sociological Review* 48: 147-160.

Eriotis N., Vasiliou D., Ventoura-Neokosmidi Z. (2007), 'How firm characteristics affect capital structure: an empirical study', *Managerial Finance* 33 (5): 321 – 331.

Fox I., Marcus A. (1992), 'The causes and consequences of leveraged management buyouts', *Academy of Management Review* 17 (1): 62-85.

Hall B.H. (1999), 'Mergers and R&D revisited', Paper presented at the Quasi-Experimental Methods Symposium, University of California, Berkeley, 3-7 August.

Harris R., Siegel D.S., Wright M. (2005) 'Assessing the Impact of Management Buyouts on Economic Efficiency: Plant-Level Evidence from the United Kingdom', *Review of Economics and Statistics* 87 (1): 148-153.

Hitt M.A., Hoskisson R.E., Ireland R.D., Harrison J.S. (1991), 'Effects of Acquisitions on R&D Inputs and Outputs', *Academy of Management Journal* 34 (3): 693-706.

Hitt M.A., Hoskisson R.E., Johnson R.A., Moesel D.D. (1996), 'The Market for Corporate Control and Firm Innovation', *Academy of Management Journal* 39 (5): 1084-1119.

Jensen M.C. (1986), 'Agency Cost of Free Cash Flow, Corporate Finance and Takeovers', *American Economic Review* 76 (2): 323-329.

Kahneman D., Tversky A. (1979), 'Prospect Theory: An Analysis of Decision Making Under Risk', *Econometrica* 47 (2): 263-291.

Keynes J.M. (1936), *The General Theory of Employment, Interest, and Money*, London: Macmillan.

King D.R., Dalton D.A., Daily C.M., Covin J.G. (2004), 'Meta-Analyses of Post-Acquisition Performance: Indicators of Unidentified Moderators', *Strategic Management Journal* 25: 187-200.

Long W.F., Ravenscraft D.J. (1993), 'Decade of Debt: Lessons from LBOs in the 1980s', in: Blair M.M. (ed.): 205-238.

Marris R. (1964), *The Economic Theory of 'Managerial' Capitalism*, London: Macmillan.

Moeller S.B., Schlingemann F.P., Stulz R.M. (2003a), 'Do Shareholders of Acquiring Firms Gain From Acquisitions?', *Working Paper* 9523, NBER

Moeller S.B., Schlingemann F.P., Stulz R.M. (2003b), 'Wealth Destruction on a Massive Scale? A Study of Acquiring-Firm Returns in the Recent Merger Wave', *Working Paper* 10200, NBER

Mueller D.C. (1986), *Profits in the Long Run*. Cambridge/New York: *Cambridge University Press*.

Mueller D.C. (1993), Comment, in: Blair M.M. (ed.): 193-196.

Mueller D.C. (2003), 'The finance literature on mergers: a critical survey', in Waterson (ed.): 161-205.

National Science Foundation (1989), *An assessment of the impact of recent leveraged buyouts and other restructurings on industrial research and development expenditures*. Prepared for the US Subcommittee on Telecommunications and Finance, US House Committee on Energy and Commerce.

Olsen J.P., March J.G. (2004), 'The logic of appropriateness', *Discussion Paper* 04/09, Centre for European Studies, University of Oslo.

Otten J. (2007), *Agency theory and executive compensation: essays in corporate governance*, PhD Diss., Utrecht University.

Porter M.E. (1987), 'From Competitive Advantage to Corporate Strategy', *Harvard Business Review*, 65 (May-June): 43-59.

- Raj M., Forsyth M. (2003), 'Hubris Amongst U.K. Bidders and Losses to Shareholders,' *International Journal of Business* 8: 1-16.
- Ravenscraft D.J., Scherer F.M. (1987), *Mergers, Sell offs, and Economic Efficiency*. Washington, D.C.: Brookings Institution.
- Roll R. (1986), 'The Hubris Hypothesis of Corporate Takeovers', *Journal of Business* 59 (2): 197-216.
- Scharfstein D.S., Stein J.C. (1990), 'Herd Behavior and Investment', *American Economic Review* 80 (3): 465-479.
- Schenk H. (2005), 'Organisational Economics in an Age of Restructuring, or: How Corporate Strategies Can Harm Your Economy', in De Gijssel P., Schenk H. (eds.): 333-365.
- Schenk H. (2006), 'Mergers and Concentration', in Bianchi P, Labory S. (eds.): 153-179.
- Schenk H. (2007), 'Private Equity Buy Outs and Bankruptcy Risk', *Paper*, presented at the Annual Conference of EUNIP, Università di Firenze (I), 12-14 September.
- Scherer F.M. (1984), *Innovation and Growth: Schumpeterian Perspectives*. Cambridge, Mass.: MIT Press.
- Schumpeter J.A. (1939), *Business Cycles*, New York: McGraw-Hill.
- Spotton B., Rowley R. (1998), 'Efficient Markets, Fundamentals, and Crashes', *American Journal of Economics and Sociology* 57 (4): 663-690.
- Waterson M., ed. (2003), *Competition, Monopoly and Corporate Governance. Essays in Honour of Keith Cowling*. Cheltenham: Edward Elgar.
- Williamson O.E. (1988), Corporate Finance and Corporate Governance, *Journal of Finance* 43: 567-591.
- Wright P., Mukherji A., Kroll M.J. (2001), 'A re-examination of agency theory assumptions: extensions and extrapolations', *Journal of Socio-Economics* 30: 413-429.

4

Financial innovation: economic growth versus instability¹

Arnoud Boot, University of Amsterdam

1. Introduction

The impact of financial development on economic growth is an important public policy issue. A key issue is whether financial development spurs economic growth, or even is a prerequisite for economic growth? I will argue that financial development is an important facilitator of economic growth. This is not very controversial; having well functioning financial institutions (and markets) is considered important for the economy at large and the financing of corporations in particular. Also financial instruments – as manifestations of financial development – can be of considerable importance. In particular, some financial instruments are explicitly designed to facilitate underlying real transactions. For example, commercial letters of credit are an indispensable part of import-export transactions. These instruments effectively guarantee payment upon delivery of goods which make exporting companies willing to let go of their goods. The dramatic contraction in world trade during the financial crisis may have been fuelled by the collapse of banks and hence their ability to provide credible guarantees.

The question to this paper is therefore not whether financial development is important for economic growth. It obviously plays a role. The question is what this role exactly is, and particularly how to look at the proliferation of financial innovations which appear to have become the most visible manifestation of financial development in recent times. Financial innovations seem an inherent part of financial development, but has the unprecedented level of financial innovation in the last decades been good for economic growth? No readily available answers come to mind. Obviously, when looking at the last few years with the economic crisis at the center of our attention, it seems hard to argue that recent innovations like subprime mortgages and their repackaging in marketable securities has been good for economic growth. But also this is not carved in stone.

What appears to be true is that the financial sector more and more operates as a business in itself rather than just a facilitator for the 'real' economy. This might not be surprising. The financial sector is a commercial profit-seeking activity driven by high-powered individuals. As we know from agency-theory, individuals at least in part are driven by self-interest and that may deviate from the collective interests of society. Hence, financial institutions look for profitable opportunities, and those may

¹ I thank participants in the AWT meeting on Finance and Innovation (February 1, 2010) for comments. Particular thanks to Paul van Dieren, Luc Soete, Rens van Tilburg and Paul Tang.

not coincide with choices that optimally facilitate the real economy. Moreover, financial institutions may go for self-preservation. For example, any player in the financial sector might seek to become a power bastion by itself, try to be indispensable and become self-serving. The severe disruption in 2007-2009 financial crisis clearly points at such behavior.

Equally importantly, the financial sector at large might gain true power and influence in society, and even some crowding-out of other economic activities may occur.² OECD statistics are in this context interesting. They show a substantial increase in direct contribution to GDP coming from financial services in recent decades (OECD, 2009). If crowding-out plays a role, this direct contribution could be at the expense of their facilitating role. A manifestation of this is that banks give less priority to their relationship-oriented business (e.g. SME lending) and more to transaction-oriented banking. But also more indirect types of crowding-out are possible. An example of the latter is that the most talented students in period 2003-2007 increasingly chose for a career in banking, and often pure transaction banking (predominantly present in investment banking). This could be interpreted as a crowding-out of talent at the expense of the real economy. Similarly, the boom in the financial sector during those years diverted massive resources to this sector. For example, many countries came to see the financial sector as a growth engine of their economies and chose to allocate scarce public resources to subsidizing this sector. In The Netherlands for example substantial public investments were made to improve the attractiveness of the country as location for financial services firms. To the extent that these investments were at the expense of other sectors, a true crowding out occurred. In this respect, also the enormous lobbying power of the financial services sector is noteworthy.

Nevertheless, the literature rationalizing the role of financial markets and financial institutions essentially has the financial sector serve as facilitator. It facilitates businesses in their funding needs, allows for diversification, and serves as liquidity provider. The financial sector either acts as broker (e.g. passing through money by bringing together buyers and sellers of securities, or helping firms raise money in the financial markets), or as asset transformer (e.g. intermediating liquidity risk by transforming (more) liquid liabilities in term loans). The latter distinction is particularly relevant because financial systems are often characterized as either being bank-based (continental Europe) or financial market driven (US, UK). In the former, bank financing is dominant while direct funding from the financial market plays a more important role in the latter. The distinction is not as sharp as the

2 An example of this that the most talented students choose for banking, and often pure transaction banking. This may lead to a crowding-out of talent at the expense of the real economy. Similarly, the boom in the financial sector during 2004-2007 diverted massive resources to this sector. For example, many countries came to see the financial sector as a growth engine and allocated scarce public resources to subsidizing this sector. See also the example of The Netherlands where substantial public investments were made to improve the attractiveness of the country as location for financial services firms. To the extent that these investments were at the expense of other sectors, a true crowding out occurred. In this respect, also the enormous lobbying power of the financial services sector is noteworthy.

dichotomy might suggest, e.g. more than half of US businesses is bank-financed; hence no system is fully market or bank-driven. But the distinction is relevant, and an important question is whether the more recent proliferation of financial innovations might impact those systems differently. In particular, financial innovations have intertwined banks and financial markets and this, as I will argue, might have impacted bank and financial market driven economies differently.

This essay seeks to uncover what we know about the link between financial development and economic growth. To that end, in section 2, I first add some further thoughts on the link between financial development and economic growth. The causality between financial development and economic growth is discussed quite a lot in the literature. The consensus appears to be that financial development does add to economic growth.

Section 3 focuses on bank-based versus financial market driven economies. Part of the discussion here is to uncover the role that banks play in the economy. How does this relate to the role that financial markets play? That is, how to compare bank-based to financial market focused economies? These questions are interesting from the perspective of analyzing the link between financial development and economic growth.

The dichotomy between a bank-based system and a financial market-driven economy appears to have been weakened. In particular, recent innovations like securitization have made banks' assets more marketable and increased the sensitivity of banks to financial market developments. Banks have thus become a more integral part of financial markets. This observation will turn out to be important because the stronger links between banks and financial markets might well have destabilized banks. Securitization – a type of financial innovation³ – is at the root of this. This brings me to the question what impact financial innovations – as manifestation of a more advanced financial development – have. This might challenge the largely positive view of financial development.

Nevertheless, as I will first show in section 4, there is a core literature that convincingly argues that financial innovations can – in principle – contribute to economic growth. An important element of this is the discussion in the modern finance literature on the 'spanning' that innovations can facilitate. That is, financial innovations can help complete markets, and this could augment social welfare. However, more recently, a more negative image has come up. Financial innovations could have a destabilizing impact; the financial crisis of 2007-09 is arguably a manifestation of this.

³ To be more exact, securitization could be seen as a process innovation. The asset backed claims that it creates and that are being sold to investors could be called financial innovations.008.

Section 5 asks the question what causes innovations to be potentially value destructive. This asks for an understanding how innovations come about. What drives the creation of new financial innovations? A fundamental feature that comes up is that the marketability that innovations typically aim for can augment diversification opportunities, yet can also create instability. Facilitating marketability is a core element of the most noteworthy innovations that have become infamous during the 2007-09 financial crisis (securitization resulting in securities like CDOs, ABCP, and CDS). An important observation is that marketability is not always good. The mere fact that something becomes tradable can undermine commitment. For example, mortgages that become tradable might undermine the incentives of the originator to monitor the quality of borrowers. Or, in a very general sense, when markets exist for all kinds of real assets of a firm, a firm can more easily change direction of strategy. This might be good, but could also lead to lack of commitment (and staying power), more impulsive decisions and possible herding. The latter refers to the tendency to follow current fads.⁴

In the various sections I will seek to draw implications for the effects of financial development and innovation on economic growth. Section 2 focuses on the more traditional literature on financial development and economic growth. Section 3 distinguishes bank-based and market based financial systems. In section 4 I will focus on the pros of financial innovation; section 5 discusses the cons. Section 6 seeks to put these insights together particularly by comparing the implications of financial development and innovation for the more bank-based economies of continental Europe to those for the financial market driven economies of the UK and the US.

2. Financial development and economic growth

An interesting question about the relationship between financial development and economic growth is one of causality. Arguably, one could say that this is even the key question in much of the older literature, and one with strong controversies. On the affirmative side, John Hicks (1969) and Joseph Schumpeter (1912) see a strong causal link from financial development to economic growth. Yet, other eminent economists, most notably Joan Robinson (1952) and Robert Lucas (1988), are very much skeptical about this causality and argue that financial development largely *follows* economic development. This is not an innocent controversy.

Most notably, the 'workhorse' of modern macro economics – the Dynamic Stochastic General Equilibrium (DSGE) type of models – does not give much of a role to the financial sector. Since Robert Lucas is one of the founders of these class

⁴ In banking herding is particularly worrisome because it could create systemic risk. Meaning, when all institutions make the same bets, risk exposures become highly correlated and a simultaneous failure of institutions becomes more likely.

⁵ The macro economist Wouter den Haan emphasizes in a contribution to the web-discussion forum www.mejudice.nl (October 21, 2009) that one should not take the critique on the DSGE models to the extreme; some efforts are being made to include financial mechanisms like the financial accelerator.

of models, this is not surprising. What it means is that these models largely ignore the financial sector.⁵ It implies that issues related to financial development cannot be analyzed in such models, let alone things related to financial innovations. In light of the recent financial crisis, questions are raised about the desirability to enrich these models by giving a distinct role to the financial sector. It might help add understanding to the functioning of the economy, and possibly affect policy implications that would follow from such models. The lack of importance of the financial sector in macro-economic research (not surprisingly) also shows up in recent textbooks, see Box 1.

A more fundamental view at the importance of financial development could help. In a frictionless (perfect) world financial development is not important. In such world no impediments to an optimal resource allocation exist. What that really means is that information and transaction costs are non-existent. That is, firms have a frictionless access to finance, diversification can be accomplished at no cost, so can the enforcement of contracts and the behavior of firms being financed. Financial development matters because all these things are not automatically satisfied, or rather never satisfied; improvements are always possible and this is what financial development could add to.

Box 1: Textbooks on macro economics silent on financial sector

Central to much of the work in macro economics are the real business cycle theories and new-Keynesian theories. Following recent textbooks like Gali (2008) and Mankiw (newest edition of his macroeconomics textbook just now being published, 2009) one notices that the financial sector does not play a role in their treatment of business cycles and new-Keynesian theories. Apparently insights developed by Greenwald and Stiglitz (1987 and 1993) on the real world implications of asymmetric information in financial markets, and insights coming from Bernanke and Gertler (1990) on the effect of capital market imperfections on the monetary transmission mechanisms (and the banks' role in the allocation of credit) have not reached main stream textbooks. In a recent, lucid discussion Bas Jacobs concludes rightfully that the macro-economic implications of the 2007-09 financial crisis cannot be understood without incorporating capital market imperfections in macro-economic theories (Jacobs, 2009).

The lack of focus on financial development in micro-economics is therefore a direct artifact of the frictionless world that macro-economics has emphasized for so long. This has created a dichotomy with micro economics that has very much focused on imperfections. In terms of being relevant for policy this has made macro economists somewhat ineffective. In particular, they may have not given enough support for an institutional design (including regulation) that can contain the imperfections (i.e. incentive problems) that micro economists did focus on.

In any case, the suggestion that financial development plays a secondary role is surprising in light of the strong links between economic and financial development that were already observed many years ago. Goldsmith (1969), for example, concludes based on data over the period 1860-1963 that periods of more rapid economic growth go hand in hand with an above average rate of economic development. Strictly speaking, this says nothing about causality, but neither does it refute a potentially important (leading) role for financial development. In an extensive review of all relevant pre-1995 work Levine (1997) concludes that “A growing body of work would push even most skeptics towards the belief that the development of financial markets and institutions is a critical and inextricable part of the growth process and [would push those skeptics] away from the view that the financial system is an inconsequential side show, responding passively to economic growth and industrialization.”

In more practical terms, the consensus that has formed views financial development as an important facilitator of economic growth. What has emerged is that economic growth may need simultaneous financial development. This conclusion has translated into the understanding that lack of speed of adjustment in the financial sector might hinder economic growth. The concern is then that sudden real economy needs may not be met because the financial sector might only slowly adjust to the needs of the real economy. This is an interesting question because it bypasses the discussion about causality. That is, even if real economic developments are leading, the financial sector development determines whether the real economy can continue its growth path. A sequentially (over time) shifting causality between economic growth and financial sector development then follows. From this perspective, it would seem obvious that financial development is good. As we will see, this is not always the case.

An issue that is not, or barely discussed in the financial development and economic growth literature is the type of financial development, i.e., institution-based (say, banks) versus market based (financial markets) financial development. This issue, I will address next.

3. Fundamentals of bank versus capital market dominated economies

The standard view is that banks and markets compete, so that growth in one is at the expense of the other (e.g. Allen and Gale (1995, 1997), and Boot and Thakor (1997a,b)). In this context Deidda and Fattouh (2008) show theoretically that both bank and stock market development have a positive effect on growth, but the growth impact of bank development is lower when there is a higher level of stock market development. What this shows is that dynamics of the interaction between banks and markets can have *real* effects. How banks and markets interact is therefore of great interest.

There is evidence that banks and financial markets not just compete, but also are complementary. For example, the close monitoring role of banks might facilitate timely intervention. This feature of bank lending is valuable to the firm's bondholders as well. They might find it optimal to efficiently delegate the timely intervention task to the bank.⁶

Another manifestation of potential complementarities between bank lending and capital market activities is the increasing importance of securitization. Securitization is an example of unbundling of financial services and a more recent example of financial development. It is a process whereby assets are removed from a bank's balance sheet, so a bank no longer permanently fund assets when they are securitized; instead, the investors buying asset-backed securities provide the funding. Asset-backed securities rather than deposits thus end up funding dedicated pools of bank-originated assets. Securitization decomposes the lending function such that banks no longer fully fund the assets, but continue to be involved in other primal lending activities, e.g. monitoring and servicing the borrowers. A potential benefit of securitization is better risk sharing. The proliferation of securitization may however also be induced by regulatory arbitrage, e.g. as vehicle to mitigate capital regulation, see later.

Central to the extensive academic work on securitization is the idea that it is not efficient for originators to completely offload the risks in the originated assets. The originating bank needs to maintain an economic interest in the assets to alleviate moral hazard concerns and induce sufficient effort on the originating bank's part in screening and monitoring. What this implies is that even with securitization, banks do not become disengaged from the assets they originate. Banks still continue to provide the services involved in screening and monitoring borrowers, designing and pricing financial claims, and providing risk management and loan servicing support. As such, securitization preserves those functions that are at the core of the *raison d'être* for banks. This militates against the notion that securitization effectively lessens the importance of banks.

As the sub-prime crisis of 2007 has shown, this development was not without problems. The structure of real world securitization transactions appeared to have taken a rather fragile form. In particular, it is important to note that much of the securitization leading up to the crisis involved the financing of long-term assets with short term funding, which induced substantial liquidity risk; e.g. as in asset-backed commercial paper – ABCP conduits. While this liquidity risk was sometimes

6 To play this role well, banks may need senior status. Seniority makes them willing to act tougher. To see this, observe first that the unsecured other debtholders need to be compensated for their subordinated status. This is directly related to the work on bargaining power and seniority, see the work of Gorton and Kahn (1993) and Berglof and Von Thadden (1994). The complementarity between bank lending and capital market funding is further highlighted in Diamond (1991), Hoshi, Kashyap and Scharfstein (1993) and Chemmanur and Fulghieri (1994). See Petersen and Rajan (1994) and Houston and James (1996) for empirical evidence, and Boot and Thakor (2010) and Freixas and Rochet (2008) for recent overviews.

mitigated by liquidity guarantees (e.g. stand-by letters of credit and other refinancing commitments), the underwriting institutions often underestimated the risks involved and overstretched themselves.⁷

Recent events clearly point at the sub optimality of such strategies. Originating institutions behaved as if they retained minimal residual risk. As a consequence, monitoring incentives may have been compromised (see Mian and Sufi, 2007).⁸ The eagerness of banks to securitize claims – and keep the “repackaging machine” rolling – may have also adversely impacted the quality of loans that were originated through a dilution of banks’ screening incentives due to lower retained residual risks (e.g. sub-prime lending). Credit rating agencies have played an important role in this process as well. Their willingness to provide favorable ratings clearly helped in growing this market, see Box 2.

Box 2: Gatekeepers, de role of credit rating agencies

A positive view of credit rating agencies is that they play a similar certification role (in the financial market) as banks do with bank loans.⁹ As rating agencies become more sophisticated and reliable, the certification role of banks diminishes in importance, causing bank borrowers to migrate to the capital market. In this sense, rating agencies intensify the competition between banks and markets. But they also pull banks into the capital market. For example, banks originate loans that they securitize, and then seek ratings for the securitized pools from rating agencies. The ratings, in turn, facilitate the ability of banks to sell (securitized) asset-backed securities in the capital market. Rating agencies then play a role as gatekeeper (Coffee, 2002).

This rather positive interpretation of rating agencies, and does by the way not really address the question about stability. Rating agencies are clouded somewhat by recent negative publicity. In the 2001 crisis surrounding Enron, rating agencies were accused of being strategically sluggish in downgrading. More recently, they have been blamed (in part) for the sub-prime crisis in which they were allegedly too lenient in rating the senior tranches in securitization transactions. Allegations

7 Most noteworthy are the bankruptcies among German Lander banks that were involved in providing liquidity guarantees. Risks were further elevated by enormous leverage in the securitization process.

8 Securitization is facilitated in part by credit enhancement, including partial guarantees by the arranger of a securitization transaction (and/or he holds on to the most risky layer of the transaction). In the recent credit crisis, this disciplining mechanism broke down; residual risk with the arranger appeared minimal, and were often framed as liquidity guarantees to off-balance sheet vehicles without appropriately realizing the inherent risks. That is, banks, while they might have believed that risk was off-loaded, often had been underwriting the liquidity risk in securitization transactions by, for example, guaranteeing the refinancing of commercial paper in ABCP transactions via standby letters of credit. Such guarantees have generated profits for banks, but also created risks, as illustrated by the losses incurred by banks in the recent sub-prime crisis. The marketability of securitized claims has also been facilitated by accreditation by credit rating agencies (see Boot, Milbourn and Schmeits (2006)). However, even the role of rating agencies has been called into question during the subprime lending crisis

9 Datta, Iskandar-Datta and Patel (1999) show that the monitoring associated with bank loans *facilitates* borrowers’ access to the public debt market. This certification role of banks therefore complements what rating agencies do.

have been made about conflicts of interest for rating agencies arising from the fact that structured finance is (was) a source of ever-increasing income for them, which then corrupts their incentives for accurately rating the issuers involved in structured finance (Cantor, 2004; Partnoy, 1999). In this context, Coffee and Sale (2008) point at the naiveté to think that reputation building incentives alone would keep credit rating agencies in check.

Of particular concern are the so-called “rating triggers.” For example, some debt contracts may dictate accelerated debt repayments when the rating falls. The consequences of such accelerated debt repayments might, however, be so severe as to cause rating agencies to become reluctant to lower the ratings of those borrowers in a timely manner. Complications also arise from the role played by the so-called “monoliners.” These are insurers who traditionally guaranteed municipal bonds but now also guarantee the lowest-risk (best) tranches in securitization transactions. These insurers are virtually indispensable in the sense that the viability of many forms of securitization is predicated on this type of “reinsurance.” However, the ability of the monoliners to issue credible guarantees (and hence their role in securitization) depends on these institutions themselves having AAA ratings. This potentially generates an indirect chain-reaction mechanism for rating agencies. In rating (and monitoring) the monoliners, rating agencies affect the viability of the securitization market. Thus, the impact of rating agencies is both direct (rating securitization tranches) and indirect (rating the monoliners). The potential failure of such monoliners has (had) a significant effect on the value of various structured finance products and induces an additional chain reaction among players active in the structured finance market, including investors. This further underscores the increasing interlinkages in the financial markets. Rating agencies appear to have provided little stability, and might even have elevated instability.¹⁰

The 2007-2009 financial crisis brought securitization almost to a grinding halt. However, the risk-diversification that securitization can accomplish appears to be of more than just ephemeral importance. Thus, I expect securitization to reemerge, albeit possibly in a form that entails lower levels of liquidity risk, as well as lesser moral hazard in screening (loan underwriting standards) and monitoring. A caveat is that some of the activity in securitization may have been induced merely by capital arbitrage, in which case its social value may be rather limited; the new Basel II capital requirements may diminish such regulatory arbitrage.

10 Other concerns are related to the oligopolistic nature of the industry, and the importance that ratings have due to regulation. The latter includes the exclusivity given to a few rating agencies via the “Nationally Recognized Statistical Rating Organization” (NRSRO) classification, recently weakened in the 2006 Credit Rating Agency Reform Act, but also the inclusion of external ratings in the new Basle II capital regulation framework. See also U.S. Senate (2002).

Another effect of the interaction between banks and markets is that as markets evolve and entice bank borrowers away, banks have an incentive to create new products and services that combine services provided by markets with those provided by banks. This allows banks to “follow their customers” to the market rather than losing them. There are numerous examples. For instance, when a borrower goes to the market to issue commercial paper, its bank can provide a back-up line of credit in order to guarantee refinancing. Securitization of various sorts is another example in that banks not only originate the loans that are pooled and securitized, but they also buy various securitized tranches as investment securities. The impetus for such market-based activities grows stronger as interbank competition puts pressure on profit margins from traditional banking products and the capital market provides access to greater liquidity and lower cost of capital for the bank’s traditional borrowers. As a consequence, there is a natural propensity for banks to become *increasingly* integrated with markets, and a sort of unprecedented “co-dependence” emerges that makes banking and capital market risks become increasingly intertwined. This could make banks more willing to engage in lending and hence improve access to financing, but also points at potentially a higher level of instability. One conclusion that I will draw is that this improves access to finance under ‘normal’ circumstances, yet makes access more volatile and subject to the boom-and-bust nature of financial markets. This comes back in the next section.

4. Understanding the pros of financial innovation

The notion that financial innovation is good for economic growth is based on the idea that such innovations will improve the allocation of capital. In the words of Fed Chairman Ben Bernanke, “The increasing sophistication and depth of financial markets promote economic growth by allocating capital where it can be most productive”.

This sounds politically correct, and by its very generality difficult to refute. However, more specificity is needed. What can precisely be good about financial innovations? In a first best world where information is available to everybody, and everybody is capable of fully discerning all relevant attributes, financial innovations could help complete the market, i.e., facilitate a complete set of Arrow-Debreu securities. This is the typical ‘spanning’ argument; financial innovations are good because they help complete the market.

The reader might wonder what is good about having a ‘complete’ market. A complete market means that investors or consumers can ‘contract’ on any conceivable future state of the world, and in doing so create an optimal allocation. In the context of hedging for example such complete market allows investors to neutralize whatever state-contingent risk they may face. What this means is that investors can tailor the state-dependent pay-offs to their precise preferences. As a

more or less immediate corollary, financial development (and financial innovations) help improve the allocation of capital.¹¹ In more simple terms, a complete market allows individuals to optimally hedge, or smooth, their income over time. Given this higher level of predictability that results, they can abscond of their money for longer periods of time facilitating more long-term investments. Similarly, the tradability of debt and equity in financial markets allows investors to liquefy their holdings at any point in time (i.e. by selling their holdings to other investors) and helps in diversifying risks. Also this helps firms in obtaining long(er) term financing. Liquidity therefore is valuable, yet, as we will see, can simultaneously have some negative repercussions. More specifically, in a world with imperfections, agency and information problems lead to potential distortions that can show a dark side of liquidity.

New securities are sometimes introduced to help overcome information asymmetries. For example, in the costly-state-verification literature it is shown that firms may have access to loans because these can be provided at relatively low cost. The idea is that an equity type claim would suffer from a lemon problem: outsiders would not be able to assess the value and hence refuse to provide funding since the firm could try to exploit a too optimistic view among potential investors about the firm. As put forward in Akerlof's (1970) famous paper, investors would be naive to buy a firm's equity at an average price because only the below average firms would happily be willing to sell the equity at that price. Investors thus face a problem of adverse selection and the market may break down.

Note that things might not be that bad if there is a very low cost in verifying the true state of nature which would help enforce the ensuing obligations. That is, if the lemon problem can be easily overcome by verifying the true state at relatively low cost equity financing might be available. However if the verification cost is high this may not work. A debt claim may now help since with debt (contrary to equity) verification is not always needed. That is, if debt is repaid (interest plus principal) there is no need to verify. If it is not repaid (or only in part) one needs to verify whether there is indeed a lack of resources. Having a debt contract in conjunction with a third party (bankruptcy court?) that can impose a stiff penalty on the firm if it falsely claims insufficiency of funds solves the misrepresentation problem. Unless the debt is issued by a very risky firm the anticipated costs of verification are limited since in most cases the firm can and will repay (and no verification is needed). Note that in the case of external equity there is no fixed payment and verification is always needed. The upshot of this is that a debt security can be seen as a value enhancing innovation to help facilitate access to funding (see the earlier contribution of Gale and Hellwig, 1984; and also Tirole, 2006).

¹¹ One cannot automatically assume that introducing new securities in incomplete markets that give investors greater 'spanning' opportunities is by definition value enhancing. Elul (1995) shows that adding a new security has "almost arbitrary effects on agent's utilities".

The financial innovation literature – also called the security design literature – has come up with various approaches to mitigate problems of information asymmetry. One that also rationalizes debt as a valuable security is Boot and Thakor (1993). They show that if information production costs are not excessive, introducing debt in the capital structure of firms could encourage information production in equity financial markets. This would then via trading in the financial market get prices closer to the underlying true value. The idea is with debt in a firm's capital structure, the equity becomes riskier, but importantly more information sensitive. Hence, the value of producing information about the firm goes up, more information is produced as a result, and prices are pushed towards their real value (see also Fulghieri and Lukin, 2001). All this would be good for resource allocation because mispricing is mitigated.¹²

Others have argued that a rights issue – again a financial innovation – could help solve the lemon problem. With a rights issue existing shareholders get the right to buy the newly issued shares. In essence, if existing shareholders buy the new shares that a firm wants to issue, the pricing is not that important. Why? Observe that when shares are issued at a price that is too low, new shareholders get a windfall gain at the expense of existing shareholders. With a rights issue (in principle) the new shares go pro rata to the existing shareholders; gains and losses are now in one and the same hand, i.e. internalized by the same group of investors. A right issue may therefore allow the firm to raise new equity while a 'normal' equity issue would have been infeasible because of a lemon problem. This is important because it highlights that existing shareholders may continue to provide financing. In a different context this is also what happens with venture capital financed firms; this typically involves a small group of investors.¹³

The security design literature provides several other examples of financial innovations that could resolve particular agency- and asymmetric information problems. For example, convertible bonds could give bondholders protection against risk-seeking behavior by shareholders. The idea is that in a situation where a lot of debt already exists, new debt financing might not be available because it might induce shareholders to favor excessive risk. That is, their leveraged claim gives them an enormous upside potential if risks work out, while the down side is born by the debtholders. With convertible debt, debtholders will share in the upside if risks work out (i.e. conversion will then occur). This will make matters somewhat more balanced because shareholders no longer exclusively get the upside which

12 Hennessy (2009) shows that firms may issue securities that are less information sensitive if the Akerlof (1970) lemon problem is too severe. In that case, risk and information problems are overwhelming and trying to carve out a relatively safe claim might be the only hope for obtaining external finance.

13 Note that this may not work in the presence of (too much) debt. With, what is called, debt overhang new equity even from existing shareholders may not be forthcoming because it would give debtholders a windfall gain. This is the case particularly when the coupon on existing debt is fixed. It is also quite prevalent in banking where a government guarantee effectively makes debt available at low cost, while the guarantee is not priced. This induces risk taking behavior and could make banks averse to raising new equity because it would benefit the government (i.e. lower the value of the guarantee).

discourages risk taking. Thus equity-like financing might possibly be available.

In all these theories financial innovation is something good; it tries to mitigate or resolve a particular friction. Other motivations for introducing financial innovations include regulatory arbitrage and minimizing transaction costs. Whether this is good or bad depends on the particular context. For example, innovations designed to bypass regulations (regulatory arbitrage) could be good if one considers those regulations not desirable. But assuming that the regulation involved has merit, say capital requirements imposed on banks, innovations that are only aimed at bypassing them should probably be viewed negatively. Reducing transaction costs as rationale for financial innovations can often be viewed more positively. If certain frictions – transaction costs – impede the optimal allocation of capital then innovations that reduce these seem optimal.¹⁴ In this positive interpretation, innovations like credit default swaps (CDS) and collateralized debt obligations (CDO) would promote an optimal allocation of capital by reducing the cost of diversifying and reallocating risk. However, as Posen and Hinterschweiger (2009) note during the period 2003-2008 the growth in OTC derivatives outpaced that of real investment by a factor of twelve (300 versus 25 percent). And after 2006 real investments stagnated while OTC derivatives grew arguably faster than ever. While this does not preclude that the proliferation of these financial instruments provided benefits also later in the boom, the negative effects on the robustness of the financial system – as observed in 2007-2009 – tend to refute this.

I now turn to the dark side of financial innovation.

5. Innovations might be problematic

Johnson and Kwak (2009) state that a financial innovation is only good if it “enables an economically productive use of money that would not otherwise occur”. This statement makes it clear that financial innovations may not have added value. This might particularly be the case when information asymmetries are present.

When information asymmetries are present and particular contingencies are not contractible, having complete markets is infeasible.. This happens when contingencies are not verifiable, and/or too costly to verify. Introducing a financial innovation might now have a much darker motivation. For example, introducing financial innovations might be intended to fool market participants. An example might be the Dutch market for life insurance products. The heading ‘woekerpolissen’, refers to a great variety of product innovations that share one characteristic: complexity in conjunction with obscurity of costs relative to potential benefits.¹⁵

¹⁴ Tufano (2002) summarizes other motivations for introducing financial innovations along these lines.

¹⁵ Gabaix and Laibson (2006) analyze how producers (e.g. financial services firms) can exploit uniformed consumers by misrepresenting attributes. In Carlin (2009) complexity is added to discourage information production, intended to facilitate expropriation of investors.

Financial innovations would then tend to worsen the allocation of capital. The more recent advances in securitization could be interpreted that way too. Initially securitization could have allowed for a wider access to investors, and hence improved lending opportunities for banks. As stated this might be value enhancing. The demand for high investment grade securities made it optimal to package mortgages, and sell the low risk portion to (distant) investors. As long as the originators of the loans keep the more risky layer, they would still have a strong incentive to screen loan applicants and monitor them. What happened subsequently is less benign. It is clear that lending standards weakened. In part this had little to do with securitization. The housing boom in the US seduced lenders in granting higher mortgages. As long as prices kept rising, loans could always be refinanced and/or sales of underlying houses would cover the outstanding mortgages. Where securitization did come into the picture is that the insatiable appetite for AAA paper in the market pushed financial institutions into a high gear repackaging mode, ultimately lowering standards even further. Also, in a desire to issue as much AAA paper as possible, the more risky tranches of securitization structures were repackaged again, and more AAA paper was squeezed out. All this packaging and repackaging led to very complicated securities. When the market finally started questioning the sustainability of the housing boom, the arcane securities were suddenly out of favor.

Financial innovations often cause harm by reducing transparency, and this might be deliberate. The earlier example about life insurance – as stated – might be a good example about that. While securitization did create arcane products (the sequentially repacked claims), the objective of securitization might not have been to create this lack of transparency. The arcane nature of the end product might have been a side effect of the sequential repackaging that was driven to ‘squeeze out’ as much triple A paper as possible. In practice this may still have had the same effect: some market participants got fooled in trusting the quality of this highly rated paper (and the willingness of rating agencies to grant such high ratings did help, see also Box 2).

The more fundamental observation – and the one already mentioned in the previous section – is that securitization is a financial innovation that intertwines banks with financial markets. Financial markets are however subject to booms and busts, or better heavily momentum driven. As long as momentum was there, the market’s appetite could not be saturated, and much money could be made by putting the ‘repackaging machines’ in higher and higher gear. The important observation is that financial innovations are typically linked to financial markets, and financial markets have this boom and bust nature.

Securitization has opened up the bank balance sheet. Many bank assets have potentially become marketable. This marketability is typically seen as something positive, but the links with the financial markets that this has created has made

banks potentially more vulnerable vis-à-vis the volatility and momentum in financial markets. Moreover, marketability means that existing activities and risks can be changed almost instantaneously. Since financial markets go through cycles and are subjected to hypes, the banks' decisions might become more momentum driven. This adds further instability.

In a recent book (Boot, 2009), I talk about footloose corporations. What I mean by this is that corporations (or banks for that matter) due to the proliferation of financial markets and the increased marketability of their operations (creating a transaction orientation) become uprooted, meaning lose a degree of fixity and stability. This discussion is also related to the general corporate governance question on the rights of shareholders and the role of private equity investors in particular. While different opinions exist, typically it is considered important that management has some mandate (i.e. elbow room) vis a vis shareholders. In related work by Boot, Gopalan and Thakor (2008), the emphasis is on the need of having some stable shareholders. The liquidity stock markets provide may cause ownership to be changing all the time such that no stable and lasting link with shareholders comes about. This could make firms even more sensitive to financial market pressures. In Box 3 I provide a brief summary of the key insights of the Boot (2009) study.

Box 3: Footloose corporations: the instability coming from financial markets

The uprooting of firms – footloose corporations – is a reinforcing process. The financial market perspective tends to result in excessive volatility and instability within firms, which damage the social fabric. Companies have accentuated this by giving in to the pressures from those same financial markets. They are tempted to organize themselves in such a way that they become divisible; instead of striving for internal synergies, they have created separate, easily accountable units. And yes, that further erodes the social fabric and so leads to even more transactions, which in turn continue to fuel the process of decomposition. And so a kind of vicious circle forms.

At the same time, such a process can be seen affecting the behavior of both senior management and employees. As soon as the CEO lets his position be dictated by the fickleness of the financial markets, he becomes like a (temporary) mercenary of the financial market. He either has momentum or he does not. It is all or nothing, with the concomitant increase in the turnover of senior executives. This results in the boardroom's effective alienation from the rest of the organization, undoubtedly accompanied by numerous transactions, and again it is the social fabric of the organization which suffers. All those transactions, plus the alienation – whether real or only perceived – of those supposed to be running the company, encourages the rest of the workforce to give in to calculating self-interest. "What's in it for me?," they ask themselves. Their ties to the organization more or less collapse to

solely their financial remuneration contract. Self-serving behavior then becomes the norm. For instance, they start to overly invest in developing marketable skills – those of use to any employer – rather than abilities specific to the company itself. And so another vicious circle is created.

The key challenge facing businesses is to recognize these self-reinforcing processes and to counter those effectively. Leadership requires vision, and it is essential that management creates elbow room to maneuver. A mandate is key. The reality is that management can claim this mandate. For shareholders, notwithstanding everything that has been said, it is very difficult to intervene. It is management's own fixation with highly visible share prices and with the circus of analysts and consultants which underlies its capitulation to the financial markets.

From: Boot (2009).

Creating liquidity and opening up markets, i.e, trading possibilities, is typically seen as something positive. But this is not always the case as follows from the previous section. One application is the context first investigated by Amar Bhide (1993). His insight was that the liquidity of stock markets is typically considered a virtue, yet may have a dark side in that fully liquid stock markets encourage diffuse ownership, and this may undermine monitoring incentives. Hence corporate control over managers might be lax inducing inefficiencies. In other words, monitoring incentives typically require a larger and enduring stake in a company, yet this is at odds with liquidity. This suggests a trade-off between liquidity and a more enduring presence by committing not to sell. In subsequent research Bolton and Von Thadden (1998) have shown that stock market liquidity may benefit from the simultaneous presence of a few block holders. That is, having some proportion of shares freely traded but not all, may help create liquidity in the freely traded shares in part because the market knows that some investors have a more sizable and permanent (minority) stake that gives them an incentive to monitor. In this way some agency problems at the level of the firm might be mitigated. This is in line with the earlier discussed work of Boot, Gopalan and Thakor (2008) who focus on the pros and cons of (lack of) stability in the shareholder base particularly in the context of exchange listed firms.

The costs of liquidity and/or marketability can be further emphasized in the context of financial sector stability. This can be linked to securitization (see earlier), but also to the stability of investment banks vs commercial (relationship oriented) banks. Traditional relationship oriented banks seem incentivized to build up *institutional* franchise value. Individuals are part of the organization as an entity, and not readily identifiable as individual stars. In other words, the value created is fixed to the organizational entity and not portable as part of individuals.

Investment bank on the other hand, seems more based on the individual star concept with high marketability of individuals. As a consequence, less institutional franchise value is build up; individual franchise values dominate. If this the only difference then the relationship banking institution has implied value, while the investment bank has little implied value, and hence Keeley (1990) analysis would suggest that an investment bank would take lot of risk, while the franchise value of a commercial bank would help curtail its risk taking.

Historically investment banks have solved this marketability problem (and potential lack of institutional franchise value) by having partnerships. The partnership structure has two dimensions that jointly resolve the risk taking problem and marketability (and star phenomenon):

- a partnership means that bankers have their personal wealth tied up in the business – they own the equity claim themselves;
- simultaneously, the partnership structure means that the equity is not (optimally) marketable.

The latter implies that ‘stars’ cannot take their money out, or only at a reduced value. Implicitly, this also means typically that franchise value is created this way, and this value is transferred over time (to future partners). Interesting examples exist where institutions have made changes that have destroyed this structure. For example, in an initial public offering (converting a partnership in a listed shareholder owned company) the current partners effectively expropriate all franchise value that has been build up over time. Even worse, once the partnership is gone, stars are no longer ‘under control’. Their financial interest is no longer tied to the firm. This elevates risk and reduces stability.

One way of interpreting the developments in banking is that even in commercial banking more of the business has become marketable, and the ‘star’ phenomenon may also come up there. In any case partnerships among major financial institutions are no longer common. Changes, whether in the form of financial innovations (products), processes (securitization) or institutional changes (the demise of a partnership in lieu of an exchange listing with marketable equity) all work in the same direction. They make things footloose and in doing so could undermine stability. These links between marketability and financial sector stability (and the real economy) are important in the context of evaluating financial development and financial innovations.

6. Putting it together: what to conclude?

What has been shown is that financial innovations can be good from the perspective of completing markets, as well as from a perspective that focuses on overcoming asymmetric information and agency problems. Nevertheless, a much more negative

picture can be drawn. Innovations might be designed to fool market participants, and in doing so cause serious harm (see Henderson and Pearson, 2009). The instability that they might cause is arguable even more worrisome. This red flag is related to the earlier observation that financial innovations often make things (e.g. banks!) intertwined with financial markets, and that those financial markets are subject to booms and busts, or better heavily momentum driven. The question then is when do financial innovations destabilize things, as securitization might have done to banks.

It is very difficult to come up with conditions that help us distinguish between value enhancing and value destroying innovations. My discussion on the value of partnerships points at the need for some 'fixed points', not everything can be fluid. Marketability definitely has a dark side; it potentially causes severe instability.¹⁶

When we take a bigger picture and focus on innovation in the financial sector not just in the product sense but also in processes and institutional structure more can be said. Recall that the type of innovations encompass products (financial innovations in the strict sense), processes (securitization) and institutional changes (e.g. the demise of a partnership in lieu of an exchange listing with marketable equity). The institutional structure at the most aggregate level was discussed in section 3 where bank-dominated versus capital market dominated economies were discussed. As I emphasized, financial innovations in the product sense are often linked to financial markets, and effectively bring bank-dominated intermediation closer to the financial market.

What has not been discussed is that bank-based systems versus market-driven systems might also deviate in terms of their openness to real innovations. There is a body of work (e.g. Rajan and Zingales, 2001; Boot and Thakor, 1997a) that argues that being bank-based gives too much power to existing institutions and businesses at the expense of new activities and initiatives. This could retard real innovation and renewal.¹⁷ A bank-based system is more conservative, particularly more incumbent oriented, and hence less able to take advantage of new opportunities. This suggests a trade-off between a more volatile market-based system and a less innovative, yet possibly more stable banking system.

In work by Allen (1993), Carlin and Mayer (2002), and more recently Herrera and Minetti (2007), the message is that truly path breaking innovations are better facilitated in financial market dominated economies (like the US), while bank-dominated economies could possibly be better in accommodating more gradual innovations. In Allen (1993) this is linked to the information aggregation role of

¹⁶ Other thoughts on instability and financial innovation are provided in Shiller (2008), Loayza and Ranciere (2005) and Brunnermeier et al. (2009). See also Frame and White (2002) on the difficulty of evaluating the added value of financial innovations.

¹⁷ See also Bekaert, Harvey and Lundblad (2005), and Levine and Zervos (1998).

financial markets that might be crucial for assessing unknown path breaking innovations. In Herrera and Minetti (2007), the reasons are more linked to Rajan and Zingales (2001) in that a bank may want to obstruct path breaking innovations that may render its information about the firm obsolete (i.e. the bank may seek to preserve its hold-up power over the borrower). Carlin and Mayer's (2002) empirical results seem to support these observations.¹⁸

Following the overview of findings in my 2007 study for the OECD (Boot, 2007), the bank-dominated nature of the financial sector in The Netherlands would then translate into difficulty of financing more radical innovations. Given the information induced switching costs (hold-up problems), SME firms may face constraints on availability of financing, and this would particularly show in those cases where collateral is not readily available. Again this would be in more innovative firms. The focus on incumbents that a highly concentrated bank-dominated system can induce would be most apparent with (newer) high growth firms and SME's.

The level of product (e.g. CDS) and process financial innovation (securitization) observed in the recent past have definitely affected the institutional landscape. Obviously the financial crisis has hit Dutch institutions considerably. The long-term implications for the structure of the Dutch banking industry are not yet clear. More concentration is definitely a possibility. Whether the financial sector becomes more or less bank-dominated is not clear yet. What the new equilibrium looks like and what the implications are for potential financing frictions are (e.g. the ones mentioned just above) is therefore an open issue.

I have emphasized potential complementarities between banks and financial markets. On the positive side one could say that financial innovations have possibly strengthened these complementarities. One could however easily draw a more negative conclusion. In the 2007-09 financial crisis European banks have arguably been hit most. One interpretation is that the European financial sector started combining the worst of both worlds: it continued to be bank-driven with its negative effects on renewal and entrepreneurship, yet these very same banks became intertwined with financial markets and as a consequence volatility increased and the benefits of stability disappeared.

This is clearly linked to the observation that financial innovations are to some extent opportunistic. They are part of a more open financial system. This gives potentially more instability but also allows for more immediate possibilities to take advantage of opportunities. What comes out of this paper is that we need to (learn to) deal with the instability that marketability brings. The proliferation of marketability clearly has a dark side. Particularly the continental European bank-dominated financial sectors need to find a new equilibrium in this fluid world.

¹⁸ Van Tilburg (2009) includes further references and observations.

References

- Akerlof, G. (1970), The market for lemons: quality uncertainty and the market mechanism, *The Quarterly Journal of Economics*, Vol. 84, No. 3, p. 488-500.
- Allen, F. (1993), Stock Market and Resource Allocation, in C. Mayer and X. Vives, eds., *Capital Markets and Financial Intermediation*, Cambridge University Press, p. 81-108.
- Allen, F., and D. Gale (1995), A welfare comparison of intermediaries and financial markets in Germany and the U.S., *European Economic Review*, Vol. 39, p. 179-209.
- Allen, F., and D. Gale (1997), Financial markets, intermediaries and intertemporal smoothing, *Journal of Political Economy*, Vol 105, p. 523-546.
- Bekaert, G., C. Harvey and C. Lundblad (2005), Does financial liberalization spur growth?, *Journal of Financial Economics*, Vol. 77, p. 119-152.
- Bhidé, A. (1993), The hidden cost of stock market liquidity, *Journal of Financial Economics*, Vol. 34, p. 31-51.
- Berglöf, E., and E. von Thadden (1994), Short-term versus long-term interests: capital structure with multiple investors, *Quarterly Journal of Economics*, 109-4, 1055-1084.
- Bernanke, B., and Gertler, M. (1990), Financial fragility and economic performance, *Quarterly Journal of Economics*, Vol. 105, p. 87-114.
- Bhattacharya, S., Boot, A.W.A., and A.V. Thakor, eds. (2004), *Credit intermediation and the macro economy*, Oxford University Press, Oxford, UK.
- Bolton, P., and E. von Thadden (1998), Blocks, Liquidity and Corporate Control, *Journal of Finance*, Vol. 53, p. 1-25.
- Boot, A.W.A. (2007), Competitiveness Assessment and Key Issues for the Dutch Retail Financial Sector, study for the OECD competition assessment.
- Boot, A.W.A., (2009), Footloose corporations: have financial markets destabilized firms? In Dutch: "De ontwortelde onderneming", Van Gorcum Publishers.
- Boot, A.W.A., R. Gopalan and A.V. Thakor (2008), Market liquidity, investor participation and managerial autonomy: why do firms go private?, *Journal of Finance*, Vol. 63 (4), p. 2013-2059.

Boot, A.W.A., Milbourn, T., and Schmeits, A. (2006), Credit ratings as coordination mechanisms, *Review of Financial Studies*, Vol. 19-1, p. 81-118.

Boot, A.W.A., and Thakor, A.V. (1993), Security design, *Journal of Finance*, Vol. 48, p. 1349-1378.

Boot, A.W.A., and Thakor, A.V. (1997a), Banking scope and financial innovation, *Review of Financial Studies*, Vol. 10, p. 1099-1131.

Boot, A.W.A., and Thakor, A.V. (1997b), Financial system architecture, *Review of Financial Studies*, Vol. 10, p. 693-733.

Boot, A.W.A., and Thakor, A.V. (2010), The Accelerating Integration of Banks and Markets and its Implications for Regulation, in: *The Oxford Handbook of Banking* (Editors: Allen Berger, Phil Molyneux and John S. Wilson), Oxford University Press.

Boyd, J.H., and Gertler, M. (1994), Are banks dead, or are the reports greatly exaggerated?, *Federal Reserve Bank of Minneapolis Quarterly Review*, Vol. 18-3.

Brunnermeier, M., Crockett, A., Goodhart, C., and Shin, H. (2009), The fundamental principles of financial regulation, preliminary draft of *Geneva Reports on the World Economy*, 11, International Center for Monetary and Banking Studies, Geneva, Switzerland.

Cantor, R. (2004), An introduction to recent research on credit ratings, *Journal of Banking and Finance*, Vol. 28-11, p. 2565-2573.

Carlin, B. I. (2009), Strategic Price Complexity in Retail Financial Markets, *Journal of Financial Economics*, Vol. 91, p. 278-287.

Carlin, W., and C. Mayer (2002), Finance, Investment and Growth, *Journal of Financial Economics*, Vol. 69, p. 191-226.

Chemmanur, T.J., and Fulghieri, P. (1994), Reputation, renegotiation, and the choice between bank loans and publicly traded debt, *Review of Financial Studies*, 7-3, 475-506.

Coffee, J.C. (2002), Understanding Enron: it's about the gatekeepers, stupid, working paper, *Columbia Center for Law and Economics Studies*, No. 207.

Coffee, J.C. and H.A. Sale (2008), Redesigning the SEC: Does the Treasury have a better idea), working paper, *Columbia Center for Law and Economics Studies*, No. 342.

Datta, S., Iskandar-Datta, M., and Patel, A. (1999), Bank monitoring and pricing of corporate public debt, *Journal of Financial Economics*, Vol. 51-3, p. 435-449.

Deidda, L., and Fattouh, B. (2008), Banks, financial markets and growth, *Journal of Financial Intermediation*, Vol. 17-1, p. 6-36.

Diamond, D. (1991), Monitoring and reputation: the choice between bank loans and directly placed debt, *Journal of Political Economy*, Vol. 99, p. 689-721.

Dynan, K.E., D.W. Elmendorf and D.E. Sichel (2005), Can Financial Innovation Help to Explain the Reduced Volatility of Economic Activity?, *Journal of Monetary Economics*, Vol. 53, p. 123-150.

Elul, R. (1995), Welfare Effects of Financial Innovation in Incomplete Markets Economies with Several Consumption Goods, *Journal of Economic Theory*, Vol. 65, p. 43-78.

Frame, W.S., and L.J. White (2002), Empirical Studies of Financial innovation: Lots of Talk, Little Action?, Working paper, Federal Reserve Bank of Atlanta.

Freixas, X., and J. Rochtet (2008), *Microeconomics of Banking*, 2nd edition, MIT Press.

Fulghieri, P., and D. Lukin (2001), Information production dilution cost and optimal security design, *Journal of Financial Economics*, Vol. 61, p. 3-42.

Gabaix, X., and D. Laibson (2006), Shrouded Attributes, Consumer Myopia, and Information Suppression in Competitive Markets, *Quarterly Journal of Economics*, Vol. 121, p. 505-540.

Gale, D., and M. Hellwig (1984), Incentive-Compatible Debt Contracts: The One-Period Problem, *Review of Economic Studies*.

Gali, J., (2008), *An Introduction to the New Keynesian Framework*, Princeton University Press.

Goldsmith, R. (1969), *Financial Structure and Development*, Yale University Press, New Haven, CT.

Gorton, G.B., and Kahn, J.A. (1993). The design of bank loan contracts, collateral, and renegotiation, working paper, NBER, No. W4273.

Greenwald, B., and Stiglitz, J. (1987), Imperfect information, credit markets and unemployment, *European Economic Review*, 31, 444-456.

Greenwald, B. and Stiglitz, J. (1993), Financial market imperfections and business cycles, *Quarterly Journal of Economics*, 108, 77-114.

Henderson, B.J. and N.D. Pearson (2009), The Dark side of financial Innovation, Working paper, to be presented at EFA meetings in Bergen, Norway.

Hennessy, C. (2009), Security design, liquidity and the informational role of prices, working paper LBS.

Hicks, J. (1969), Automatists, Hawtreyans, and Keynesians, *Journal of Money, Credit and Banking*, Vol. 1(3), p. 307-17.

Hoshi, T., Kashyap, A., and Scharfstein, D. (1993). The choice between public and private debt: an analysis of post-deregulation corporate financing in Japan, working paper, NBER No. 4421.

Houston, J., and James, C. (1996). Bank information monopolies and the mix of private and public debt claims, *Journal of Finance*, Vol. 51-5, p. 1863-1889.

Jacobs, B. (2009), Lessen van de crisis voor macro economische theorie en beleid, *Economische Statistische Berichten*, 4573, 27 november, 724-725.

Johnson, S. and J. Kwak (2009), Finance: Before the Next Meltdown, *DemocracyJournal.org*, Fall, p. 19-24.

Keeley, M. (1990), Deposit Insurance, Risk, and Market Power in Banking, *American Economic Review*, Vol. 80, p. 1183-1200.

Levine, R. (1997), Financial Development and Economic Growth: Views and Agenda, *Journal of Economic Literature*, Vol. 35, p. 688-726.

Levine, R. and S. Zervos (1998), Stock Markets, Banks, and Economic Growth, *The American Economic Review*, Vol. 88, p. 537-558.

Loayza, N. and R. Ranciere (2005), Financial Development, Financial Fragility, and Growth, IMF Working Paper.

Lucas, R.E., Jr. (1988), On the Mechanics of Economic Development, *Journal of Monetary Economics*, Vol. 22, p. 3-42.

Mankiw, N. G. (2009), *Macro Economics*, Worth Publishers, 7th edition.

Mian, A., and A. Sufi (2007), The Consequences of Mortgage Credit Expansion: Evidence from the U.S. Mortgage Default Crisis, University of Chicago Working Paper.

Partnoy, F. (1999), The Siskel and Ebert of financial markets: two thumbs down for the credit rating agencies, *Washington University Law Quarterly*, Vol. 77, p. 619-712.

Petersen, M., and Rajan, R.G. (1994), The benefits of lending relationships: evidence from small business data, *Journal of Finance*, Vol. 49-1, p. 1367-1400.

Posen, A., and M. Hinterschweiger (2009), How Useful were Recent Financial Innovations? There is Reason to be Skeptical, *Real Time Economic Issues Watch*, May 7th.

OECD (2009), *OECD in Figures 2009*, OECD.

Rajan, R.G. and L. Zingales (2001), Financial Systems, Industrial Structure, and Growth, *Oxford Review of Economic Policy*, Vol. 17, p. 467-482.

Ranciere, R., A. Tornell and F. Westermann (2006), Decomposing the Effects of Financial Liberalization: Crises vs. Growth, *Journal of Banking & Finance*, Vol. 30, p. 3331-3348.

Robinson, J. (1952), The Generalization of the General History, in: *The Rate of Interest, and Other Essays*, Macmillan, London.

Schumpeter, J. (1912), *Theorie der Wirtschaftlichen Entwicklung*, Dunker & Humblot, Leipzig, Germany.

Shiller, R.J. (2008), Has Financial Innovation Been Discredited?, *Project Syndicate*.

Tilburg, R. van (2009), Finance for Innovation, AWT.

Tirole, J. (2006), *The Theory of Corporate Finance*, Princeton University Press.

Tufano, P. (2002), Financial Innovation, in: G. Constantinides, M. Harris and R. Stulz (eds.), *The Handbook of the Economics of Finance*.

U.S. Senate (2002), Hearings before the Senate Committee on Governmental Affairs: *Rating the Raters: Enron and the Credit Rating Agencies*.