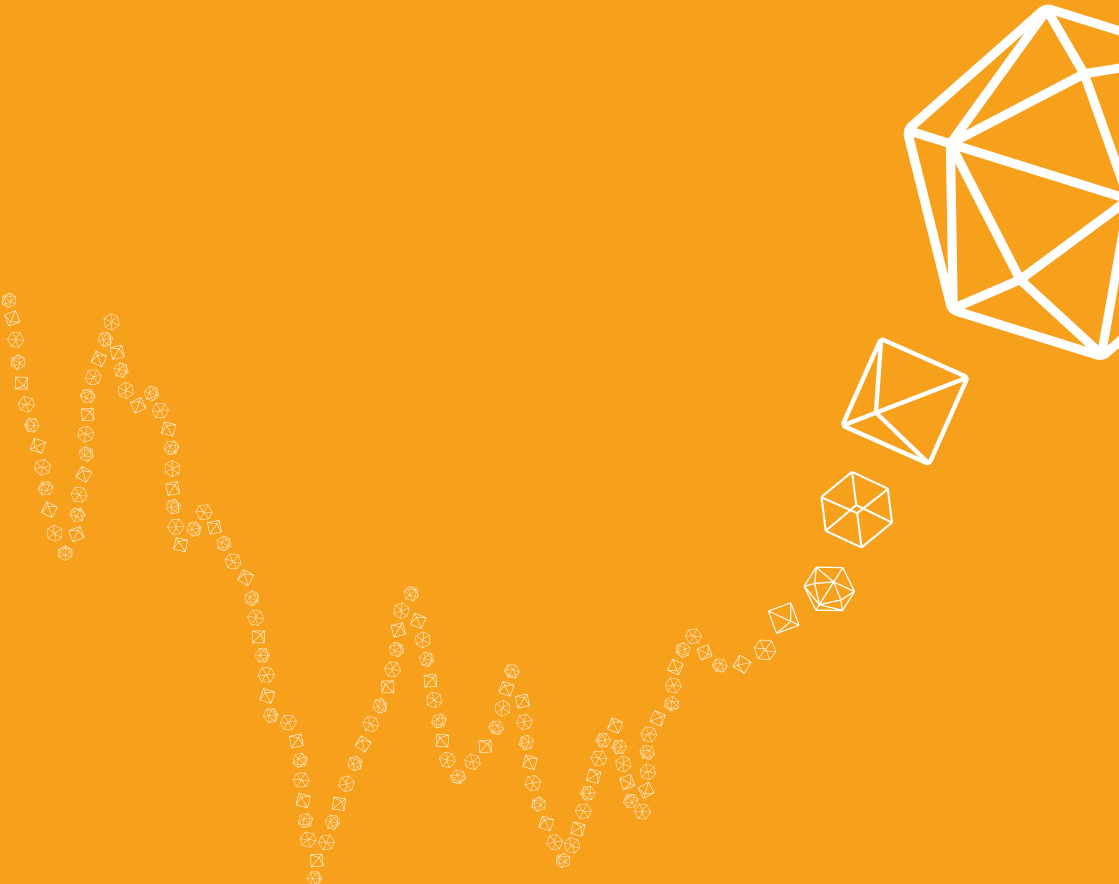


The failure of market failure

Towards a 21st century Keynesianism

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The success of market failure?

The boundaries between state and market are the most contested in the political economy. After the Second World War the consensus centred on a belief in the mixed economy managed by an activist state using a panoply of tools – monetary and fiscal activism, planning, industrial policy, prices and incomes policies – to achieve its ends. But the stagflation of the 1970s called into question the viability of the mixed economy model and state activism. Free-market critics argued passionately that inflation, low growth and poor productivity alike were the consequence of too much state and too little market, creating a new, so-called ‘neoliberal’ consensus and a push for deregulation that held right up until the extraordinary events in the financial markets in the early autumn of 2008. The presumption has been that in general markets work and states do not. Only in exceptional circumstances – where a particular market is proven to fail – is there any case for government action, which should, in any case, be temporary.

Economic actors must freely follow market incentives and maximise profits, and in so doing, economically rational individuals and firms generate innovation, growth and wealth. Markets will regulate themselves, problem-solve themselves and balance themselves. This set of propositions reached its apotheosis in the celebrated ‘first fundamental theorem of

welfare economics’, a mathematical proof which was always a limited and denuded conceptualisation of markets but which showed that as long as there are many participants freely entering any market, with everyone having access to the same information, unfettered competition produced the best, most efficient allocation of resources. The state is unlikely to improve upon these processes, and even if it did, the compulsion and enforcement that would be involved contrasted illegitimately with the voluntarism of markets. It is more likely that the state will both make matters worse and constrain freedoms.

However, the intervention of western governments into their financial systems has called into question the whole thesis. In particular, the massive recapitalisation of the UK banking system – with £37 billion of taxpayers’ funds, provision of £200 billion liquidity, and guarantees of £250 billion of interbank lending – along with universal acceptance of the need for more effective regulation, has dealt a major blow to the free-market consensus. Markets – even the financial markets that come closest to the theoretical ideal, with many well-informed participants – are capable of making incredible, systemic mistakes that threaten the entire economic fabric.

At the same time, our growing understanding of key economic processes like innovation are widening the

categories of activity in which markets are continually prone to failure.

It is thus timely to reappraise the case for markets, together with identifying the limits of traditional market failure analysis.

Our proposition is simple. The genius of markets is that they encourage the experimentation and variety necessary to cope with the indeterminacy of the future, not just that they are efficient allocators of resources, a machine that can be precisely manipulated.

Markets, however, have systemic weaknesses. They are unstable, unfair and vulnerable to manipulation – and no amount of intellectual theorising can surmount these realities. But the free-market fundamentalists have been so successful in creating an intellectual hegemony that they have managed to steer the debate about the shortcomings of markets away from a discussion about the market's weak properties as a system, and into a debate about the scope of particular market failures. The presumption has been that the market paradigm works, even if they admit deviations from the general rule.

But if markets are prone to system-wide breakdowns, market failure thinking needs to be radically overhauled. Government action is not just about fixing temporary malfunctions in an otherwise smooth running machine; it is about continually designing and redesigning the machine itself. Government action in the financial markets recently is thus not an exceptional case in response to a very

acute and unexpected market failure. It is the rule.

This calls for a wholesale reappraisal of our approach to policy – not suddenly to become distrustful of markets and move to statism, but to become a lot more savvy and less ideological about what can be expected from any particular market and markets as a system.

The impossible quest for the perfect market

For the market model to deliver its predicted results there are a number of fundamental and near-impossible-to-meet preconditions – which are recognised by mainstream economists as putative sources of market failure. First, there is the imperative that information is equally and transparently shared so that neither buyer nor seller relies on false information.¹ Real life examples show just how hard this condition is to meet. The market in second-hand cars, for example, is problematic: the price of a car just a few months old plunges below its true economic value, as measured by any objective discount rate used to compute its proper present day price. The explanation is that buyers believe that if a car is on the market so quickly the seller knows that something is wrong with it – it is a ‘lemon’. Buyers know that information is not equally and transparently shared, and the second-hand price of the car reflects this belief. This then becomes a self-fulfilling prophecy, because sellers of good used cars are deterred from offering them for sale – so that the average quality in the second hand marketplace becomes poor. Without some form of external intervention – say a form of kitemarking, or independent testing – the market is locked in an economically irrational process.

Second, prices in an efficiently functioning market must reflect all economic costs: there must be no so-called ‘externalities’ that impose costs or benefits on others that the market transaction does not capture. But again this is very hard to reproduce in real life. Airplane tickets, for example, should capture the costs of air pollution, so incentivising the introduction of more sophisticated engines. If these costs are left out of the account, the price of the ticket will not represent the true costs that travel imposes on society. Who is going to persuade the airline to charge the higher price – and how would it be determined? Plainly the state has to enter the frame.

The list continues. Markets need consumers and businesses alike accurately to trade off present and future gains. If there is myopia and short-termism, so that near-term gains and profits are valued excessively more than those that are further into the future, then that will introduce irrational biases to their decision-making. However, the evidence is that consumers and businesses are myopic – and unless there are powerful countervailing forces, consumers save less than they should, and businesses invest less than they should.

Similarly, effective markets are disrupted if there is scope for ‘gaming’ the system. But establishing incentives that work in an economically rational fashion, and which

are not then easily gamed, is fiendishly difficult. As we discuss later, schemes for performance enhancement are bedevilled by those who know more about the work – managers or workers – tricking their less knowledgeable superiors into setting targets that are too easy to beat. Beta performance gets alpha rewards. Organising a labour market solely around economic incentives proves difficult and sometimes self-defeating. Yet the scope for the market to correct such imperfections itself is limited.

In addition, the theorists rarely inquire into the actual process through which bargaining takes place. The assumption is that people would not accept a process that had bias – as in real life they do, from inertia, ignorance or weakness – and that all that matters is an economically efficient outcome. Whether the process by which the outcome is achieved is impartial, transparent and participatory is left unconsidered – but in reality the means are as important as the ends.² This is already a long and awkward list of failures which should give reason for the market theorist to pause. Yet the presumption has still been that, systemically, markets work.

Innovation drivers go well beyond market mechanisms

Economic theory, historically, has tended to prioritise two explanations for capitalism's extraordinary dynamism. For the first modern economist, Adam Smith, it was specialisation, scale and the division of labour within markets that explained economic growth; for pioneering growth theorist, Robert Solow, growth was about giving workers more capital with which to work.

But technology and innovation itself can have a profound impact. General purpose technologies, in particular, are those whose ramifications extend far beyond the imaginations of their inventors and the industry in which they were first invented – like railways, electricity, and the internal combustion engine. Innovation of this kind is pivotal to the growth process and flourishes best in market systems that allow for experimentation by many economic decision-makers who can expect rich rewards for success.

But the totality and subtlety of elements that generate innovation-driven growth are not captured by the narrow trammings and assumptions of market theory. Once an economy is operating on the frontiers of knowledge, using the best available tools, techniques and technologies, markets by themselves should not, and cannot, be expected spontaneously to deliver the innovation that is the driver of productivity and wealth.

It is the dynamism of the long-term growth process – and the necessary uncertainty and serendipity that surrounds it – that requires a more sophisticated economics than the algorithms of market theorists. Studies of economic growth over the very long-term show that the pattern is of long stretches of incremental, largely unobserved change and adaptation, punctuated by bursts of technological upheaval (see chart at the back of this Provocation).³

In the 19th century, for example, the general purpose technology of railways transformed companies, creating both mass consumption and mass production. Railways transformed local, fragmented markets into powerful, national markets and, in doing so, enabled countries like the US to achieve scale economies unimaginable to European producers – with seismic ramifications for global industrial leadership. Railways rewrote the rules of economic geography as cities were freed from the need to be located on rivers or coasts for access to resources. They underpinned the growth of the modern welfare state, impacting on everything from military strategy to tax collecting powers.⁴

But to interpret the growth process as a story of innovation and ideas is to enter a world in which market failure is the rule. Rather than an unfortunate exception that must be explained away, it is a

regular and systemic occurrence – part of the very dynamic of markets.

Consider, for instance, an entrepreneur calculating the profit from taking an innovation to market. If the project is successful, the innovation will inevitably become known to consumers, developers of complementary products and, most gallingly, direct competitors who can imitate her example. If it fails, she alone must bear the entire cost of the endeavour.

Innovators cannot hope to capture and appropriate all the value their innovation creates. Others can profit easily from their insights and hard work; consequently less innovation takes place than would be ideal, and growth as a whole is reduced. This damned-if-one-does-and-damned-if-one-doesn't attribute of innovation is not trivial: estimates suggest that the rate of return from R&D to society as a whole is up to twice as much as the private return to research. This social rate of return is even higher among small firms that have difficulties in protecting their intellectual property (IP) or extracting most of the rents in the product market.⁵

"Aha", responds the pro-market economist. The answer is to create intellectual property rights via patent and copyright. This will give the entrepreneur the incentive to innovate, and – as long as the property right is time-limited – the wider damage to the market can be contained because eventually the innovation will be available to everyone.⁶

While this may provide a partial solution conforming to the categories of free-market theory, it dodges the fundamental challenge the issue poses. To work, intellectual property rights must be comprehensive. But this is necessarily impossible. Much 'hidden innovation' – largely non-scientific and non-basic technological activities and expenditures along with the most fundamental innovations ('ideas' in copyright and 'discoveries' in patent) – fall outside IP law's protective umbrella.

Worse, the presumed cure intensifies the malady. If the right is awarded, the monopoly holder of IPR will raise the price of each and every additional copy of the good above the negligible costs of its reproduction and, as a consequence, potential demand will be frustrated – even though it could have been satisfied at virtually no additional cost. The capacity to accumulate and experiment with knowledge and drive the economy forward is fatally undermined.

The alternative, of promoting unfettered market competition, is no better. This will squeeze out the return to innovation entirely, driving the price of every product down to the value of its short-run costs alone. For many firms, this is the first step towards oblivion. The sunk cost of innovation, from the sheer time over which development occurs to the inevitable costs of following false leads, cannot be recovered from marginal cost pricing.

The assumption of perfect competition – free entry into any industry – has a similar effect. As Lipsey and others have argued, super-profits are the *quid pro quo* for entrepreneurs that take a step into the unknown, like adopting a new technology or entering a new market. Consider the film industry, where revenues are highly concentrated and unevenly distributed: studios' return on investments for the period 2001 to 2004 ranged from -96.7 per cent to over 677 per cent, with a median of -27.2 per cent,⁷ a bruising and thankless pattern reproduced in sectors such as pharmaceuticals, telecommunications and software. Firms need a degree of monopoly power and a capacity to inhibit imitation otherwise they cannot drive the growth process forward.

Nor is this all. Because the benefits of an innovation are uncertain until it is applied, individuals may prefer to observe and learn from others' experience to ascertain whether the innovation is a viable alternative to the *status quo*.⁸ But if everybody decides to play this waiting game, adoption will be delayed with knock-on consequences for market formation and firms' investment decisions. Unblocking this logjam, demonstrating the benefits of new technologies and encouraging adoption, is an important role for the state.

The problems in creating incentives for innovation underline the inapplicability of the core market concept of bargaining to the complexities of an innovation economy. Bargaining does not necessarily produce the best outcomes. And

conventional economists' models are too abstract to describe the process properly.

The economist Ronald Coase, when trying to capture the beneficial dynamics of market barter, drew the analogy of "individuals exchanging nuts for berries on the edge of the forest". After bargaining has finished, the nuts-for-berries exchange rate would perfectly express everyone's preferences. This is fine for simple economies on the edge of the forest, because there are only finite numbers of nuts and berries being traded and their qualities are well-known.

An innovator trying to organise a contract with an employee, partner, investor or customer is in an entirely different situation. Mandating the level of intangible 'quality' of a product or service, or the thought process used in coming up with a new-to-the-world insight, is extremely difficult.⁹ Projects have long and unpredictable development times: new technologies – from invention through proof of concept and market to exploitation – take on average six to eight years to complete, and as long as ten to 15 years for small biotechnology firms.¹⁰ This can involve regular and significant inputs of capital, and that capital is often invested in assets that have no alternative use or value outside the specific relationship.¹¹ Finally, individuals with diverse skills and competencies must work with each other. Hell may be other people, but no single individual can possibly know or do everything in a particular field. This is one reason for the ten-fold growth in firm networks and alliances over the last 20 years.¹²

For markets to work, the innovator has to imagine every contingency and course of action; price them; state them; and then monitor them in sufficient detail for any contract to be comprehensive and, as importantly, find words and language which do not suffer – as language does – from a ‘penumbra of ambiguity’.¹³ The task is impossible – and the innocent and honest are permanently at risk of being exploited by the guileful and dishonest.¹⁴

Incentives work best when there is a crisp and decisive link between effort and results, though these conditions rarely obtain. Workers, for example, know more about their work than their distant employer and manager. They can disguise how easy it is to do their job, and dupe the employer into paying more than she should for the work. Difficulties in measuring real-time performance further reduce the force of the incentives. In complex environments, outcomes are not just due to workers’ effort or competence but also extraneous influences such as the equipment, the organisation’s culture, industry conditions and even luck.

Solving the conundrum by establishing proxy targets for performance can, at best, provide hazy guidance and, at worst, give licence to bogus and dysfunctional behaviour. Banks, for example, that set pay based on the amount of loans generated (as a proxy for ‘performance’) may discover that the incidence of default skyrockets. Excessive bonuses in the financial markets undoubtedly led to too much lending on poor collateral and against inadequate capital in the five years up to the onset of the credit

crunch. This also partly highlighted just how hard it is for shareholders and owners to devise performance measures and incentives when so many of the activities and products – credit default swaps, collateralised debt obligations, and credit derivatives generally – were new. Managers in financial institutions argued that they should be paid very high, ‘alpha’ bonuses as appropriate for ‘alpha’ performance which they seemed to be delivering. But it is easy in a growing economy with rising asset prices and cheap debt to leverage short-term performance so that it looked like a return for risk, innovation and entrepreneurialism. In reality, the returns were unsustainable, and the volumes of debt collateralised against bubble asset prices have now brought the viability of many banks into question.

Left to themselves, owners and managers have two essential strategies if they persist in relying on incentives to deliver results. They can either scale back and focus on less ambitious and profitable goals for which there exist proven measurement techniques. Or they can batten down the hatches and set up an across-the-board scheme of monitoring and supervision, even if this diverts a large amount of financial resources away from more productive activities. Neither is very satisfactory. The better option, and one which real-life firms and owners use, is to step outside the framework of incentives, contracts and bargaining and use trust and reciprocity to get the results they want. Trust makes economic agents more willing to engage in interactions that involve the risk of deception.¹⁵

Reciprocity and trust as the best response to market failures

A surprising number of businessmen and women try to conclude contract negotiations with a shake of the hand and eye contact – or even to avoid signing a detailed contract altogether, opting instead for an exchange of letters or memorandum of understanding. They understand the importance of trust and reciprocity in persuading their interlocutors to act cooperatively and keep their bargain, even without explicit incentives and assurances.¹⁶

Such is the impossibility of creating the conditions to avoid market failure in the real world, that businessmen fall back – or willingly embrace – trust as a means to achieve rational economic ends. Economies and societies with lower levels of trust tend to be less productive and have more stifling levels of regulation – higher barriers to entry, lower freedoms in price-setting, more formalistic legal systems, reduced product and labour market flexibility – to try and compensate.¹⁷ People's demand for trust is intense, so that even when they know that government is ineffective and corrupt they would prefer its intervention than to operate in a trust-free casino. They know what market theorists do not.

Market failure as model failure:

I. The myth of self-interest

It would be wrong to suggest that economists are indifferent to the second-best complications of markets, and to deny the considerable efforts they make to understand their implications. But despite extensions to the suggested situations in which markets may fail, the doctrine of market failure remains compromised by some of its founding assumptions that appear to leave adherents chasing and fighting phantoms of their own making.

Nowhere is this more evident than in the assumption that economic actors rationally pursue their own self-interest – indeed, are condemned to do nothing else. Altruism is relegated to no more than delayed self-interest, so, for example, the more we create a good reputation, the more we can exploit it for economic advantage. The common good, it is assumed, is not something we can be relied upon to create for ourselves. Unless it is supported by appropriate taxes, subsidies, tournaments and auctions that reconcile the self-interest of individuals with the loftier common good, it will not happen. Economists quest to design systems that deliver this outcome, a research agenda that yielded three of its architects – Leonid Hurwicz, Eric Maskin and Roger Myerson – a Nobel Prize in 2007.

Yet even Adam Smith, founding father of free-market economics, had a more

sophisticated view of self-interest than the simple wish to buy cheap and sell dear at all times and in all circumstances (though this also mattered). Individuals were concerned for a self-betterment that was not only economic, accepted Smith; they desired the good opinion of others and were anxious to promote the interest of the commonwealth. They also valued fairness: it is “the main pillar that upholds the whole edifice. If it is removed, the great, the immense fabric of human society... must in a moment crumble to atoms”. Smith had no illusions about human nature, but he understood the complexity of motivation. “All men”, he opined, “even the most stupid and unthinking, abhor fraud, perfidy, and injustice, and delight to see them punished. But few men have reflected upon the necessity of justice to the existence of society, how obvious soever that necessity may appear to be”.¹⁸

Recent research is beginning to rediscover this collaborative, altruistic instinct in human beings. It can be found and reproduced even under laboratory conditions. In the so-called dictator game, the subject (the dictator) has an endowment of \$10 and chooses how much of the \$10 to transfer to an anonymous partner. Standard economic theory predicts that the dictator would keep the whole endowment, but over 60 per cent of subjects end up transferring a positive amount.¹⁹

In other experiments, such as the Prisoners' Dilemma, standard economic theory suggests that cooperation will only take place in small groups where there is a readier recourse to informal sanctions and codes of behaviour, and where reputations can be communicated more swiftly.²⁰ Lab evidence, however, suggests that groups of four and ten people contribute less effectively to common projects than do groups of 40 and 100.²¹

Other experiments, studies of giving, and field observations of behaviour confirm the story. The same results apply across complex and simple societies, across different cultures, and across a range of social institutions. When people have confidence in others' willingness to contribute their fair share, they will be moved by honour or altruism to do the same, even if it is implausible to expect that costs will be recovered at a later date. Conversely, when they believe that others are taking advantage of them, feelings of resentment and pride will cause them to seek revenge.²²

Many who resist this position base their argument on their idea that notions of honour are costly luxuries.²³ Modern societies, they argue, are dining on the last morsels of reciprocity and honour left over from an irrecoverable age of religious enchantment, rural communities and 'organic' solidarity. But this ignores the long, formative trajectories of our evolutionary history that equipped humans with the cognitive and emotional skills to sustain deep forms of cooperation.

One suggestion is that we have internalised the norms of primitive food-sharing agreements: even the most skillful hunter could return from an expedition empty-handed because of bad luck, expecting that others might help him out.²⁴ Alternatively, he might come back with a large yield, but food would perish, making hoarding useless. Because both these possibilities were likely, pooling and smoothing the yield from any one hunt was rational. Similarly, in the fluid world of population crashes, sudden disease or the need to move dwelling-places, human beings had to have the cooperative skills to manage their encounters with strangers, with whom they would want to collaborate. The desire to co-operate, to seek to trust, to want fair outcomes and to expect reciprocity are deeply embedded in the human DNA.

Assuming that people are only self-interested and respond solely to carrots and sticks can be not only ineffective but also counterproductive, undermining the establishment and functioning of trust.²⁵ The reason is that incentives may adversely signal to actors that others are not willing to cooperate voluntarily, or deny others the opportunity to demonstrate their willingness to contribute, thereby weakening the bases of generosity and commitment. News of enforcement crackdowns in the collection of taxes is shown to incite a higher, not lower, incidence of cheating as others deduce that more taxpayers than assumed are preferring to cheat.

In fact, incentives may ultimately change the very marrow of our preferences.

They influence – and arguably corrupt – the economic, social, cultural and legal crucibles in which motivations are formed. Children trained to believe that all that counts at school are good grades, for example, then understand future achievement only in individual terms. Workers who see their loyalty and hard work undermined by a transactional emphasis on cost-cutting, contracting out and short-term profits are likely to be less restrained in the pursuit of their own interests. Many of these effects are scarcely captured by laboratory experiments that last a few hours. But when market norms crowd out social norms, those vital social rules may be slow to return.²⁶

Market failure as model failure:

II. The myth of rationality

Besides their suspect understanding of human motivation, proponents of market failure are hobbled by a second Achilles Heel. It is no longer axiomatic that the majority of people, the majority of the time, can be assumed to make choices that are unambiguously in their best interests.²⁷

Human beings are prone to procrastination, and can be led astray by myopic emotions at the expense of longer-term commitments. There is an extensive literature showing how we irrationally value present gain over future gains. Faced by complexity, people fall back on blunt heuristics or mental short-cuts to decide how to react. We over-attribute events to the intentional actions of individuals, or to acts of God. We assume cause and effect are close in time when they may be wide apart. We over-generalise. We are unable to assess events whose probabilities of occurrence are very low (though sophisticated risk management techniques fare little better).²⁸ We are loss-averse, or as Adam Smith put it: “pain... is, in almost all cases, a more pungent sensation than the opposite and correspondent pleasure”. We are congenital optimists, ready to overestimate our own abilities and underestimate evidence that foreshadows potential problems, a pattern of judgment that sits behind the failure of so many mergers and takeovers.

We allow ourselves to be infected by the collective imagination, what Yale’s Professor Robert Shiller calls “new era stories” – the idea that technology, housing, emerging markets or whatever are the next El Dorado for canny investors.²⁹ As individuals, we do not have the time or resources to survey independently what is going on in the world, so we base decisions on the actions of others; their behaviour is assumed to be based on valid information that we have not had time to collect. Even if this counts as ‘rational’ behaviour, the result is that we suspend our own insights in favour of group judgments that may be mistaken.

We value goods more, simply because we own them. And as every opinion pollster knows, our decisions are based upon on how options are framed: if notified that ice-cream is ‘90 per cent fat-free’ we are far more likely to lunge (regrettably) for a second scoop than if we are informed it is ‘10 per cent fat’. We are subject to ‘anchoring’, the tendency to attach weight to initial prices that, once implanted in our minds, shape not only present prices but also future ones.

Confronted by all of this, the mystery isn’t why we make so many poor economic choices, but why we persist in accepting economic theory that predicts we are biased toward making good ones. By making so many assumptions that plainly could never correspond to real life, the

predictive reach of market economics is much diminished.

However, there is the beginning of a rethink. A new generation of economists – behavioural economists – are inserting more accurate assumptions about behaviour into economics, and yielding more illuminating results. These accounts accept that individuals try to act in ways that are outwardly rational. Individuals do learn from errors and make the best of their environment as a matter of routine adaptation rather than conscious evaluation. But behavioural economists are not surprised when other people make errors – thus, in social and economic settings, feedback is either too infrequent (for example in choosing a school) or too noisy (like buying shares) to enable this iterative, emergent rationality.³⁰

These are not grounds for despair but something more positive. As Dan Ariely points out, where standard market economics sees ‘free lunches’ as definitionally impossible – because if there were any, somebody would have already identified and captured their value – behavioural approaches see them as presenting substantial opportunities for policy.³¹

The typical example is saving for a pension. Standard market economics tries to explain the fact that seven million people under-save for their retirement because they are misinformed and poorly incentivised. Behavioural economics argues, on the contrary, that savers are naturally myopic, or procrastinators, or have problems calculating the benefits

of saving. In this way, judiciously crafted pension rules – say, an automatic opt-in – can enable us to do what we always planned to do and in hindsight are pleased we did.³² If we do not want to save, we can always opt out – but almost nobody does.

The market as the locus for experimentation inevitably integrates the political

Standard market economics' preoccupation with how markets deliver efficiency in the allocation of given resources to given ends is a very limited account of the genuine genius of markets and capitalism. Markets may have significant shortcomings in general and in particular, but they remain incredibly effective as 'open access' systems in creating conditions for innovation and producing a multitude of runners and riders between which consumers and citizens choose.³³ Market selection provides a way of evaluating and choosing between competing entrepreneurial judgments: successful ones draw more resources and expand while ineffective ones free up theirs and are discarded.³⁴

It was no accident that the European industrial revolution succeeded the European Enlightenment. The societies governed by the rule of law, and guaranteeing civic and constitutional freedoms, were an essential handmaiden to industrial capitalism. Property rights; commercial law; the capacity for an entrepreneurial class to champion invention and capture its profits; a public realm where difference was tolerated and ideas could be freely exchanged – all were part of the cocktail that created an industrial capitalism where productivity increased continually, based on systematic innovation. These were the first 'open access' societies combining market freedoms and constitutional entitlements

in which no position or idea was exempt from scrutiny and criticism.

This is not merely a source of economic creativity and innovation. Markets are conceived on the basis of multiple, dispersed sources of power. This creates a self-reinforcing mechanism for limiting the exercise of arbitrary power and possibilities for coercion and corruption. A better way of thinking about capitalism is through a combination of Austrian economist Joseph Schumpeter's insights, together with our earlier reference to Richard Lipsey. Companies will try to earn above-average profits, and indeed need to, in order to recoup the existential costs of innovation – but they are at permanent risk from what Schumpeter called "creative destruction" that will destroy their current business model. This, for example, is happening to today's music and newspaper industries as digitisation takes grip. It is not orthodox competition from other newspapers or music publishers that is the problem for the established newspaper and music companies. It is a completely new way of delivering their service that is wrecking their business models.

But this process is inevitably political. Governments can accept or not accept firms enjoying temporarily above-average profits, and a degree of economic rent – and can slow down or freeze the process of creative destruction. Few companies in the FTSE 100 have grown solely through their in-house capacity to innovate; they

have required government, at a minimum, to collude in their economic rent or, at best, actively to support it. Thus (until recently) UK governments have colluded in maintaining the high economic rent of the pharmaceutical companies, believing it an important platform for research and development – as it has been. Mobile phone company Vodafone could never have grown so rapidly without being given the 400 MHz radio spectrum for free, and being allowed to build a national network of telephone masts with minimal planning permission. The need to keep a national capacity to build defence equipment has meant that BAe has been permitted above-average profits. Planning permission for new supermarkets determines the degree of competition in any given shopping hinterland. And so on.

However, governments have to be equally wary about indulging rent for too long, and so blocking creative destruction. The ever-present risk is that an entrenched, successful company in a profitable market has the incentive and the wherewithal to stop others entering the market. An incumbent can freeze the existing business model by manipulating the rules of the game – lobbying government to limit foreign competition, regulate or deregulate as the case may be.³⁵

The rationale for resisting change is not difficult to find. Incumbents that have made expensive prior investments in specific technological solutions and production processes are less fleet-footed in the face of shifts in trade, technology and tastes.³⁶ One comprehensive study by Wiggins and Ruefli looked at the

performance of 7,000 firms over 25 years, ranking them to whether they were superior, middle or inferior performers in their respective industries. It was found that only 5 per cent of these firms were able to maintain their position as superior performers for over ten years or more, and only 0.5 per cent managed to do so for 20 years.³⁷ Newcomers, unconstrained by the baggage of history, have much greater freedom to devise radical solutions. Not surprisingly, patents developed by ‘Young Turk’ small firms are twice as likely as those patents developed by large firms to be among the 1 per cent of the most cited patents.³⁸

Thus the American car industry furiously lobbied Washington through the 1980s and 1990s to protect it from Japanese competition and not to introduce tough rules on engine efficiency and carbon emissions. By giving in, the US government did the car industry a disservice. US car manufacturers were committed for too long to the manufacture of archaic gas-guzzling cars, leading to GM and Ford’s dramatic lack of competitiveness today. The car industry argued that government should not meddle in the process of wealth generation – interpreted here as protecting existing producers from the force of creative destruction. It was self-serving and wrong.

Economic and political markets thus go hand in hand. Policymakers need a much more sophisticated compass for action than simply accepting business’s case for ‘wealth generation’ on business terms, or of endorsing or refusing any proposal on market failure grounds. Down that path madness lies.

Markets thrive where there is equality and fairness

There is a tendency to indulge the view that inequality is the inevitable by-product of successful capitalism; the consequence of incentives that reward innovation and risk-taking. Equality and efficiency are thus in conflict.

But if:

- a. successful capitalism is about innovation, experimentation and capacity to accept change;
- b. change is best negotiated in a culture with a wider readiness to accept disruption; and that
- c. non-contractual relationships based on trust and reciprocity are fundamental to resolving embedded difficulties in creating workable bargains,

then there is arguably less tension. Rather, and paradoxically, capitalism needs fairness and not wild inequality.

This is not an argument for flat-earth equality – taking from the proverbial ants and giving to the grasshoppers. Inequalities that arise from above-average returns and incomes are necessary to signal where resources should be allocated, and are justified by effort and risk. But that is the point. They should be justified by effort and risk and consistently be proportionate. It is the proportionality of reward to value-

added and the notion that fortunes reflect choices, not circumstances and other arbitrary advantages, that underpin the equity and fairness essential to the integrity of capitalism.

Capitalism thrives on and generates change. The rate of introduction of new general purpose technologies, as referred to earlier, is quickening. If there were only two such technologies introduced in the 18th century, four in the 19th and seven in the 20th, the reasonable expectation should be that the 21st century will see a further doubling (see chart at back of this Provocation).

In other words, the rise and fall of firms and industries is likely to become more commonplace – and it will be a source of great wealth. But 21st century economic life will as a result also be continually disruptive, and the impact will be felt especially by the ill-educated, marginalised and poor. Disadvantage, deprivation, weak social security systems, and poor education and training make it harder for the mass of people to accept change. If there is too large a part of the population fearful of change because it directly hurts them, and the cushion of protection is too weak, then the forces driving innovation will be resisted. This is one reason why anti-free trade preferences are found to be correlated with a person's level of human capital.³⁹ Equally, if there is too much distance between top and bottom earners

then there is no basis for constructing reciprocity so crucial to trust and escaping the tyranny of trying to build comprehensive contracts.⁴⁰

By contrast, the more that wealth and assets are widely dispersed, the better functioning the system. The more that ordinary workers have a stake in the system, the more they benefit from its growth and accept the attendant hazards and risks. Good economic policy is often associated with short-term costs for long-term benefits; in societies with deep social cleavages, it is difficult to build patience for reform, and persuade citizens that the short-term costs of change will be compensated for by long-term benefits.⁴¹ To take just one example, in these circumstances it is more likely that ordinary workers will be able to borrow to start businesses, challenging incumbents, or invest in existing businesses and hold managements to account.⁴² Finally, inequality may interact with institutional arrangements to lower growth as poor majorities spend more energy pursuing redistributive rather than growth-enhancing policies.⁴³

Inequality and unfairness are morally pernicious. But they also undermine the capacity of capitalist economies to change and innovate – the dynamic, elemental force that sustainable market economies must embrace, or perish.

The role of government

The other dimension of the purist free-market case is the assumption that government efforts to correct market failures will only magnify them. In this worldview, governments and regulators are blind giants, all chubby thumbs and slight fingers, incapable of eliciting common underlying information about market needs, or of taking efficient action even when they do. They are risk-averse, bureaucratic, over-manned and never deliver their intended outcomes. They are vulnerable to influence and capture by powerful organised groups, so that the benefits they distribute are skewed. One of the reasons for persevering with market solutions is because government ‘solutions’ are no solution at all.

There is a powerful element of ideology in this condemnation. The assumption is that government is incapable of learning or adaptation. It is frozen in aspic; its institutional and incentive structure are stuck in stone. Democracy, and the government action, regulation and legislation it produces, are seen as obstructions to economic growth.

Increasingly, these views would seem eccentric, almost quaint, if they were not taken so seriously. The mounting evidence is that high quality decision-making and creativity emerge most easily from the deliberative exchange of many voices, and that the ‘soft’ institutions of capitalist societies – the rule of law,

accountability mechanisms like voting, but also the media and even trade unions – are fundamental to their effectiveness. Deliberation and soft institutions are crucial to good governance, which in turn is crucial to well-executed sustainable capitalism.

Standard market economics views the market as the sole legitimate and effective way in which consumers can express their preferences and where economic issues and problems can be resolved. Democracy and public deliberation are characterised as belonging to a different and discrete realm that tends to obstruct the purity of the market process.

But consumers are also citizens. The political arena is of equal importance in allowing them to express preferences – for more safety, fewer carbon emissions, no smoking in public places, less fatty food – that may be difficult or impossible to express through the price mechanism.

Public deliberation necessitates the exchange and giving of reasons rather than the raw aggregation of preferences; as such it is better equipped to bring to light errors and omissions. Unlike market exchange, it is better at dealing with issues that have more than one dimension or objective;⁴⁴ it expresses deeper respect for parties as equals in a process of justification, and so is more likely to secure compliance with outcomes, even if there is disagreement over substance; and

it guarantees that everyone can observe that the considerations supporting a position are relevant ones and not just strategically motivated.⁴⁵ This can be done well or badly depending upon the quality of the democratic institutions to hand.

What cannot be argued is that the process is somehow necessarily economically inefficient because it takes place in a public sphere that entails public policy and action in consequence. Importantly, the law and regulation that results from good democratic deliberation often has the effect of a canary down a mineshaft – warning firms of changing tastes that may not yet be expressed in the marketplace.⁴⁶ Joschka Fischer, leader of the German Greens, makes this claim about the impact his party had in forcing early implementation of increased car engine efficiency and lower carbon emission in Germany. Although resisted by the German car industry as a ‘burden’ at the time, it proved an important early warning of how consumer preferences would develop in Germany and beyond – and put the German car industry significantly ahead of its competitors.

Nor is it true that government is necessarily always stupid and self-defeating. Peter Lindert of the University of California has demonstrated that although ‘Big Government’ EU states in Scandinavia, the Netherlands, France and Germany do have higher tax takes as a share of GDP, they have been careful to design a mix of taxes that has been friendlier to growth than that in the US, UK and other laissez-faire countries.⁴⁷ They have lightened the tax burden on

capital accumulation (corporations, capital etc.) relative to labour earnings (labour supply is typically less elastic). They have targeted for taxation leisure-oriented and addictive goods that create social harms. At the same time, the design of transfers such as unemployment compensation has been structured not to subsidise unproductive activities. The unemployed have been obliged to take up work in return for generous retraining and other traditional social benefits. Denmark and Sweden’s ‘flexisecurity’ is better designed, more rational and produces better results than the US’s punitive and minimalist system. Finally, higher budget costs have not only increased productive investments in education and health but have increased and made more visible the cost of bad choices. As such, these governments can only get away with so much before the system recoils and voters express their discontent at the ballot box – a powerful inducement to act with restraint.

Moreover, critics of government have to assume that none of the institutional breakthroughs of the last 50 years has made any difference to public performance – that ‘government failure’ is so endemic that it is impervious to reform. But there are any number of important innovations. Public-private collaborative partnerships, for example, can be organised to capture the best of the strategic, bird’s-eye view of the centre with the grainier, more detailed knowledge of local public and private actors – mindful that those actors also serve microscopically local interests. Public spending programmes can have

built-in sunset clauses to ensure that resources are not locked up for a long time in activities that no longer deliver sufficient returns. General criteria for success and failure can be introduced to monitor outcomes. Agencies responsible for carrying out a particular policy can be required to demonstrate that they have proven competence, and senior managers can be chosen with clear stakes in the outcomes. We can even accept that experimentation in the public sector, as in the private sector, may go wrong rather than expecting 100 per cent infallibility.

In the UK, a number of institutional innovations in the public sector have embodied these new approaches. Foundation hospitals have enlisted local stakeholders into the governance structures, radically improving the institutions' access to external knowledge while greatly increasing their accountability and transparency. City academies have energised education opportunity in deprived areas. The Highways Agency has greatly reduced the impact of accidents on traffic flows. The Job Centre Plus network, integrating job search and the administration of benefits, has increased the numbers of workless finding work. And there are many more examples, ranging from the BBC to the UK university sector, of high-performing public bodies. Critics assume that institutional and governance design can make no difference to performance because public institutions are incapable of responsiveness, intelligence or adaptation; these examples prove the assumption wrong.

More generally, democracies have a respectable record in generating growth. It is democracies that produce more predictable long-run growth rates, coping with adverse shocks more effectively and delivering better distributional outcomes.⁴⁸ Economic growth is much more variable among non-democracies than among democracies. Ninety-five per cent of the worst economic performances over the past four decades have taken place under autocracies.⁴⁹ The few, like China, who have bucked this trend possess some form of 'selectorate' – a party structure, the military, a close group of allies – capable of dislodging leaders.⁵⁰ They have simulated the performance-related pressures analogous to those found in democracies – but questionably not so well.

Democracy, notwithstanding its critics in both the West and Asia, is not inefficient. Moreover it is capable of reform and improvement. Just as markets and governments can both succeed, so they can both fail. There is no reason to suppose that failure is the unique preserve of government.

Our thesis in practice – the credit crunch is not a market failure but a systemic failure of markets

The financial services sector in the UK, the US and beyond has, of all industries, most exploited the arguments of standard market economics to its advantage. It has campaigned for 20 years for light-touch regulation, for minimal intervention, and for the dismantlement of all forms of government control – exchange and capital controls, minimum reserve requirements, margin trading limits, separation of investment and commercial banking, to name but a few. The argument has been that financial markets, more than any other, conformed to the necessary preconditions to deliver efficiency. Information was rapidly and equally shared among many participants; prices were free and flexible; systematic rigging of prices through monopoly, market dominance and collusion was very hard, if not impossible – and so on. Financial markets were efficient markets, and the more they could be deregulated and liberalised, the more efficient they would be.

In the autumn of 2008, this claim looks risible. Western governments have pledged over \$500 billion to recapitalise their banking systems, offered over a trillion dollars in guarantees to their respective interbank markets, and \$2 trillion in additional liquidity to their money markets. The Bank of England Financial Stability Review identifies \$2.8 trillion of mark-to-market losses

across the spectrum of financial assets. It became clear in September and early October of 2008 that western banks, most acutely in the UK and the US, were dramatically undercapitalised in relation to the amount of loans they had made and potential losses. They would be unable to support the scale of potential losses triggered by falling property prices, bank failures, and financial derivatives so complex they cannot be priced reliably. There was over \$350 trillion in financial derivatives written on the basis of core capital ratios that the banks had not increased. Sixty trillion dollars of credit default swaps were not even traded through a central clearing house. The leverage exposed in the US investment banks – of loans worth 30 or 40 times bank reserves – was breathtaking. When Lehman Brothers collapsed on September 15, trust disappeared from the world's interbank markets: banks stopped lending to each other, LIBOR rates soared and credit flows effectively dried up – a situation now easing because of the scale of intervention. Although the crisis was triggered by problems in the US sub-prime market, the structure of lending was an accident waiting to happen.

The assumptions of standard market economics had permitted the creation of an impossible edifice of financial transactions that was systemically unstable. Free decision-making proved myopic and succumbed to 'new era' thinking about the upward trajectory of

the housing market, and the capacity of new models and instruments to come to grips with financial risk. Reward mechanisms were constructed to benefit the individual in the short-term rather than the organisation in the medium term. There was no concern in building trust relationships with borrowers, seen as commodities needed to fill targets, creating the income flows to be securitised. Conflicts of interest with credit rating agencies were disregarded.

There was no understanding by either participants or regulators that the system exemplified what leading sociologist Charles Perrow terms ‘tight coupling’ and ‘interactive complexity’.⁵¹ He argues that systems are coupled to the extent that each part of a process is linked to the next, and each step without delay sets off the next; and that they are complex to the extent that different, often remote parts of a system interact, allowing problems to ‘jump’ from one part of the system to another in ways that can appear freakishly and defiantly improbable.

Robust practices, whether in engineering, regulation or management, internalise these lessons and organise themselves with the possibility of failure and instability in mind: thus, a fully functional Boeing 777 could be built with just a few hundred sub-components, when in fact it utilises more than 150,000.⁵²

The financial markets are no different.⁵³ The non-stop information flows and trades that efficient market theory celebrates create a voracious and destabilising appetite for liquidity.

Prescriptions such as mandating greater responsiveness or purging waste that appear efficient in fact provide little buffer for recovery once a problem arises, and make rapid and effective intervention all the harder. At the same time, the explosion of swaps and derivatives that facilitate highly-leveraged positions across otherwise unrelated asset classes, along with the blurring of commercial and investment banking, has built complexity into the system. This complexity cannot be seen by market participants. Finally, unlike natural or technical systems, self-interested participants may be motivated to exploit information asymmetries and manufacture complexity to their advantage.

Because of this interactive complexity and the potential for problems to jump, Anil Kashyap, Raghuram Rajan and Jeremy Stein argue that two problems accelerated the massive shakedown of financial markets.⁵⁴ First, for banks that were unwilling to raise capital through issuing new equity, the alternative was to sell assets; however, interconnectedness can lead to a fire sale. Losses incurred by bank A induce it to liquidate assets – that is, to sell off some of its mortgage-backed securities. But in so doing, bank A damages another bank B who holds the same assets, depressing the mark-to-market price of its assets and so weakening its capital position. In response, bank B must unwind some of its positions, selling off assets and so feeding back into bank A’s already parlous condition.

These dangers, they point out, are heightened when banks face short-term funding constraints. If bank B is funding mortgage-backed securities with short-term secured borrowing, any decline in their value will confront it with a margin call. It will only be able to meet its commitments through a further, disorderly flurry of selling. Finally, interactive complexity means that costs and burdens will be borne by small businesses and households, located in remote and far-flung corners of the economy, but dependent on capital for sustenance. Numerous measures of aggregate activity are shown to be highly sensitive to banks' balance sheets, even taking into account variables such as short-term interest rates. In a recent study covering 17 developed economies over the past 30 years, the IMF finds that slowdowns or recessions preceded by banking crises tend to be deeper and longer than those not preceded by banking crises. In fact, the cumulative loss of output is, on average, two to three times as great and three to four times as long.⁵⁵

The crisis in the American sub-prime market jumped to London; the collapse in investor demand for residential mortgage-backed securities then created a crisis for Northern Rock. That, in turn, made investors even more risk-averse, creating a swirling vortex of mortgage famine, falling house prices, further loan write-offs and more risk to the entire banking system. None of these interconnected events from a highly coupled and complex system could be captured by the price of an individual security, credit default swap or derivative. Only a regulator's

intervention, taking a system-wide view, could insist on more correct pricing.

The lack of this regulation, and the structure of the system, took the world to the brink; there was a real prospect without intervention of the collapse of the western banking system. Keynes argued that the financial system's relationship with the real economy constituted an existential problem because of the mismatch of time-horizons, complexity, herd thinking and different speed of adjustment – and this imparted capitalism its systemic instability. His views, and the regulation so supported, was spurned. Thirty years of standard market theory had reached its climax. Only public intervention – fast, clever and decisive – saved the day.

Conclusion

There is genius, dynamism and innovation in capitalism. Unfortunately, standard market theory does not properly allow it to be unlocked. We need a new and more subtle economics and a cleverer approach to public policy. A 'good' capitalism recognises the interdependence of public and private. In particular, there needs to be a reappraisal of:

- Innovation as the key wealth creator. Too much emphasis on competition, fast outcomes and commercial disciplines undermines innovation. Too much monopoly and protection has the same impact. Policymakers need to aim for 'goldilocks' markets that permit both creative destruction and sufficient economic rent to reward risk-taking.
- Good capitalism is founded on trust and kept promises, which in turn requires reciprocity between economic actors who share the same economic and social universe. Too much inequality, dividing economy and society into discrete spheres, thus undermines reciprocity and trust – and ultimately undermines the capacity of capitalism to embrace change and solve market failure problems by 'handshakes'.
- Regulation, far from being anti-business or a burden, is another source of information to business about preferences among the population

and is as valid as signals from the marketplace – the 'canary down a mineshaft' effect. It is part of a wider story in which sustainable business models are co-produced by public and private action.

- The relationship between finance and the real economy constitutes an existential challenge to capitalism because of the mismatch of time-horizons, speed of differential adjustment and different objectives. To avoid systemic failures, governments need to put in place an infrastructure of risk management including new risk markets, standardisation of contracts, new financial institutions, risk management instruments and regulatory rules.

The traditional economic model has a role to play in policy alongside other disciplines, though claims should and must be more modest and certainly less preemptory. The task of theory and practice is to understand the present and actual, not to set up a world beyond.⁵⁶ The bad news is that it has taken a crisis to remind us of this; the good news is that the tide is now turning.

Endnotes

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3. Lipsey, R., Carlaw, K. and Bekar, C. (2005) 'Economic Transformations: General Purpose Technologies and Long Term Economic Growth.' Oxford: Oxford University Press.
4. At first glance this is a triumph of free-market capitalism – but it does not correspond to any free-market theoretical purism. The inventors were certainly private; the companies were private; and the funds were raised from private quarters. But the British state had constructed London's financial system in which savings could be readily raised; and the state ensured that land for railway construction was readily available. Engineering emerged as an academic discipline supported by the state. Nor could the way the market developed be remotely compared to the theorems of market theory. The railway companies and their financial backers could never have guessed at the ramifications of the industry they were launching or even begun to alert others – had they wanted – to the possibilities, so that mistakes would be minimised and valuable resources not misused. This was a market that from the beginning had imperfect knowledge, asymmetric information and massive imbalances of power. It could never have worked in any other way, and the state had to offset its wilder proclivities.
5. Gompers, P. and Lerner, J. (2004) 'The Venture Capital Cycle.' Cambridge, MA: MIT Press. To be precise, the claim is not that spillovers per se reduce incentives, only immediate and total spillovers. Epistemologically, knowledge is a very different beast from information or the way it was understood by Aristotle and Descartes and its absorption, interpretation and translation into practical artefacts is never costless.
6. From this perspective, private appropriation mechanisms, such as secrecy, lead-time advantages, reliance on complementary sales and service may appear to temper the peremptory edges of monopoly but they, too, are not free from problems. While patents require rights holders to disclose information about the invention in return for monopoly, mechanisms such as secrecy involve no such quid pro quo. In fact, historical evidence suggests that secrecy relative to patent ultimately impedes the diffusion of knowledge and the development of markets for technology. Patents may also contribute to welfare in other ways: they play an invaluable role in negotiations for cross-licensing and act as a signalling device for shareholders banks, venture capitalists, competitors or customers.
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14. Note that this would be impossible if complete contracts could be drawn up. They would be able to specify all the circumstances that might arise and fix the course of action to be followed in each and every case.
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16. The usual reference point here is the socio-legal work of Stewart Macaulay, in particular (1963) The Use and Non-use of Contracts in the Manufacturing Industry. 'Practical Lawyer.' 9 (7); and (1985) An Empirical View of Contract. 'Wisconsin Law Review.'; see also Collins, H. (1999) 'Regulating Contracts.' Oxford: Oxford University Press; Heckscher, C. and Adler, P. (2006) The Firm as a Collaborative Community: Reconstructing Trust in the Knowledge Economy.' Oxford: Oxford University Press.

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32. From the perspective of standard market economics, the assumption is that people save the exact amount they want to save, perhaps because they expect to win the lottery; or do not care about the future; or are anticipating support from kin; or indeed are looking forward to slumming it in retirement. But these rationalisations strain credulity both as common sense and tested fact.
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42. Indeed, the more they own the fruits from their decisions, the more they exert maximum effort, reducing the conflict of interest between principals and agents described earlier.
43. Alesina, A. and Rodrik, D. (1994) *Distributive Politics and Economic Growth*. 'The Quarterly Journal of Economics.' 104 (2), pp. 465-90. See also: Easterly, W., Ritzen, J. and Woolcock, M. (2006) *Social Cohesion, Institutions, And Growth*. 'Economics and Politics.' 18 (2), pp. 103-120.
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Timeline of world inventions

9000-3000 BC

3000-1000 BC

4th Century AD

15th-18th Century

19th Century

20th Century

21st Century

Domestication of animals and plants

- 9000-7500 BC
- domesticating plants turned humans into settled farmers
 - led to invention of wheel; societies that failed to domesticate animals failed to exploit the wheel

Wheel

- 4000-3000 BC
- led to transportation of crops, goods, people, being able to travel distances
 - invention of the heavy plough which revolutionised farm production

Bronze

- 2800 BC
- accelerated technology of warfare to include siege weapons, war chariots, armour
 - revolutionised combat so armies could advance in phalanxes rather than just relying on man-to-man combat
 - shifted control of the state from priesthood to lay rulers

Waterwheel

- Early Medieval Period
- first instance of replacement of animate by inanimate power on a significant scale
 - led to need to develop and refine property rights

Printing

- 16th Century
- paper lowered cost of storing information, facilitating growth in economic activity and introduction of innovations like credit, bills of exchange, insurance
 - development of standardised language with workable grammar
 - introduction of ideas of copyright and property rights
 - introduction of advertising, propaganda, bureaucracy

Factory system

- Late 18th to early 19th Century
- harnessing steam in factories meant massive rise in productivity
 - big demand for skilled mechanical workers
 - poor working conditions for most workers led to new labour movement, trade unions and political parties

Iron steamship

- Mid 19th Century
- rapid transportation of goods allowing increased trade, globalized the market for agricultural trade
 - made international travel a reality
 - revolutionised naval warfare with huge cannon and armour

Electricity

- Late 19th Century
- giving more leisure time by eliminating a lot of household drudgery
 - electricity in factories increased productivity and safety
 - the power source behind all later technological inventions – radio, computer, satellite, laser

Airplane

- 20th Century
- made the world smaller and more accessible
 - led to aviation warfare and ability to bomb cities from above, i.e. The Blitz

Computer

- 20th Century
- led to medical, technological advances – usage in R&D
 - internet and email – mass means of communication
 - led to innovations in mass production and assembly line – robotics
 - led to new methods of storing information

Internet

- 20th Century
- transformed long-distance communication, email virtually eliminated normal mail
 - communities able to form around issues – new forms of social protest

Nanotechnology

- 21st Century
- future technology but likely to mean no need for raw materials at a factory – deposits of iron or coal no longer meaningful
 - factories can be mobile
 - nanomedicine, including non-intrusive surgery
 - eliminate waste



Writing

- 3400-3200 BC
- led to better organisation and coordination of societies
 - led to system of storing information
 - increased the scope for tax collection and management of large-scale public works

Three-masted sailing ship

- 15th Century
- led to ships being able to carry heavy loads such as huge cannon – seafaring warfare
 - led to discoveries of new lands and ability to map the world
 - led to invention of true and accurate compasses which led to understanding of magnetism which in turn, led to invention of dynamo and electricity

Railway

- Mid 19th Century
- first mass passenger transport, allowing people to relocate
 - able to move goods quickly so increased trade
 - telegraph invention

Motor vehicle

- 19th Century
- production was major source of employment and wealth creation
 - brought with it mass production
 - made large numbers of people from most social classes truly mobile for the first time

Lean production

- 20th Century
- led to big increases in productivity within Japan's factories
 - allowed Japan to challenge North American and European markets
 - led to changes in organisation of labour within firms

Smelting of ore

- 8000-7000 BC
- required technological advances in furnaces, which occurred at the same time to allow smelting of ore
 - allowed bronze to be used to create tools and weapons

Iron and steel

- 1200 BC
- made metal tools cheap so could be universally used for heavy work
 - in later years enabled the development of machine tool industry in 19th Century which revolutionised mass production

Steam engine

- Late 18th to early 19th Century
- changed Britain from rural society to urban factory-based society
 - railways – big passenger transport, people able to relocate, move goods quickly

Internal combustion engine

- Late 19th Century
- enabled development of heavier-than-air craft and the automobile
 - gave rise to oil industry
 - led to tanks and trucks which allowed mobile warfare

Mass production, continuous process factory

- 20th Century
- able to produce standardised goods at lower cost and of poorer quality, but available to wider public thus increasing general living standards
 - led to innovations in food production
 - increased social mobility

Biotechnology

- 20th Century
- understanding of DNA led to discoveries in combating diseases
 - genetic modifications of food and bioengineering

Will Hutton

Will Hutton is executive vice chair of The Work Foundation. Will began his career as a stockbroker and investment analyst, before working in BBC TV and radio as a producer and reporter. Prior to joining The Work Foundation, Will spent four years as editor in chief of *The Observer* and he continues to write a weekly column for the paper. Will has written several best-selling economic books including *The World We're In*, *The State We're In*, *The State to Come*, *The Stakeholding Society* and *On The Edge* with Anthony Giddens. In addition, he won the Political Journalist of the Year award in 1993. Other roles Will performs outside The Work Foundation include: Governor of the London School of Economics; Honorary Fellow, Mansfield College, Oxford; Visiting Professor, Manchester University Business School and Bristol University and he is a member of the Scott Trust. He is also a Fellow of the Sunningdale Institute. Will's book, *The Writing on the Wall: China and the West in the 21st Century*, was published in the UK in January 2007 by Little, Brown.

Philippe Schneider

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