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How economic theory came to ignore the role of debt

Michael Hudson (University of Missouri at Kansas City, USA)

Starting from David Ricardo in 1817, the historian of economic thought searches in vain through the theorizing of financial-sector spokesmen for an acknowledgement of how debt charges (1) add a non-production cost to prices, (2) deflate markets of purchasing power that otherwise would be spent on goods and services, (3) discourage capital investment and employment to supply these markets, and hence (4) put downward pressure on wages.

What needs to be explained is why government, academia, industry and labor have not taken the lead in analyzing these problems. Why have the corrosive dynamics of debt been all but ignored?

I suppose one would not expect the tobacco industry to promote studies of the unhealthy consequences of smoking, any more than the oil and automobile industries would encourage research into environmental pollution or the linkage between carbon dioxide emissions and global warming. So it should come as little surprise that the adverse effects of debt are sidestepped by advocates of the idea that financial institutions rather than government planners should manage society's development. Claiming that good public planning and effective regulation of markets is impossible, monetarists have been silent with regard to how financial interests shape the economy to favor debt proliferation.

The problem is that governments throughout the world leave monetary policy to the Central Bank and Treasury, whose administrators are drawn from the ranks of bankers and money managers. Backed by the IMF with its doctrinaire Chicago School advocacy of financial austerity, these planners oppose full-employment policies and rising living standards as being inflationary. The fear is that rising wages will increase prices, reducing the volume of labor and output that a given flow of debt service is able to command.

Inasmuch as monetary and credit policy is made by the central bank rather than by the Dept. of Labor, governments chose to squeeze out more debt service rather than to promote employment and direct investment. The public domain is sold off to pay bondholders, even as governments cut taxes that cause budget deficits financed by running up yet more debt. Most of this new debt is bought by the financial sector (including global institutions) with money from the tax cuts they receive from governments ever more beholden to them. As finance, real estate and other interest-paying sectors are un-taxed, the fiscal burden is shifted onto labor.

The more economically powerful the FIRE sector (Finance, Insurance and Real Estate) becomes, the more it is able to translate this power into political influence. The most direct way has been for its members and industry lobbies to become major campaign contributors, especially in the United States, which dominates the IMF and World Bank to set the rules of globalization and debt proliferation in today's world. Influence over the government bureaucracies provides a mantel of prestige in the world's leading business schools, which are endowed largely by FIRE-sector institutions, as are the most influential policy think tanks. This academic lobbying steers students, corporate managers and policy makers to see the world from a financial vantage point.

Finance and banking courses are taught from the perspective of how to obtain interest and asset-price gains through credit creation or by using other peoples' money, not how an economy may best steer savings and credit to achieve the best long-term development. Existing rules and practices are taken for granted as "givens" rather than asking whether economies benefit or suffer as a whole from a rising proportion of income being paid to carry the debt overhead (including mortgage debt for housing being bid up by the supply of such credit). It is not debated, for instance, whether it really is desirable to finance Social Security by holding back wages as forced savings, as opposed to the government monetizing its social-spending deficits by free credit creation.

The finance and real estate sectors have taken the lead in funding policy institutes to advocate tax laws and other public policies that benefit themselves. After an introductory rhetorical flourish about how these policies are in the public interest, most such policy studies turn to the theme of how to channel the economy's resources into the hands of their own constituencies.

One would think that the perspective from which debt and credit creation are viewed would be determined not merely by the topic itself but whether one is a creditor or a debtor, an investor, government bureaucrat or economic planner writing from the vantage point of labor or industry. But despite the variety of interest groups affected by debt and financial structures, one point of view has emerged almost uniquely, as if it were objective technocratic expertise rather than the financial sector's own self-interested spin. Increasingly, the discussion of finance and debt has been limited to monetarists with an anti-government ax to grind and vested interests to defend and indeed, promote with regard to financial deregulation.

This monetarist perspective has become more pronounced as industrial firms have been turned into essentially financial entities since the 1980s. Their objective is less and less to produce goods and services, except as a way to generate revenue that can be pledged as interest to obtain more credit from bankers and bond investors. These borrowings can be used to take over companies ("mergers and acquisitions"), or to defend against such raids by loading themselves down with debt (taking "poison pills"). Other firms indulge in "wealth creation" simply by buying back their own shares on the stock exchange rather than undertaking new direct investment, research or development. (IBM has spent about $10 billion annually in recent years to support its stock price in this way.) As these kinds of financial maneuvering take precedence over industrial engineering, the idea of "wealth creation" has come to refer to raising the price of stocks and bonds that represent claims *on* wealth ("indirect investment") rather than investment in capital spending, research and development to increase production.

Labor for its part no longer voices an independent perspective on such issues. Early reformers shared the impression that money and finance simply mirror economic activity rather than acting as an independent and autonomous force. Even Marx believed that the financial system was evolving in a way that reflected the needs of industrial capital formation.

Today's popular press writes as if production and business conditions take the lead, not finance. It is as if stock and bond prices, and interest rates, reflect the economy rather than influencing it. There is no hint that financial interests may intrude into the "real" economy in ways that are systematically antithetical to nationwide prosperity. Yet it is well known that

central bank officials claim that full employment and new investment may be inflationary and hence bad for the stock and bond markets. This policy is why governments raise interest rates to dampen the rise in employment and wages. This holds back the advance of living standards and markets for consumer goods, reducing new investment and putting downward pressure on wages and commodity prices. As tax revenue falls, government debt increases. Businesses and consumers also are driven more deeply into debt.

The antagonism between finance and labor is globalized as workers in debtor countries are paid in currencies whose exchange rate is chronically depressed. Debt service paid to global creditors and capital flight lead more local currency to be converted into creditor-nation currency. The terms of trade shift against debtor countries, throwing their labor into competition with that in the creditor nations.

If today's economy were the first in history to be distorted by such strains, economists would have some excuse for not being prepared to analyze how the debt burden increases the cost of doing business and diverts income to pay interest to creditors. What is remarkable is how much more clearly the dynamics of debt were recognized some centuries ago, before financial special-interest lobbying gained momentum. Already in Adam Smith's day it had become a common perception that public debts had to be funded by tax levies that increased labor's living costs, impairing the economy's competitive position by raising the price of doing business. The logical inference was that private-sector debt had a similar effect.

How national debts were seen to impair economic competitiveness prior to Ricardo

An important predecessor of Adam Smith, the merchant Mathew Decker, emigrated from Holland to settle in London in 1702. In the preface to his influential *Essay on the Causes of the Decline of the Foreign Trade*, published in 1744, he attributed the deterioration in Britain's international competitiveness to the taxes levied to carry the interest charges on its public debt. These taxes threatened to price its exports out of world markets by imposing a "prodigious artificial Value . . . upon our Goods to the hindrance of their Sale abroad." Taxes on food and other essentials pushed up the subsistence wage level that employers were obliged to pay, and hence the prices they had to charge as compared to those of less debt-ridden nations.

The tax problem thus was essentially a debt problem, which in turn reflected royal military ambitions. Eight centuries of warfare with France had pushed Britain deeply into debt. Interest on the government's bonds was paid by levying excise taxes that increased prices. The cost of doing business was raised further by the high prices charged by the trading monopolies such as the East India Company (of which Decker himself had been a director) that the government created and sold to private investors for payment in its own bonds.

The system of funding wars by running into debt rather than on a pay-as-you-go basis was called Dutch Financing because, as Adam Smith explained (*The Wealth of Nations*, V, iii; Cannan ed.: 452), "the Dutch, as well as several other foreign nations, [have] a very considerable share of our public funds." In fact, they held more than half of these securities, including shares in major Crown corporations such as the East India Company and Bank of England, on which Britain paid a steady flow of interest and dividends that absorbed much of its trade surplus. "As Foreigners possess a Share of our national Funds," Smith wrote

(anticipating the complaint of global debtors ever since), "they render the Public in a Manner tributary to them, and may in Time occasion the Transport of our People, and our Industry."

The economic popularizer Malachy Postlethwayt estimated that Seven Years War (1757-63) cost Britain £82 million. In the year the conflict broke out, his pamphlet on *Great-Britain's True System* (1757:165) explained how the taxes levied to service the public debt had increased the nation's cost structure: "the Sum-Total of these Taxes is at least 31 per Cent. of the annual Expense of the whole People of England. Now, where is the Nation with which we can enter into a Competition of Commerce on equal Terms? And what Matter is the 1 or 2 per Cent. Advantage we boast over some of our Rivals in the interest of Money, towards restoring the Equality between them and us?"

The economy's financial problem was whether to lend its savings to the government (almost exclusively to finance wars) or invest them in industry and commerce. "The more the Nation runs into Debt," Postlethwayt warned (*ibid*.:20f.), "the more Money will be locked up in the Funds, and the less will there be employed in Trade." Taxing the population to pay interest to public creditors would drain money that otherwise could be used to fund private investment. "Before such Debt took Place, every body possessed their whole Gains," he added (pp. 52f.). "If the present public Debt instead of being encreased, was paid off, the Profits of the Manufacturers, Tradesmen and Merchants, &c. would be all their own," doubling their rate of profit. "This would be equal in every Respect to a Bounty to that Amount on all our Productions and Fabricks: with that Advantage we should be able to undersell our Neighbours; Our People would of Course multiply; Our Poor would find ample Employment; even the aged and infirm might then earn enough to live upon; new Arts and new Manufactures would be introduced, and the old ones brought to greater Perfection."

Inasmuch as paper credit was convertible into bullion, the outflow of capital and dividends reduced the monetary base for Britain's credit superstructure. This threatened to leave the nation with no wherewithal to employ labor, and hence little domestic market for its own products. Like many of his contemporaries, Postlethwayt (p. 53) decried the remittance of debt service to Dutch investors on the ground that the outflow of bullion led to a monetary stringency, resulting in less production and higher prices. This is just what modern third world debtors have suffered for the past half-century under IMF austerity programs in order to pay their foreign-currency debts.

Even if all the debt were held at home, Postlethwayt warned (p. 21), "it would not upon that account be less pernicious." Taxpayers would pay the bondholders, who tended to spend their revenue unproductively. Even worse: "Funding and Jobbing too often . . . introduces Combination and Fraud in all Sorts of Traffic. It hath changed honest Commerce into bubbling; our Traders into Projectors; Industry into Tricking; and Applause is earned when the Pillory is deserved." He then described what modern analysts call the crowding-out phenomenon (p. 69):

> The national Debts first drew out of private Hands, most of the Money which should, and otherwise would have been lent out to our skilful and industrious Merchants and Tradesmen: this made it difficult for such to borrow any Money upon personal Security, and this Difficulty soon made it unsafe to lend any upon such Security; which of Course destroyed all private Credit; thereby greatly injured our Commerce in general . . .

These complaints seem so modern that one may ask why Postlethwayt has been so neglected all these years. He might have been speaking of today's Latin American and Asian debtors in concluding (pp. 22f.) that Britain's wars and standing armies "hath overwhelmed the Nation with Debts and Burthens, under which it is at present almost ready to sink; and it hath not only hindered those Debts from being paid off, but will daily contribute to enhance them; for while there is more to be got by Jobbing, than by dischargeing our Debts, all Arts will be used to encrease the new Debts, not to redeem the Old." In a similar way the protests by Smith and Decker against the sale of public monopolies anticipated today's complaints that the monopoly profits, dividend payouts and interest charges by the public utilities that Britain sold off to cope with its national debt problems in the 1980s and '90s have increased the costs that the economy's labor and industry must pay.

The great systematizer of mercantilist principles, James Steuart, pointed to many positive results of England's credit/debt superstructure, but acknowledged that "if we suppose governments to go on increasing, every year, the sum of their debts upon perpetual annuities, and appropriating, in proportion, every branch of revenue for the payment of them; the consequence will be, in the first place, to transport, in favour of the creditors, the whole income of the state, of which government will retain the administration" (*Principles of Political Œconomy* [1767]:II, 349ff.).

This actually has become the aim of today's ideology of privatization, which goes hand in hand with an advocacy that planning by financial institutions is preferable to that of government – or more to the point, that interest rates, employment, price and wage targets should be set by the Federal Reserve Board. In view of what has happened to today's debt-wracked economies, such warnings as those of Steuart were prescient. Britain's government was threatened with the prospect of being turned into little more than a collection agent for overseas bondholders and a rising vested financial interest at home.

If public borrowing forced up interest rates and diverted money away from productive investment, agricultural and industrial productivity could not keep pace with the growth in debt-service charges. The implication was that wars eroded rather than built British international power, for the decisive levers in Anglo-French rivalry lay beyond the military battlefield, above all in the financial sphere. Higher debts and taxes threatened to increase Britain's production costs and export prices, impairing its balance of trade regardless of the nation's military victories. Bullion would flow out and industry would stagnate, leaving Britain without the monetary sinews needed ultimately to defend itself against nations growing economically stronger.

Adam Smith's views

Smith's protest against government profligacy and taxation was essentially an argument against war debts. He saw that new wars could be financed only by running further into debt, as populations were unwilling to support them when they had to pay taxes to defray their costs directly on a pay-as-you-go basis and thus felt the full economic burden immediately. The landed gentry, whose members formed the cavalry and officer corps, supported wars out of patriotism but opposed the proliferation of public debts whose interest charges were defrayed by taxes that fell ultimately on their own property. When the barons had opposed royal taxation in medieval times, rulers avoided the tax constraint by borrowing from Italian bankers and other lenders.

By the 18th century, governments had turned to more anonymous Dutch and domestic investors. This created a vested interest of bondholders. And it was only natural for them to portray their lending in as patriotic and economically productive a light as they could, claiming to provide capital to the nation. However, Smith wrote (V, iii; Cannan ed. pp. 460ff.): "The opinion that the national debt is an additional capital is altogether erroneous." Debt was just the opposite of an engine of development. A nation's real wealth lay in its productive powers, not its money or the buildup of financial securities. These were only the shadowy image of real wealth. In fact, Smith explained, the policy of funding wars by bond issues diverted money that taxpayers could use more productively for direct investment. Taxes to pay debt service were "defrayed by the annual destruction of some capital which had before existed in the country; by the perversion of some portion of the annual produce which had before been destined for the maintenance of productive labour, towards that of unproductive labour."

Smith thus joined Decker, Postlethwayt and other critics of the Funding System in observing that public debts forced up taxes to pay interest charges – money that otherwise would be "employed in maintaining productive labour." Whereas industrial and commercial borrowers invested the proceeds to acquire capital whose earnings served to pay off the debt, governments borrowed to wage wars. A deteriorating economic spiral ensued as the taxes needed to carry these debts threatened to "diminish or destroy the landlord's ability to improve his land, and induce the owner of capital to remove it from the country" (pp. 464f.).

By the time Smith published *The Wealth of Nations* there seemed to be little likelihood of Britain paying down her national debt. Tax revenues had become "a fund for paying, not the capital, but the interest only, of the money which had been borrowed . . ." (pp. 450f.). He warned that at some point the burden of war debts would drive the belligerent nation bankrupt, for "Bankruptcy is always the end of great accumulation of debt."

Public bondholders felt little obligation to promote long-term investment for the nations to whose governments they lent money. Although "a creditor of the public has no doubt a general interest in the prosperity of the agriculture, manufactures, and commerce of the country, he has no interest in the good condition of any particular portion of land, or in the good management of any particular portion of capital stock." All that creditors really cared about was the government's power to levy taxes to raise the revenue to pay their debts. When the debt and tax burden had impoverished a country, they could remove their capital to other lands to repeat the process, as has happened again and again.

In sum, the ability of Britain's government to wage war rested on its power to run up debt, which in turn rested on the power to tax. The struggle to free the economy from taxes involved freeing it from public debt, and this required constraints on royal ambitions. Tax charges were not direct production costs, but were the price to be paid for military self-indulgence financed by bonds and other borrowings or the sale of the public domain and monopolies. Such taxes and sell-offs threatened to grow as military technology was becoming more capital-intensive for shipbuilding and cannon, and as the field of conflict with France stretched to America.

In this perception lay the seeds of the economic individualism of Adam Smith and many of his Whig contemporaries. If Britain were to secure a commercial advantage, it would have to reduce the taxes that had been imposed to carry its war debts. This entailed loosening the Old Colonial System so that economic competition would replace military and political coercion.

How Ricardo's value and trade theory ignored the impact of debt and interest charges

The debt discussion peaked at a time before most modern readers imagine that economic theory began. It was the bond-broker Ricardo that ended the discussion rather than moving it forward. His labor theory value focused only on the direct costs of production, measured in labor time. Credit and interest charges did not enter into his model. Workers earned the subsistence wage, and capital was valued in terms of the labor needed to produce it. The land was provided freely by nature, and its natural fertility (and hence, economic rent) was not a cost of production. As for the taxes to which Ricardo referred in his 1817 *Principles of Political Economic and Taxation*, they were the tariffs levied on agricultural products, not taxes levied to pay bondholders. Yet as the economic historian Leland Jenks has observed (1927:14ff.), Britain's government paid out some three-fourths of its tax revenue as dividends to bondholders in the typical year 1783. "Nine million pounds were paid to *rentiers* when the entire annual turnover of British foreign trade did not exceed thirty-five millions."

By 1798, in the wake of the American and French Revolutions, William Pitt's financial policy of borrowing rather than running government on a tax-as-you-go basis imposed interest charges so heavy that, in Jenks' words, "the nation was mortgaged to a new class of society, the *rentiers*, the fundholders, for an annual sum of thirty million pounds, three times the public revenue before the revolutionary wars. The bulk of this sum was being collected in customs, excise and stamp duties, and constituted an engine by which wealth was transferred from a large consuming public to the much smaller number who owned consols," that is, government bonds with no fixed maturity, paying interest only – forever.

Prices for gold and other commodities had drifted upward after the paper pound's convertibility into gold was suspended in 1798. This set the stage for postwar depression after the Napoleonic Wars ended in 1814 and the Bank of England decided to restore the convertibility of sterling currency into gold at the low prewar price level. Debtors had to repay their obligations in money that was becoming more expensive, giving bankers and bondholders a free ride. Seeking to avoid blame, they nominated Ricardo for a safe seat in Parliament to represent their interests.

He set about to convince voters (still made up mainly of property holders) that the nation's economic problems were not caused by debt deflation, but by the Corn Laws, as Britain's agricultural tariffs were called. These high tariffs supported high domestic prices for agriculture on the logic that high food prices would support rental earnings that could be invested to increase output. Over time this would enable Britain to replace imports with higher domestic production levels. But Ricardo argued that higher prices merely would give protected industries a free lunch, above all in the form of land rent, assuming no investment of this revenue to enhance productivity. Ricardian value theory provided a way to measure this unearned income, the element of price that had no counterpart in cost outlays except for the least efficient, highest cost (zero-rent) producers.

Given the subsistence conditions of the day, wages reflected food prices. These in turn reflected agricultural productivity. As Britain's population growth forced resort to poorer soils to produce the crops needed to feed it, producers on the most fertile land enjoyed a widening margin of market price in excess of their own low costs. The marginal supply price was determined by production costs on the least fertile soils, as long as protective tariffs blocked consumers from buying from lower-cost suppliers abroad.

Ricardo portrayed this agricultural cost differential – economic rent – rather than interest as the paradigmatic form of unearned income. It was an element of price that had no corresponding cost of production for well-situated producers. The best way to minimize it, he explained, was for Britain to open its markets to foreign producers, so that high-cost soils would not need to be brought into cultivation. In exchange, foreigners would be asked to open their own markets to British manufactures. Each nation would produce what it was "best" at producing.

This tradeoff became the new objective of British diplomacy, whose market-oriented strategy replaced the Old Colonial System's coercive prohibitions against colonial manufacturing. Underlying this new policy was the perception that if Britain were to undersell its potential rivals to become the workshop of the world, it needed to minimize the money wages it paid its labor. The work force could be fed least expensively by importing grain rather than supplying it with high-cost domestic production. From 1817 through the repeal of the Corn Laws in 1846 the great political struggle in Britain therefore was between the free-trade Manchester School and the protectionist landed interest. In the United States, Germany and other countries the fight was between industrial protectionists and agricultural free traders who hoped to exchange their raw materials for relatively cheap British manufactures.

Ricardo was the first major economist to be a financier since John Law, who had managed France's Mississippi Bubble a century earlier, in the 1710s. At first glance it seems ironic that a bond broker should have developed classical trade theory in a way that viewed exchange essentially as barter rather than analyzing of how public and private-sector debt levels influenced production costs. Of all people who should have been aware of the financial elements of costing, it would seem that a bond broker would have had a comparative advantage in incorporating such considerations into his trade theory. Yet one looks in vain for a discussion of how debts and the taxes to carry them affected prices and international pricing.

Today, global competitiveness in automotives, steel-making and other capital-intensive industries turns less on wage rates than on variations in the cost of financing investment – interest rates and debt/equity ratios, taxes, subsidies and land or rent charges. Yet such financial considerations do not appear as elements of production cost in Ricardo's value theory, nor do they appear in today's Chicago School monetarism that stands in line with Ricardian doctrine. By focusing on labor-time proportions, Ricardo implied that non-labor expenses such as interest did not really matter. As for taxes, they mattered to the extent that import tariffs forced up the price of labor's food and other necessities, but there was no memory of the long analytic tradition that attributed taxes to the Funding System's interest payments on the public debt. Hence, the policy conclusion of Ricardo's comparative labor-time approach to international trade theory was not that nations should avoid going into debt, but that they should abolish their tariffs to lower prices.

This limited approach implicitly took bond brokers and bankers off the hook from accusations that their debt charges impaired the nation's well being. Ricardo's advocacy of free trade and its consequent specialization of production among countries promised to create a growing commercial loan market and an even larger bond market to finance transport infrastructure such as railroads, canals and shipbuilding.

No prior economist had claimed that public and private debt levels did not affect competitiveness. Yet this is what Ricardo's trade and value theory implied by not

acknowledging any impact of debt service or that monetary stringency had to be imposed to stem the drain of bullion to pay foreign creditors. In these respects he was like an individual viewing the world around him, but not seeing himself (or in this case, finance) in the picture. He denied that paying foreign debts had any serious economic impact, depicting them as being self-financing by an automatic monetary adjustment process. This approach rationalized the kind of deflationary austerity imposed today on hapless debtor countries, providing the conceptual foundation for modern IMF and World Bank austerity doctrines.

Inasmuch as money and credit are forms of debt, one would think that monetarists working for central banks, finance ministries and business schools would analyze the debt burden and its interest charges, but they have followed Ricardo's shift of emphasis away from discussing its impact. Yet so powerful was his labor theory of value – powerful largely because of its abstraction, not its economic realism – that it led subsequent generations to speculate about how economies might function if debt and other non-labor costs had no effect on national competitiveness, living standards and the polarization of incomes and wealth.

Europe's 1815-1914 century of relative peace reduced the need for war financing, alleviating concerns about the public debt. The soaring productive powers of labor, capital and land enabled economies to carry higher levels of debt, financed readily by the growth of savings. The financial interests threw their weight behind industry. Opposing the landed aristocracy's Corn Laws, economic theory focused on price competitiveness as determined by labor productivity, using food prices as a proxy for wage levels. Credit was depicted as financing capital formation, headed by public spending on railroads, canals and other internal improvements in Britain and overseas.

Landholders had not yet become a major market for lenders. Except for insiders, personal and mortgage debts were viewed more as emergency measures than as a catalyst to get rich quickly. For all but a few financial operators the practice of debt pyramiding – borrowing money to buy properties steadily in price – would have to await the modern era of asset-price inflation. There was little hint that financiers and real estate interests would join to form a *rentier* bloc. Nobody anticipated the degree to which urban real estate would develop into the banking system's major loan market, in which developers, speculators, absentee owners and homeowners would pay most of the land's net rental revenue to mortgage lenders.

From the critique of economic rent to the critique of property rights of rentiers

Ricardo was the first major economist to portray protectionist landlords as having interests at odds with those of society at large. However, he believed that the rent problem – economic free rides – could be solved and British industrialization put on a firm footing by embracing free trade. His doctrines supported the flowering of trade credit and international investment, which were making quantum leaps forward in his day.

The opposition of Ricardian value and rent theory to Britain's vested interests, the landed aristocracy surviving from Britain's feudal past, made his approach seem progressive. What seems surprising in retrospect is the degree to which landlord spokesmen followed the shift of attention to rent, letting themselves be distracted from the analysis of how debt financing threw the brunt of carrying public spending onto their class.

In pointing out that landlords spent their rental income on servants, coach-makers and other such labor, Thomas Malthus emphasized the role of macro-economic demand, but did not discuss how debt service was deflationary. Defending the Corn Laws, his point was that although landlords and their employees might be unproductive, at least they spent their wages on the products of industry, spurring the domestic market. Ricardo's free trade proposals aimed at supporting industry more directly, by repealing the tariffs that obliged employers to pay their workers high enough wages to cover the nation's highly protected grain prices.

Adam Smith had remarked that landlords liked to reap where they had not sown, he also described their objective as being to promote prosperity inasmuch as they were the major beneficiaries of a thriving economy and growing population. Ricardo agreed that they were its major beneficiaries, but accused them of gaining passively via a free ride – economic rent. He believed that economic rent was caused by fertility differentials inherent in nature, and that nothing could alter "the original and indestructible powers of the soil" responsible for the natural superiority of some lands to others. When Malthus argued that landowners would invest their rental income in the land to improve its yields so as to earn more revenue, Ricardo replied that even if landlords did this, it would not overcome the differentials in soil fertility responsible for causing economic rent. Overall productivity might rise if fertilizer or machinery were applied to the soil, but the yield proportions would remain unchanged! The agricultural chemistry of Justus von Liebig and Thaer soon showed that this assertion was unscientific, but Malthus did not criticize this, nor did he criticize the financial blind spot in Ricardian reasoning. Despite the fact that it was mainly the landlords that were taxed to pay interest on government borrowings, they let the debt issue simply was shelved.

As resentment against the public debt and creditors waned, hostility toward landlords peaked. Yet although Ricardo accused protectionism of increasing rents, he did not challenge the property rights of landlords to receive them. He shifted the economic policy debate away from the interest problem to that of rent, but did not question the property rights of landed *rentiers* any more than those of financial *rentiers*. It was the philosophic radical John Stuart Mill, son of the economic journalist and Ricardian popularizer James Mill, who made a more far-reaching argument against the right of landlords to receive rent that once had accrued to the public domain. For J. S. Mill such rent was the ultimate free ride. He believed that rents (most of which were on inherited lands) should be returned to the public domain as the tax base, as it had been in feudal times.

This brought into question property rights as such, an inquiry that was pursued with the greatest intensity in France, and soon would be questioned even more radically by the Marxists. It was first in France, in the wake of the French Revolution's overthrow of the monarchy and feudal aristocracy, that a more radical challenge to property would be made, including a challenge to the interest collected by the banking families that had emerged to create a new, post-feudal power.

Banking theory and industrialization

Although British banks were all in favor of the flourishing trade that pro-industrial policies promised to bring about as Britain became the workshop of the world, they played little role in developing an industrial credit market. What they had done for centuries was to provide short-term trade credit, discount bills of exchange and transfer international

payments. Such lending promised to grow as a result of the global specialization of production that Ricardo's free-trade policies aimed to promote, but that was the extent of matters. Railroads, canals and other infrastructure used the stock and bond markets rather than banks for their long-term funding. Even so, Britain's security markets did not provide its industry with long-term credit to anywhere near the degree achieved by the financial systems developed in continental Europe.

The economic dislocations in all countries after 1815 made it clear that banking and financial structures would determine which nations would ride the crest of the Industrial Revolution. Stepping back to take a broad view of what their nations needed to catch up, it was French and German policy makers that moved banking theory into the industrial age. In France, followers of the Count Claude-Henri de St. Simon (1760-1825) saw that new banking institutions were needed to finance industry, thereby replacing the traditional consumer usury, trade financing and lending to governments. Their theorizing along these lines created a veritable economic religion based on the credit system's role in planning and allocating the resources of industrial society.

In 1821, St. Simon published *Du Système Industriel*. Among the followers he attracted were Prosper Enfantin and Saint-Amand Bazard, whose ideas were summarized in *Doctrine de Saint-Simon, Exposition, Première année* (1828/29). Subsequent admirers included the social philosopher Auguste Comte, the economist Michel Chevalier, the socialist Pierre Leroux, the engineer Ferdinand Lesseps (whose plans for international canals elaborated ideas initiated by St. Simon) and the brothers Emile and Isaac Pereire who founded the Crédit Mobilier in 1852. Outside of France, St. Simon influenced John Stuart Mill, Marx and other socialists.

The St. Simonians were the market reformers of their day. One even might call them market evangelists, but what made them more fundamentally radical than today's libertarians was the fact that they treated the inequalities caused by inherited wealth as market imperfections to the extent that such power was not earned directly through one's own ability and merit. As an enlightened democratic aristocrat St. Simon saw hereditary privilege as a parasitic burden for society. His 1819 satire *Parabole* depicted the governing aristocracy and *nouveaux riches rentiers* as living easily off their inherited rent and interest revenues rather than playing an active role in promoting industrial development. St. Simon's objective accordingly was to replace the hereditary *rentier* class with a regime based on merit.

The basic theme was that talent was best able to show its ability in industry, but it needed credit, and this required a reformed financial system. Paramount among the St. Simonian reforms was the principle that credit should be productive, not usurious. Past lending was criticized for indebting the rest of society without putting in place new means of production. To rectify matters governments were urged to coordinate industrial planning so as to provide a productive field for the investment of savings and credit. Each city was to be headed by a mayor acting as *chef-industriel* (head of industry), who would allocate the means of production and set income levels. These banker chiefs were to be appointed by national economic "priests" who would hold ultimate power. In this doctrine lay the seeds of a centralized government *dirigisme*.

A basic issue posed by 19th century political economy was who would allocate resources best – the market or government? It was recognized that every economy is planned by someone or other. The St. Simonians, Marxists and "state socialists" of

Bismarck's Germany believed – and indeed, hoped – that financial engineers would become virtual public planners.

The St. Simonians proposed a system to operate through financial intermediaries to mobilize and mediate the use of resources. They hoped to transform debt and credit from the burdensome forms imposed by centuries of consumer usury and government war-financing into productive, self-amortizing industrial lending to finance investment in factories, technology and a broad national economic infrastructure. It was expected that as banking and finance were harnessed to serve the industrial imperatives of society, power-driven manufacturing and transport would provide a fertile field for the investment of savings.

Today's world has fulfilled their expectations in the sense that resources are allocated by planners working for commercial banks, investment banks and other institutional investors, while the chief executive officers of major corporations are concerned more with financial strategy than with industrial engineering. Rather than operating as part of government, however, these financial institutions have become vested creditor interests in a way almost the opposite from that hoped for by St. Simon. The bankers he envisioned were to be elevated as industry's organizers and promoters. In contrast to the industrial innovators of the sort envisioned by Joseph Schumpeter, the St. Simonians industrial capitalist ("*travailleur*") was a financial engineer, seeing where credit best could be applied to promote physical investment and new technology. According to the compilation *Religion saint-simonienne, Economie politique et Politique* (Paris: 1831:98), "the banks perform the role of capitalists in their transactions with those *travailleurs*, to whom they loan money," enabling these "industrious people" to obtain financing (*ibid*.:45; Marx quotes with approval a series of such passages in *Capital* III [Chicago 1909]:714).

Today's financial management certainly is not unfolding in the way these industrial optimists expected. The planning they endorsed had a long-term time frame based on tangible capital investment, technological innovation, rising productivity and employment. But for today's financial planners the short run effectively has become the only aim. Running a corporation has become mainly a financial task whose objective is to raise the company's stock price by mergers and acquisitions, using earnings to buy one's own equity, arranging debt leveraging and orchestrating global intra-corporate "book" pricing so as to take profits in tax havens. Financial managers are more likely to downsize operations and scale back research and development than to expand employment and production so as to leave more income to pay dividends and interest. The economy's debt burden is made heavier by deflationary policies that keep expansion on a short-term leash, and to encourage rather than tax *rentier* income and debt financing.

This line of development was not foreseen either by the St. Simonians or their contemporaries. Had they anticipated it, they would have depicted it as a financial dystopia.

Emile Pereire took the first steps to put his ideas of an equity-funding system in place in the 1830s, building France's first railway line (running from Paris to St. Germain), followed by other routes. Like Friedrich List in Germany, he recognized the key role of transport in integrating and developing national economies. Such infrastructure needed large financial institutions to provide credit, and in 1852 Pereire formed the *Société Génerale du Crédit Mobilier* as a joint-stock bank designed to direct savings into the stocks of large undertakings. He was joined by his younger brother Isaac, who explained the institution's financial philosophy in *Le Rôle de la Banque de France et l'Organisation du Crédit en France* (1864)

and *La Politique Financière* (1879). The aim was to expand industrial production by providing long-term credit at a lower cost than was charged by banking families such as the Rothschilds who monopolized French finance at the time.

To give industry freedom from the constraints imposed by mercantile banking practice, the Crédit Mobilier provided equity capital and bond financing. But this freer supply of long-term credit proved to be its undoing as the bank turned into a pyramid scheme. It borrowed at a low rate of interest and invested in the securities of its customers. When France's economy was thriving this strategy worked, but over the course of every business cycle a downturn comes when stock prices crash. It was at this point that the Crédit Mobilier suffered both as stockholder and as banker, for it had borrowed short and lent long-term. Its deposit liabilities remained fixed in the face of the economic crash that occurred in 1866.

The Crédit Mobilier's close connections with Louis Napoleon's government prompted it to indulge in insider speculation that drove it bankrupt in 1867 and into liquidation in 1871. Rather than making loans the bank invested in the stocks and bonds issued by its customers. "The institution was in effect a gigantic holding company engaged in financing and managing industrial enterprises," notes George W. Edwards (*The Evolution of Finance Capitalism* [1938]:51). "The securities of the controlled companies were used as assets on which the Crédit Mobilier issued its own securities, to be sold to the public. For a number of years the Bank was highly successful, and performed notable service in promoting railroads and public utilities."

Financial scandals plagued the 19th century's largest international investments, headed by the Suez and Panama Canal schemes (both of which had been early St. Simonian ideas), and by America's railway land grants to robber barons whose subsequent stock and bond waterings helped give high finance a bad name. As aggregations of finance capital grow larger and more closely linked to government, banking systems become ingrown and prone to "crony capitalist" insider dealing. There is a reason for this. Savings grow so rapidly at compound interest that savers and investors look for new types of outlet. Inevitably they must lower their standards and lend in an increasingly risky environment, as the risk is aggravated by the volume of debt itself.

By the 1980s, for example, so large a supply of savings had mounted up in the United States that Drexel Burnham's crew of corporate raiders seemed a godsend when they financed their takeovers by high-interest junk bonds. When the dust settled they had left debt-burdened companies in their wake and bankrupted many savings-and-loan associations and cost the Federal S&L Deposit Insurance Corp. (FSLIC) some $300 billion. Japanese insider deals financed a real estate bubble by funneling bank loans to speculators and schemers. The bursting of the Asian Bubble in 1988 showed the extent to which modern financial systems lack the checks and balances needed to direct savings along more productive lines.

Today's market orthodoxy has inverted the 19th-century reformers' spirit by endorsing financial gains indiscriminately. While credit is channeled to create an asset-price inflation, free riders gain wealth not so much by inherited privilege as by their insider contacts with banks. They borrow money to buy real estate and stocks when asset prices are rising, and stick the government's taxpayers with losses when asset prices turn down.

The St. Simonian contribution was to emphasize the need for an efficient banking system to provide industry with long-term financing. The school's influence ranged from

socialists to German industrialists. As it was not anticipated that finance would overload industrial economies with debt, no one sought to develop a theory to quantify just how much debt economies could afford. No doubt the 19th century's industrial optimists would have been surprised to learn the extent to which today's financial institutions aim not to fund industry but rather to load it down with debt and extract interest. And rather than funding public investment, financial institutions have set about privatizing and dismantling it, stripping away the moral authority with which the St. Simonian reformers, socialists, German bank theorists and other early advocates of industrial progress imbued public planning and enterprise.

Marx's optimistic view of industrial finance capitalism

Engels (*Capital* III:710, fn 116) attributed Marx's ideas of how banking and finance were destined to be transformed by the economic imperatives of industrial technology to St. Simon, pointing out that Marx spoke "only with admiration" of his "genius and encyclopedic brain." To be sure, Marx criticized St. Simon's followers for being utopian in hoping to reconcile capital and labor. Yet although he spoke sarcastically of St. Simon's "world-redeeming credit-phantasies," he shared his financial optimism, most explicitly in asserting that the banking and credit system "signifies no more and no less than the subordination of interest-bearing capital to the conditions and requirements of the capitalist mode of production" (*Capital* III:704f.). What made industrial credit different "from usurer's capital" was "the totally changed character of the borrower . . . He receives credit in his capacity as a potential capitalist." Industrial credit would free society from the need to rely on the usurers' hoards of the past, and indeed from the short-term financial leash imposed by Anglo-Dutch mercantile banking.

In his 1861-63 drafts for what would become the later volumes of *Capital*, Marx called the banking system "the most artificial and the most developed product turned out by the capitalist mode of production" (*Capital* III:712). Like the St. Simonians, he expected it to become society's means of planning the future, and believed as optimistically as they did that the needs of industry would transform the shape of lending and investment to finance capital formation on a global scale.

Underlying this view was the perception that there are two ways for a loan to be repaid. If the proceeds are invested to produce a profit, borrowers can pay out of the revenue they earn; otherwise they must reduce their consumption or sell off their assets. Marx believed that productive lending would become the normal state of affairs, although he was one of the first "business cycle analysts" to describe how financial crises occurred periodically when gluts of unsold output led to collapsing prices and bankruptcies that transferred property from debtors to creditors. "Usury centralises money wealth, where the means of production are disjointed," Marx concluded (*ibid*.:700.). And as the means of production became more centralized, he added (*ibid*.:712), "it must be kept in mind that the credit system has for its premise the monopoly of the social means of production in the hands of private people (in the form of capital and landed property)."

Loan balances doubled and redoubled by usury's own laws – the mathematics of compound interest – which were not rooted inherently in the economy's ability to pay and hence were independent of the mode of production. Interest-bearing debt "does not alter the mode of production, but attaches itself as a parasite and makes it miserable," Marx warned.

"It sucks its blood, kills its nerve, and compels reproduction to proceed under even more disheartening conditions."

Marx granted that the old reliance on usurers' credit would survive for "such persons or classes . . . as do not borrow in the sense corresponding to the capitalist mode of production" (*ibid*.:705). The usurious practice that survived from antiquity "does not confront the laborer as industrial capital" but "merely impoverishes this mode of production, [and] paralyzes the productive forces instead of developing them" (*ibid*.:699f.). As long as this form of capital exerted control over governments, industrialization would be thwarted and public revenue would be diverted to parasitic forms of finance, limiting the growth of markets by siphoning off labor's wages to pay interest on consumer purchases or other pressing needs. Distress borrowers would pledge (and in due course, forfeit) their collateral.

Anticipating the arguments of Keynes in the 1930s, Marx criticized the Ricardian bullionists for demanding that governments protect the value of loans by imposing monetary deflation. This would stifle the market needed to call forth new investment. "The value of commodities is therefore sacrificed, for the purpose of safeguarding the phantastic and independent existence of this value in money," he warned (*ibid*.:607). "As money-value it is secured only so long as money itself is secure. For the sake of a few millions of money many millions of commodities must therefore be sacrificed," along with new investment and hiring.

Nonetheless, he believed, the jockeying for position between financial and industrial capital would be settled in industry's favor in the end. "This violent fight against usury, this demand for the subordination of the interest-bearing under the industrial capital," Marx promised (*ibid*.:707), "is but the herald of the organic creations that establish these prerequisites of capitalist production in the modern banking system. The hard-money age of usury no longer would deter society from achieving its technological potential." The financial achievement of industrial capitalism would be to mobilize banking and finance as the tool of industry, creating new institutions to supply industrial credit on the basis of calculations of the borrower's ability to invest the loan proceeds profitably enough to pay the loan with its interest charges. By providing productive credit, the new industrial banking system "robs usurer's capital of its monopoly by concentrating all fallow money reserves and throwing them on the money-market, and on the other hand limits the monopoly of the precious metals themselves by creating credit-money."

If economies were to avoid systemic crisis, they would have to carry the burden of financial claims accruing at compound interest, but Marx believed that industry's productive forces would be up to the task. So did most observers. Captains of industry were expected to steer the ship of state while industrial engineers would do the planning. Rather than watering stocks to load down enterprises with "fictitious capital" and ruining the world's colonial regions as they had done in Egypt and Persia, financiers would coordinate global industrialization. In the end, finance would adjust itself to the underlying "real" economy, becoming a subordinate and derivative layer. Future wealth creation would take the form of building up society's means of production and employment, not merely inflating stock market prices ("paper wealth").

The post-classical reaction analyzes interest without examining money, credit or debt

Classical economics was inherently political by virtue of dealing with society's most basic dynamics. The labor theory of value isolated economic rent as constituting unearned income, an element of pricing that represented a free lunch rather than a cost element remunerating productive effort. To the extent that rent and interest could not be a bona fide production costs, they were brought under fire as appropriate sources of taxation or outright nationalization of the *rentier* claims and property rights that produced them. These policy conclusions made it inevitable that an individualistic and anti-government reaction would arise against the reformist spirit of J. S. Mill as a halfway house to the revolutionary conclusions of Marx.

The first major shots were fired in 1871, by Anton Menger in Austria and Stanley Jevons in Britain. Looking at the economy from a psychological vantage point that placed consumers rather than employers and businesses at the center, the Austrian individualists and British utilitarians based their essentially microeconomic perspective on consumers choosing what products to buy and whether to consume them in the present or defer their gratification to the future in exchange for interest.

The logical method was that of *ceteris paribus*, "all other things remaining equal." This created a world in which consumer utility, saving and interest were discussed as if all other elements of the economic system remained unchanged. By ignoring the economy-wide feedback of given actions, this approach made it possible to avoid thinking about the financial dynamics that shaped the 19th and early 20th century.

The psychological theory, for instance, discussed interest rates as reflecting the degree of impatience to consume goods in the present rather than in the future, without reference to the interaction between interest rates, exchange rates, prices and the magnitude of debt. William Nassau Senior's "abstinence" theory represented interest as payment for a sacrifice on the part of savers, a "factor return" to reward them for the "disutility" or "service" of not consuming their income on the spot but deferring their gratification. Everything appeared to be a matter of choice, not contractual necessity or economic need. The implication was that money was something concrete to be lent out. No reference was made to how credit was created or to the forfeiture of property that ensued when things went wrong. Yet the world's economies were being shaped by "things going wrong," that is, not according to the neat textbook models.

If credit could be created at will, there would be no need for abstinence. Banks were corporate institutions, and had no psychology to consume, but a legal charge to accumulate profits without any diminishing psychic utility. A financially based theory would have focused on the banking system's credit creation and on the fact that governments were their major borrowers and Treasury bonds dominated financial markets and formed the banking system's reserves. It was for purely political reasons that they borrowed from domestic *rentiers* – owing most to the wealthiest ranks of the population – rather than taxing wealth more heavily or simply monetizing public debts.

No gunboats appeared in this theorizing to enforce a creditor-oriented international diplomacy, nor were railway stock and bond waterings recognized. There was no coercion of debtors or no unearned free lunch for *rentiers* and stock jobbers. Such considerations went

beyond the measuring rod of utilitarian psychology, having disappeared into the miasma of *ceteris paribus*.

Adam Smith estimated that businessmen operating with borrowed funds would pay half their profits to their backers as interest. The interest rate thus would be half the rate of gross profit prior to interest charges. A century later the Austrian economist Eugen von Böhm-Bawerk reversed the causality and made profit rates depend on the rate of interest. He pointed out that businessmen would not tie up their money in a venture unless they could make more by investing in time-taking "roundabout" production techniques than they could make simply by lending out their money. On this basis the primary return to industrial and finance capital alike was interest. Profit reflected the time needed to plan and put in place complex capital investments, factoring in the time process by discounting investments at the rate of interest.

In the 1930s the Chicago economist Frank Knight explained that interest yields for business represented the risk premium over and above the basic interest rate offered by risk-free bonds. Interest thus was made primary, profit secondary rather than the system's key dynamic as had been the case in classical political economy.

These theories of consumer preference for current over future consumption and other psychological or profit-rate considerations did not require a discussion of the financial system, its volume of debt and the impact of its carrying charges on economic activity. To avoid taking into account the phenomena of inflation and deflation, the evolution and polarization of wealth, and the ways in which debt service affects market demand and commodity prices, neoclassical economists discussed production and consumption as if people lived in a debt-free barter economy. Absolute values were lost sight of, as everything became a matter of ratios and proportions. As Keynes described the new orthodoxy: "Most treatises on the principles of economies are concerned mainly, if not entirely, with a real-exchange economy; and – which is more peculiar – the same thing is largely true of most treatises on the theory of money."[1]

Money was treated not as a political institution (*e.g*. to enable governments to pay their debts) but as a commodity whose value (and hence, the economy-wide measure of prices) was determined by supply and demand. This assumed that money was a fixed volume that could easily be defined. Credit made little appearance. However, Keynes warned, it would be a dangerous mistake for economists "to adapt the hypothetical conclusions of a real wage economics to the real world of monetary economics." The kind of thinking that underlay "real-exchange economics . . . has led in practice to many erroneous conclusions and

[1] "A Monetary Theory of Production" [1933], in *The Collected Writings of John Maynard Keynes* 13: *The General Theory and After* (London 1973):409f. Along these lines Keynes criticized Alfred Marshall for stating explicitly in his 1890 *Principles of Economics* (pp. 61f.) "that he is dealing with *relative* exchange values. The proposition that the prices of a ton of lead and a ton of tin are £15 and £90 means no more to him in this context than that the value of a ton of tin in terms of lead is six tons . . . 'We may throughout this volume,' he explains, 'neglect possible changes in the general purchasing power of money. Thus the price of anything will be taken as representative of its exchange value relative to *things* in general' [Keynes's italics]. . . . In short, though money is present and is made use of for convenience, it may be considered to cancel out for the purposes of most of the general conclusions of the *Principles*."

If money is ignored, then so are savings, debts and their carrying charges. The role of money as a medium in which to pay debts is missed entirely, as is the monetization of debt in the form of free credit creation.

policies" as a result of "the simplifications introduced. . . . We are not told what conditions have to be fulfilled if money is to be neutral."

If money were not neutral, neither was the debt burden. Yet Milton Friedman theorized that:

> Holders of foreign currencies [such as U.S. dollars] *want* to exchange them for the currency of a particular country in order to purchase commodities produced in that country, or to purchase securities or other capital assets in that country, *or to pay interest on or repay debt to that country*, or to make gifts to citizens of that country, or simply to hold for one of these uses or for sale . . . Other things the same, the more expensive a given currency, that is, the higher the exchange rate, the less of that currency will in general be demanded for each of these purposes.[2] (italics added)

The implication is that countries will elect to pay less on their foreign debts as the dollars in which these debts are denominated become more expensive. But in reality they have no choice. It is much the same when debtors have to pay their debts as domestic prices and incomes fall. The debt burden becomes heavier. Countries that try to pay less as the debt burden becomes more expensive to service are held in default and confronted with international sanctions, trade barriers and a loss of foreign markets. Price and income deflation thus not only shifts the proportions around, the basic structure is altered as a result of inexorable debt obligations

Few economists bothered to specify the highly unrealistic conditions that would have to be met in order for monetary and credit disturbances, debt service and asset prices to be neutral. With sardonic humor Keynes observed that "The conditions required for the 'neutrality' of money, in the sense in which this is assumed in . . . Marshall's *Principles of Economics*, are, I suspect, precisely the same as those which will insure that crises *do not occur*. If this is true, the real-exchange economics, on which most of us have been brought up and with the conclusions of which our minds are deeply impregnated . . . is a singularly blunt weapon for dealing with the problem of booms and depressions. For it has assumed away the very matter under investigation." As John H. Williams, Harvard professor and advisor to the New York Federal Reserve Bank on the balance of payments observed: "About the practical usefulness of theory, I have often felt like the man who stammered and finally learned to say, 'Peter Piper picked a peck of pickled peppers,' but found it hard to work into conversation.'"[3] Such criticisms could be levied with even greater force against economists who ignore the role of debt and the revenue that needs to be diverted to pay debt service.

Economists who recognized that payment of debt service was not a part of the "real" economy but a subtrahend proposed that it be excluded from national income and product accounts altogether. Alfred C. Pigou reasoned in *The Economics of Welfare* (1920) that these accounts should exclude income "received by native creditors of the State in interest on loans that have been employed 'unproductively,' *i.e*., in such a way that they do not, as loans to buy railways would do, themselves 'produce' money with which to pay the interest on them. This means that the income received as interest on War loan – or the income paid to the State to provide this interest – ought to be excluded." One wonders what Pigou might have said about

[2] Milton Friedman, "The Case for Flexible Exchange Rates," *Essays in Political Economics* (Chicago 1953), repr. in Caves and Johnson, eds., *Readings in International Economics* (Homewood, Ill. 1968):415.

[3] John H. Williams, "The Theory of International Trade Reconsidered" (1929), repr. in *Postwar Monetary Plans and Other Essays*, 3rd ed. (New York: 1947):134f.

the American practice of railroad directors issuing bonds to themselves gratuitously with no real quid pro quo. "Watering the stock," it was called.

Excluding debt service from the statistics meant that its deflationary impact on incomes and prices – that is, the diversion of revenue from the production and consumption processes to pay debt service – could not be measured. The degree to which this debt service interfered with Say's law got lost.

The limited scope of analysis suggested by Pigou's definition of economic welfare would be logical if the aim of economic accounts were just to trace the growth of output and consumption. But measuring debt deflation – the degree to which debt service absorbed the economy's revenue – requires a calculation of all interest payments. To the extent that *rentiers* spend their interest receipts on consumer goods and capital investment rather than plowing them back into new lending, such spending would appear in the national production and consumption statistics. But this is a relatively small phenomenon, although it is the narrow point on which neoclassical utilitarian theories of interest base themselves. To understand the dynamics of booms and depressions, debt pyramiding and economic polarization between creditors and debtors, it is necessary to take the financial system into account.

Yet his is not what Keynes himself did. He discussed the rate of interest, saving and investment without integrating debt service into his income theory.

How Keynes discussed saving and investment without citing the role played by debt deflation

Keynes distinguished himself in the 1920s by defining the limits that existed to debt-servicing capacity,[4] above all with regard to the Inter-Ally debts and German reparations stemming from World War I. By 1931 he was pointing out that "the burden of monetary indebtedness in the world is already so heavy that any material addition would render it intolerable. . . . In my own country it is the national debt raised for the purposes of the war which bulks largest. In Germany it is the weight of reparation payments fixed in terms of money. . . . In the United States the main problem would be, I suppose, the mortgages of the farmer and loans on real estate generally." He criticized deflationary monetary proposals as threatening to derange the financial superstructure of "national debts, war debts, obligations between the creditor and debtor nations, farm mortgages [and] real estate mortgages," throwing the banking system into jeopardy and causing "widespread bankruptcy, default, and repudiation of bonds."

But by 1936, Keynes was concerned mainly with the shortfall in consumption resulting from people's propensity to save. Pointing out that new investment and hiring would not occur without stronger markets, his *General Theory of Employment, Interest and Money* described the solution to lie in getting people to spend more. The countercyclical government hiring that he advocated would lead to budget deficits, which would have to be financed by debt. Yet Keynesian macroeconomics ignored the role of debt and its carrying charges. This was its major loose end, and the blind spot that has led to the most confusion.

[4] "An Economic Analysis of Unemployment" (1931, repr. 1973:343-373).

Already in 1902, John Hobson's *Imperialism* warned that growing debt levels would lead to underconsumption. Creditors would collect money at home and search abroad for new fields to lend it out at relatively high rates, to less debt-ridden (hence, "younger") economies most in need of public infrastructure and other capital investment. This dynamic, Hobson believed, was the taproot of a new form of imperialism, one that had become financial rather than military in character.

Keynes took exception to Hobson's underconsumptionist views. As late as 1931 he viewed the problem of recovery as one of lowering interest rates to make direct investment more remunerative than buying bonds (1973:356f.). Writing to Hobson, he expressed the hope that lower interest rates also would solve the problem of debt deflation, but admitted that public spending might be needed to fill the gap created by the diversion of revenue to service debts. Hobson's point "that 'money savings may continue to grow faster than they can be profitably invested' would only be the case in the event of the rate of interest failing to fall fast enough," Keynes believed. But if it fell to zero (as happened in Japan in the late 1990s), the only solution would be "more spending and less saving." Hobson reiterated that the rate of interest was only of limited efficacy. "In certain situations of boom or slump its action seems very slight and unreliable."[5]

Keynes came to accept this position five years later, by the time he published the *General Theory*. His description of the liquidity trap helped swing the political pendulum back toward government activism. The new public aim was to use deficit financing to pump enough income power into the economy to replace the purchasing power that debt service and other saving was removing from the private sector's spending stream. In time, Keynesian-type liberalism would call for government spending to employ labor that would spend its income on goods, whose sale would provide profits for industrial investors. "The system is not self-adjusting," he wrote in 1933 (repr. 1973:491), "and, without purposive direction, it is incapable of translating our actual poverty into our potential plenty." Expenditures that pushed the U.S. Government budget $1 billion into deficit in 1931, he told an American audience (1973:356ff.), "are just as good in their immediate effects . . . as would be an equal expenditure on capital works; the only difference – and an important one enough – is that in the former case we have nothing to show for it afterwards." The same was true of war spending, of course.

Keynes understood the financial sector as clearly as any economist of his day, yet he wrote in a way that diverted attention from the deflationary character of debt. Blaming high interest rates for inducing savers to buy financial securities that not find a counterpart in new direct investment, he went so far as to call for "euthanasia of the *rentier*." He criticized Say's Law (that production creates its own demand), but did not make clear what proportion of saving resulted from debt service; that is, he did not distinguish loan repayments from fresh discretionary saving. National income statistics count paying off a debt as "saving," because it is a negation of a negation (debt).

Having spent years emphasizing that debt payments are not a matter of discretion but reflect contractual obligations, Keynes dropped this idea in his *General Theory*. He confused matters by defining "saving" as tangible direct investment in factories, machinery, construction and other means of production. (His use of the word "hoarding" had connotations of money kept in a mattress, but its more prevalent forms were "indirect" investment in securities and debt pay-downs.) The role of debt and debt-service remained the missing link in his

[5] Letters to Hobson dated Oct. 2 and 14, 1931, in Keynes, *Collected Writings* 13 (1973:330-336).

theoretical exposition, and it was not noted clearly by his followers in Britain, the United States or other countries.

In a 1934 article Keynes noted that anyone who did not accept the idea that economies adjusted automatically to any external disturbance – in particular to debt problems – was labeled a crank. He placed himself in their ranks, and his *General Theory* acknowledged the writings of the Swiss-German economist Silvio Gesell as representative of this approach. On the other hand, he noted: "The strength of the self-adjusting school depends on its having behind it almost the whole body of organised economic thinking and doctrine of the last hundred years. This is a formidable power. . . . It has vast prestige and a more far-reaching influence than is obvious. For it lies behind the education and the habitual modes of thought, not only of economists, but of bankers and businessmen and civil servants and politicians of all parties."[6]

Keynes acknowledged that he still had one foot in the orthodox tradition. In the end, all he could do was blame economists for not having developed "a satisfactory theory of the rate of interest" to serve as the regulator of saving, investment and employment. But how could this be done, without tracing the effect of interest rates on the doubling times of debts, the economy's ability to pay, and the structural consequences of forfeiture under distress conditions?

How debt and interest rates are autonomous from the "real" economy

Keynes was not the first economist pointing to savings as not being an unalloyed benefit. Marx had described how the "new aristocracy of finance, a new sort of parasites in the shape of promoters, speculators and merely nominal directors . . . demands . . . precisely that others shall save for him" (*Capital* III:519f.). The saving in this case take the form of debt repayment with interest, much as British money lenders advertise that buying a home helps buyers save by building up equity via their mortgage payments each month. The liquid savings of course accrue to the lenders, not the debtors. But it was mainly fringe groups that warned of the collision course between the debt overhead and the "real" economy's production and consumption trends.

From the Austrians through Fisher and Keynes, economists sought to deduce the rate of interest on the basis of consumer utility and capital productivity. Their dream of integrating the determination of interest rates into price and value theory was something like trying to untangle the Book of Revelation. Their search to discover a neat mathematical solution, determinable in advance, culminated in Keynes's attempts to formulate a "monetary theory of production" incorporating interest rates and money. Unfortunately, he was mixing apples and oranges. The source of confusion lay in the notion that money and credit have a tangible, real cost of production that can be factored into a general, integrated theory of production, investment and employment.

In reality no such unified field theory is possible. At first glance it might seem that a "real" cost of interest might be imputed by calculating and pro-rating the administrative and overhead costs incurred by banks and other creditors, taking into account their loss ratios to assign appropriate risk premiums. But an analysis of their income and expense accounts

[6] "Poverty in Plenty: Is the Economic System Self-Adjusting?" *The Listener*, Nov. 21, 1934 (repr. 1973:488).

shows how tautological such a measure would be. Salaries and bonuses, dividends and reserve funds or new projects (including mergers and acquisitions) reflect whatever revenue creditors obtain. Such pseudo-costs are after-the-fact, not foreseeable in advance in the sense that labor, materials and capital-goods costs are foreseeable.

The reality is that credit has no cost of production beyond a modest administrative overhead. Interest rates have no determinate foundation in the "real" economy's production and consumption functions, although they intrude into that system's circular flow. Such charges therefore cannot be assigned to labor or other "real" costs of production, but the administered prices for interest and underwriting fees are akin to economic rent, out of which the financial sector's bloated salaries and bonuses are paid.

The credit system's dynamics are based on the flow of funds and terms of debt repayment that form a system no more intrinsically linked to the economics of production and consumption than is the weather. When the financial and "real" spheres intersect, they do so in the way that comets intersect with the planetary system, sometimes with devastating collisions that abruptly alter trajectories. To extend the analogy to include compound interest, one should imagine the havoc that would be wreaked by comets whose mass was growing by x% in real terms each year, relative to the constant mass of the planets. The chance of crashes increases exponentially under such conditions, and their consequences become larger.

Mathematical sophistication is of little help when applied to what is assumed to be a debt-free economy. Without analyzing the degree to which wages, profits, rents and taxes are burdened by interest payments to creditors, economic theory will be unable to provide meaningful forecasts or policy recommendations. It was on this ground that Keynes chided economists for reasoning as if the world operated on a barter basis. They used *ceteris paribus* methodology to prevent monetary "distortions" from interfering with their analysis of wages, profits and rents, neglecting to add financial reality back into the picture they were drawing. The study of banking and credit was shunted aside into a sub-discipline, to be analyzed in isolation from "real exchange" problems. This missed the point that finance ultimately is more real than barter exchange, as money is the objective of businesses and consumers alike.

Finance and interest cannot be derived from production and consumption functions, but their impact on these functions can be traced, just as the impact of weather can be traced after the fact, but not explained as a product of economic conditions. A credit-based theory of pricing would start with the perception that debt service represents a rising share of the cost of producing and distributing goods and services. Today, the major factors determining international cost differentials are variations in the costing of capital – not only the rate of interest but also debt/equity ratios, loan maturities, depreciation and tax schedules. These are not production costs but are imposed from outside the real-cost system.

Matters are aggravated by the fact that goods and services are sold in markets where debt service absorbs a rising share of the revenue of labor, business, real estate and government. This causes a debt deflation that reduces the economy's ability to buy products, even while rising debt service adds to production costs. No meaningful analysis of demand – or of the degree to which Say's Law applies – can be drawn up without taking the volume of debt service into account.

Ignoring the role of debt leaves it free to devastate the economic system. Beaudelaire famously remarked that the devil would defeat humanity at the point where he was able to convince it that he did not really exist. Financial interests have promoted the idea that money and credit are merely a veil, passively reflecting economic life as "counters" rather than actively steering and planning economies. The study of debt and its effects have all but disappeared from the curriculum. In an academic version of Gresham's Law, the financial sector's approach to the debt problem has driven other perspectives out of the intellectual marketplace. Policy-makers take the financial and banking system for granted rather than discussing what kind of a system best would serve society's long-term development and best cope with debts that grow too large to be paid without fatally polarizing economies between creditors and debtors.

Posing the debt-repayment problem leads naturally into the analysis of what public responses are most appropriate. This line of analysis is anathema to the vested financial interests, and finds little support in academic economic department dependent increasingly on FIRE-sector subsidy.

It trivializes the debt problem to treat it merely as one of finding an appropriately low rate of interest to equilibrate financial supply and demand, consumer preference and profit opportunities so that the loan can be paid out of the productive investment of its proceeds. Most loans are not invested in tangible capital formation that increase the borrower's revenue and hence debt-paying capacity. And even if they were, the problem lies in the inexorable mathematics of compound interest. What needs to be examined is how to cope with the inherent tendency of debts to multiply in excess of the economy's ability to pay.

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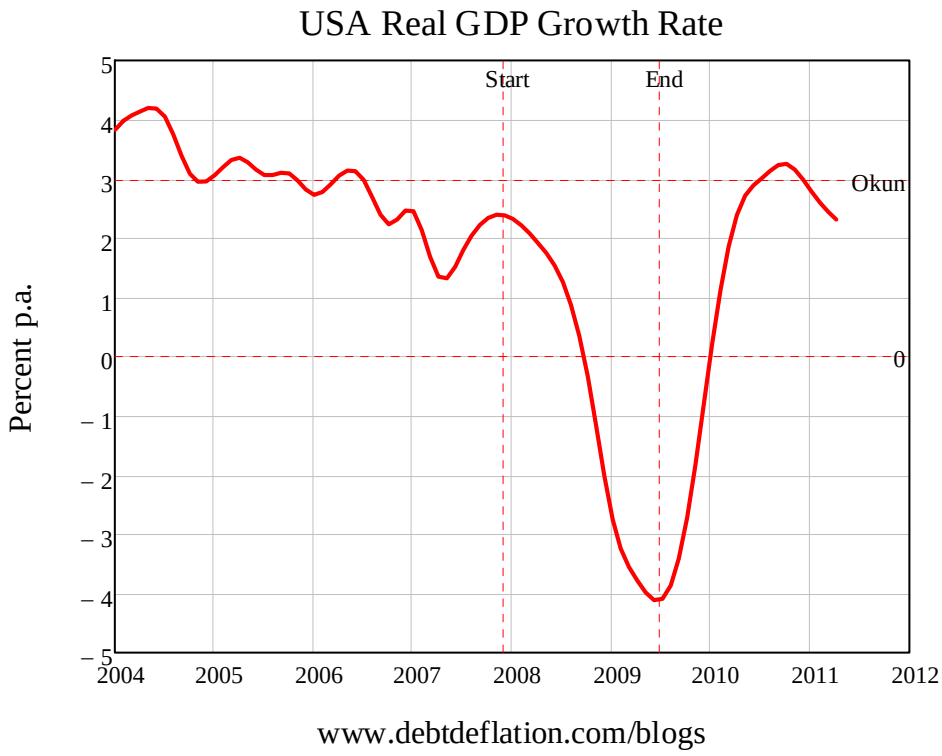
http://rwer.wordpress.com/2011/09/06/rwer-issue-57-michael-hudson/

Economic growth, asset markets and the credit accelerator

Steve Keen (University of Western Sydney, Australia)

According to the U.S. National Bureau of Economic Research, the "Great Recession" is now two years behind us, but the recovery that normally follows a recession has not occurred. While growth did rise for a while, it has been anaemic compared to the norm after a recession, and it is already trending down. Growth needs to exceed 3 per cent per annum to reduce unemployment—the rule of thumb known as Okun's Law[1]—and it needs to be substantially higher than this to make serious inroads into it. Instead, growth barely peeped its head above Okun's level. It is now below it again, and trending down. Unemployment is therefore rising once more, and with it, Obama's chances of re-election are rapidly fading.

Figure 1



Obama was assured by his advisors that this wouldn't happen. Right from the first "Economic Report of the President"[2] that he received from Bush's outgoing Chairman of the Council of Economic Advisers Ed Lazear in January 2009[3], he was assured that "the deeper the downturn, the stronger the recovery". On the basis of the regression shown in Chart 1-9 of that report (on page 54), I am sure that Obama was told that real growth would probably exceed 5 per cent per annum—because this is what Ed Lazear told me after my session at the Australian Conference of Economists in September 2009.

[1] http://en.wikipedia.org/wiki/Okun's_law

[2] http://www.gpoaccess.gov/eop/download.html

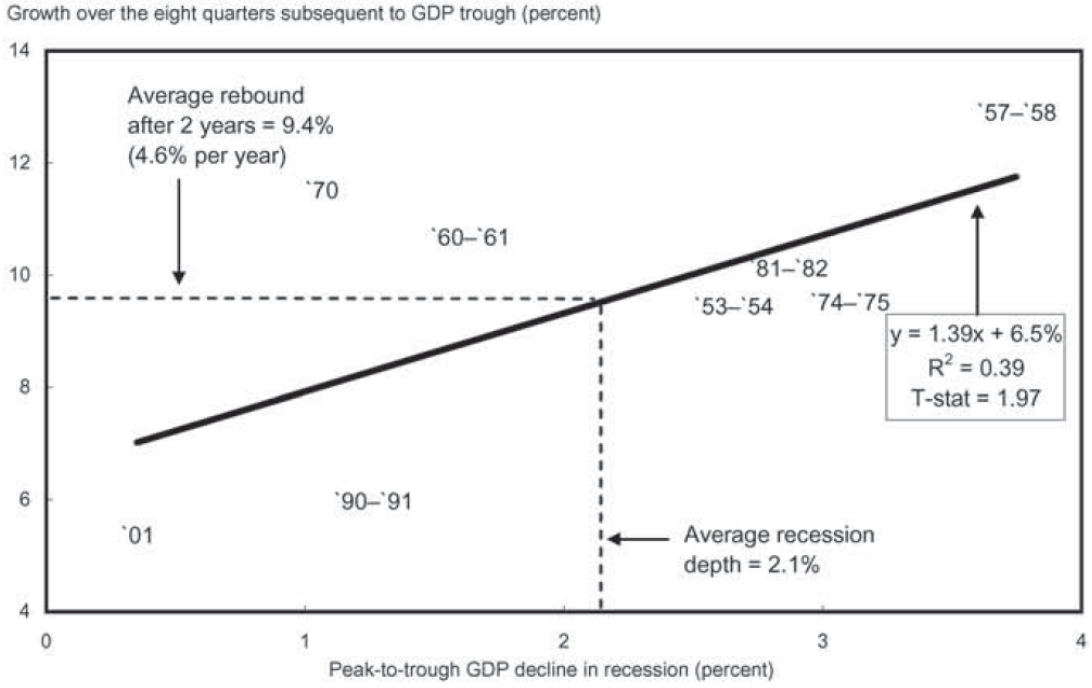
[3] http://www.gpoaccess.gov/eop/2009/2009_erp.pdf

Figure 2

Figure 3

Chart 1-9 **Recessions and Recession Recoveries**

GDP growth over the eight quarters following a recession tends to be higher after more severe recessions.

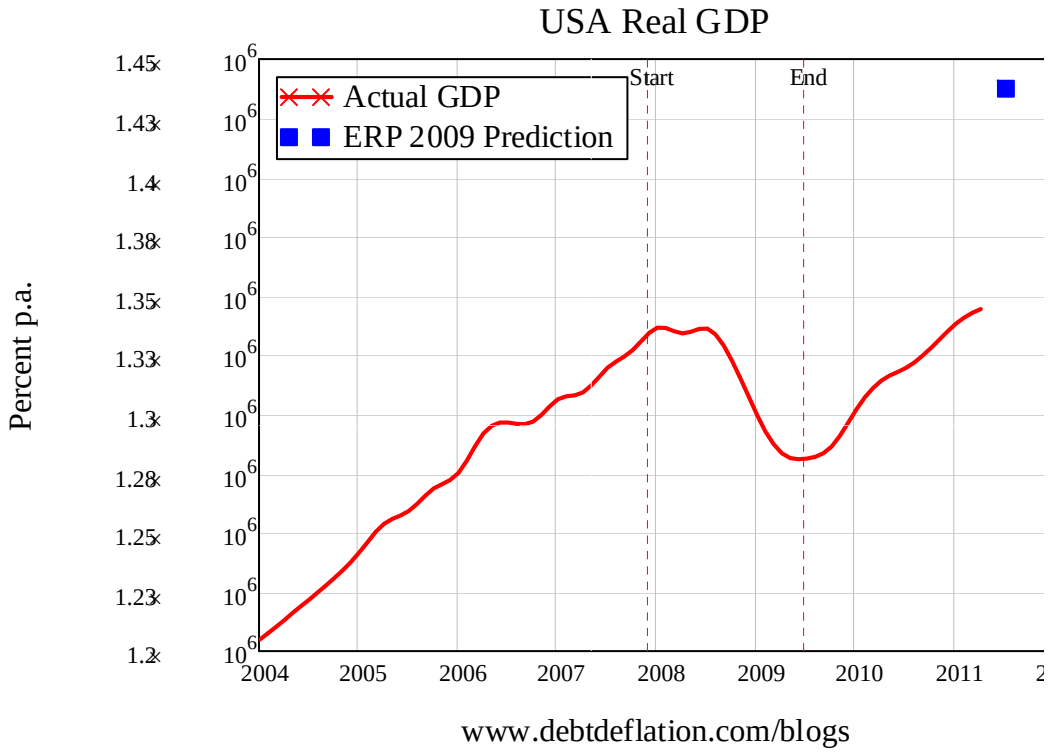


Note: Datapoint labels indicate year of recession. The depth of recession is measured from the peak GDP quarter to the minimum GDP quarter. The recovery is the eight-quarter growth from that minimum-GDP quarter.
Source: Department of Commerce (Bureau of Economic Analysis).

I disputed this analysis then (see "In the Dark on Cause and Effect, Debtwatch October 2009"[4]), and events have certainly borne out my analysis rather than the conventional wisdom. To give an idea of how wrong this guidance was, the peak to trough decline in the Great Recession—the x-axis in Lazear's Chart—was over 6 percent. His regression equation therefore predicted that GDP growth in the 2 years after the recession ended would have been over 12 percent. If this equation had born fruit, US Real GDP would be $14.37 trillion in June 2011, versus the recorded $13.44 trillion in March 2011.

So why has the conventional wisdom been so wrong? Largely because it has ignored the role of private debt.

Figure 4



Economic growth, asset markets and the credit accelerator

Neoclassical economists ignore the level of private debt, on the basis of the *a priori* argument that "one man's liability is another man's asset", so that the aggregate level of debt has no macroeconomic impact. They reason that the increase in the debtor's spending power is offset by the fall in the lender's spending power, and there is therefore no change to aggregate demand.

Lest it be said that I'm parodying neoclassical economics, or relying on what lesser lights believe when the leaders of the profession know better, here are two apposite quotes from Ben Bernanke and Paul Krugman.

[4] http://www.debtdeflation.com/blogs/2009/10/04/debtwatch-no-39-october-2009-in-the-dark-on-cause-and-effect/

Bernanke in his *Essays on the Great Depression*, explains why neoclassical economists didn't take Fisher's paper "Debt Deflation Theory of Great Depressions"[5] seriously:

> Fisher's idea was less influential in academic circles, though, because of the counterargument that debt-deflation represented no more than a redistribution from one group (debtors) to another (creditors). Absent implausibly large differences in marginal spending propensities among the groups, it was suggested, pure redistributions should have no significant macro-economic effects…[6]

Paul Krugman in his most recent draft academic paper[7] on the crisis and co-author Gauti B. Eggertsson write:

> Given both the prominence of debt in popular discussion of our current economic difficulties and the long tradition of invoking debt as a key factor in major economic contractions, one might have expected debt to be at the heart of most mainstream macroeconomic models—especially the analysis of monetary and fiscal policy. Perhaps somewhat surprisingly, however, it is quite common to abstract altogether from this feature of the economy. Even economists trying to analyze the problems of monetary and fiscal policy at the zero lower bound—and yes, that includes the authors—have often adopted representative-agent models in which everyone is alike, and in which the shock that pushes the economy into a situation in which even a zero interest rate isn't low enough takes the form of a shift in everyone's preferences…

And:

> Ignoring the foreign component, or looking at the world as a whole, the overall level of debt makes no difference to aggregate net worth -- one person's liability is another person's asset.[8]

They are profoundly wrong on this point because neoclassical economists do not understand how money is created by the private banking system—despite decades of empirical research to the contrary, they continue to cling to the textbook vision of banks as mere intermediaries between savers and borrowers.

This is bizarre, since as long as 4 decades ago, the actual situation was put very simply by the then Senior Vice President, Federal Reserve Bank of New York, Alan Holmes. Holmes explained why the then faddish Monetarist policy of controlling inflation by controlling the growth of Base Money had failed, saying that it suffered from "a naive assumption" that:

> the banking system only expands loans after the [Federal Reserve] System (or market factors) have put reserves in the banking system. *In the real world, banks*

[5] Fisher, Irving. 1933. "The Debt-Deflation Theory of Great Depressions." *Econometrica*, 1(4), 337-57.

[6] Bernanke, Ben S. 2000. *Essays on the Great Depression*. Princeton: Princeton University Press, p. 24.

[7] Krugman, Paul and Gauti B. Eggertsson. 2010. "Debt, Deleveraging, and the Liquidity Trap: A Fisher-Minsky-Koo Approach [2nd Draft 2/14/2011]," New York: Federal Reserve Bank of New York & Princeton University, p. 2, http://www.princeton.edu/~pkrugman/debt_deleveraging_ge_pk.pdf

[8] Ibid, p. 3.

> *extend credit, creating deposits in the process, and look for the reserves later.* The question then becomes one of whether and how the Federal Reserve will accommodate the demand for reserves. In the very short run, the Federal Reserve has little or no choice about accommodating that demand; over time, its influence can obviously be felt.[9] (emphasis added)

The empirical fact that "loans create deposits" means that the change in the level of private debt is matched by a change in the level of money, which boosts aggregate demand. The level of private debt therefore cannot be ignored—and the fact that neoclassical economists did ignore it (and, with the likes of Greenspan running the Fed, actively promoted its growth) is why this is no "garden variety" downturn.

In all the post-WWII recessions on which Lazear's regression was based, the downturn ended when the growth of private debt turned positive again and boosted aggregate demand. This of itself is not a bad thing: as Schumpeter argued decades ago, in a well-functioning capitalist system, the main recipients of credit are entrepreneurs who have an idea, but not the money needed to put it into action:

> "[I]n so far as credit cannot be given out of the results of past enterprise … it can only consist of credit means of payment created ad hoc, which can be backed neither by money in the strict sense nor by products already in existence...
>
> It provides us with the connection between lending and credit means of payment, and leads us to what I regard as the nature of the credit phenomenon… credit is essentially the creation of purchasing power for the purpose of transferring it to the entrepreneur, but not simply the transfer of existing purchasing power."[10]

It becomes a bad thing when this additional credit goes, not to entrepreneurs, but to Ponzi merchants in the finance sector, who use it not to innovate or add to productive capacity, but to gamble on asset prices. This adds to debt levels without adding to the economy's capacity to service them, leading to a blowout in the ratio of private debt to GDP. Ultimately, this process leads to a crisis like the one we are now in, where so much debt has been taken on that the growth of debt comes to an end. The economy then enters not a recession, but a Depression.

For a while though, it looked like a recovery was afoot: growth did rebound from the depths of the Great Recession, and very quickly compared to the Great Depression (though slowly when compared to Post-WWII recessions).

Clearly the scale of government spending, and the enormous increase in Base Money by Bernanke, had some impact—but nowhere near as much as they were hoping for. However the main factor that caused the brief recovery—and will also cause the dreaded "double dip"—is the Credit Accelerator.

---

[9] Holmes, Alan R. 1969. "Operational Constraints on the Stabilization of Money Supply Growth," F. E. Morris, *Controlling Monetary Aggregates.* Nantucket Island: The Federal Reserve Bank of Boston, 65-77.

[10] Schumpeter, Joseph Alois. 1934. *The Theory of Economic Development : An Inquiry into Profits, Capital, Credit, Interest and the Business Cycle*. Cambridge, Massachusetts: Harvard University Press.

I've previously called this the "Credit Impulse" (sing the name bestowed by Michael Biggs et al., 2010)[11], but I think "Credit Accelerator" is both move evocative and more accurate. The Credit Accelerator at any point in time is the change in the change in debt over previous year, divided by the GDP figure for that point in time. From first principles, here is why it matters.

Firstly, and contrary to the neoclassical model, a capitalist economy is characterized by excess supply at virtually all times: there is normally excess labor and excess productive capacity, even during booms. This is not per se a bad thing but merely an inherent characteristic of capitalism—and it is one of the reasons that capitalist economies generate a much higher rate of innovation than did socialist economies[12]. The main constraint facing capitalist economies is therefore not supply, but demand.

Secondly, all demand is monetary, and there are two sources of money: incomes, *and the change in debt*. The second factor is ignored by neoclassical economics, but is vital to understanding a capitalist economy. Aggregate demand is therefore equal to Aggregate Supply *plus the change in debt*.

Thirdly, this Aggregate Demand is expended not merely on new goods and services, but also on net sales of existing assets. Walras' Law, that mainstay of neoclassical economics, is thus false in a credit-based economy—which happens to be the type of economy in which we live. Its replacement is the following expression, where the left hand is monetary demand and the right hand is the monetary value of production and asset sales:

Income + Change in Debt = Output + Net Asset Sales;

In symbols (where I'm using an arrow to indicate the direction of causation rather than an equals sign), this is:

$$Y + \frac{d}{dt}D \rightarrow GDP + NAS$$

This means that it is impossible to separate the study of "Finance"—largely, the behaviour of asset markets—from the study of macroeconomics. Income and new credit are expended on both newly produced goods and services, and the two are as entwined as a scrambled egg.

Net Asset Sales can be broken down into three components:

- The asset price Level; times
- The fraction of assets sold; times
- The quantity of assets

Putting this in symbols:

$$NAS = P_A \cdot \sigma_A \cdot Q_A$$

[11] Biggs, Michael; Thomas Mayer and Andreas Pick. 2010. "Credit and Economic Recovery: Demystifying Phoenix Miracles." *SSRN eLibrary*.

[12] Kornai, Janos. 1980. "'Hard' and 'Soft' Budget Constraint." *Acta Oeconomica*, 25(3-4), 231-45.

That covers the levels of aggregate demand, aggregate supply and net asset sales. To consider economic growth—and asset price change—we have to look at the rate of change. That leads to the expression:

$$\frac{d}{dt}Y + \frac{d^2}{dt^2}D \rightarrow \frac{d}{dt}GDP + \frac{d}{dt}NAS$$

Therefore the rate of change of asset prices is related to the ***acceleration*** of debt. It's not the only factor obviously—change in incomes is also a factor, and as Schumpeter argued, there will be a link between accelerating debt and rising income ***if*** that debt is used to finance entrepreneurial activity. Our great misfortune is that accelerating debt hasn't been primarily used for that purpose, but has instead financed asset price bubbles.

There isn't a one-to-one link between accelerating debt and asset price rises: some of the borrowed money drives up production (think SUVs during the boom), consumer prices, the fraction of existing assets sold, and the production of new assets (think McMansions during the boom). But the more the economy becomes a disguised Ponzi Scheme, the more the acceleration of debt turns up in rising asset prices.

As Schumpeter's analysis shows, accelerating debt should lead change in output in a well-functioning economy; we unfortunately live in a Ponzi economy where accelerating debt leads to asset price bubbles.

In a well-functioning economy, periods of acceleration of debt would be followed by periods of deceleration, so that the ratio of debt to GDP cycled but did not rise over time. In a Ponzi economy, the acceleration of debt remains positive most of the time, leading not merely to cycles in the debt to GDP ratio, but a secular trend towards rising debt. When that trend exhausts itself, a Depression ensues—which is where we are now. Deleveraging replaces rising debt, the debt to GDP ratio falls, and debt starts to reduce aggregate demand rather than increase it as happens during a boom.

Even in that situation, however, the acceleration of debt can still give the economy a temporary boost—as Biggs, Meyer and Pick pointed out. A slowdown in the rate of decline of debt means that debt is accelerating: therefore even when aggregate private debt is falling—as it has since 2009—a slowdown in that rate of decline can give the economy a boost.

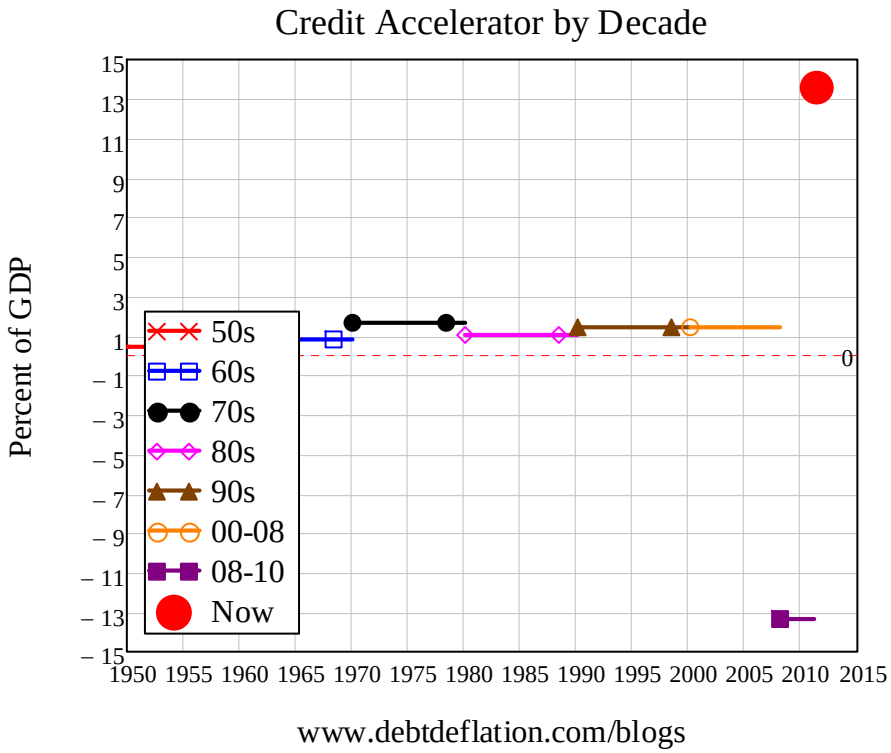
That's the major factor that generated the apparent recovery from the Great Recession: a slowdown in the rate of decline of private debt gave the economy a temporary boost. The same force caused the apparent boom of the Great Moderation: it wasn't "improved monetary policy" that caused the Great Moderation, as Bernanke once argued[13], but bad monetary policy that wrongly ignored the impact of rising private debt upon the economy.

The factor that makes the recent recovery phase different to all previous ones—save the Great Depression itself—is that this strong boost from the Credit Accelerator has occurred

[13] Bernanke, Ben S. 2004. "The Great Moderation: Remarks by Governor Ben S. Bernanke at the Meetings of the Eastern Economic Association, Washington, Dc February 20, 2004," *Eastern Economic Association.* Washington, DC: Federal Reserve Board.

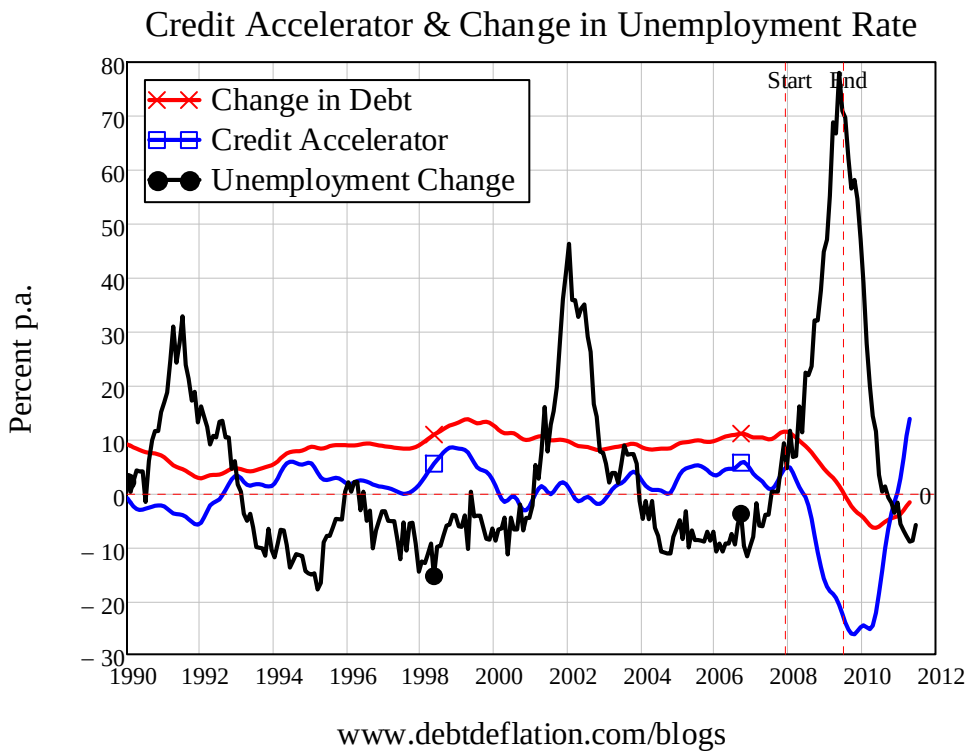
while the *change in private debt* is still massively negative. I return to this point later when considering why the recovery is now petering out.

Figure 5



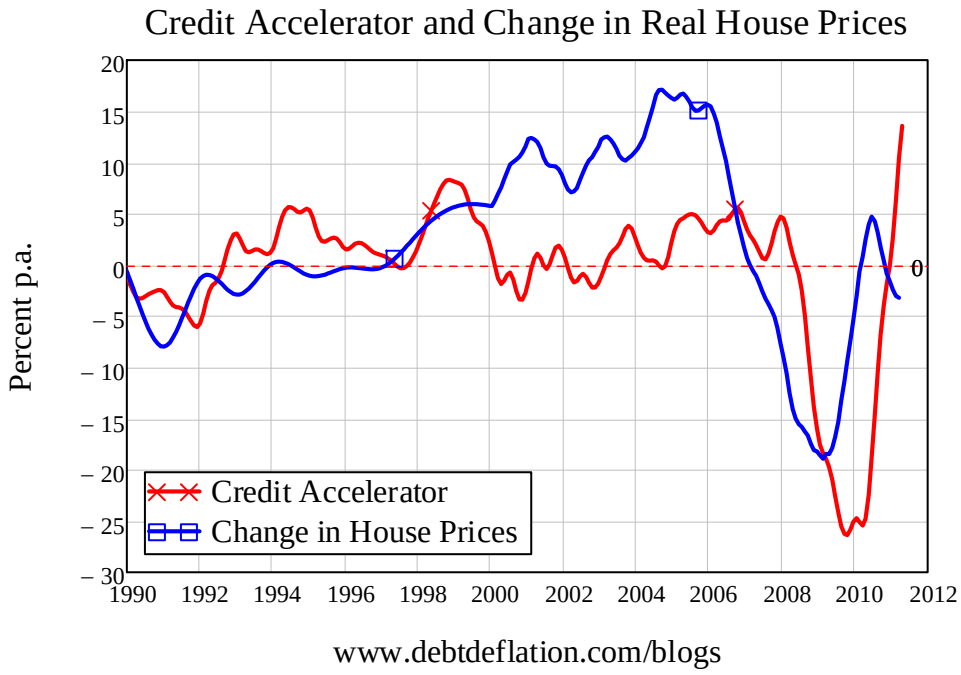
The last 20 years of economic data shows the impact that the Credit Accelerator has on the economy. The recent recovery in unemployment was largely caused by the dramatic reversal of the Credit Accelerator—from strongly negative to strongly positive—since late 2009:

Figure 6



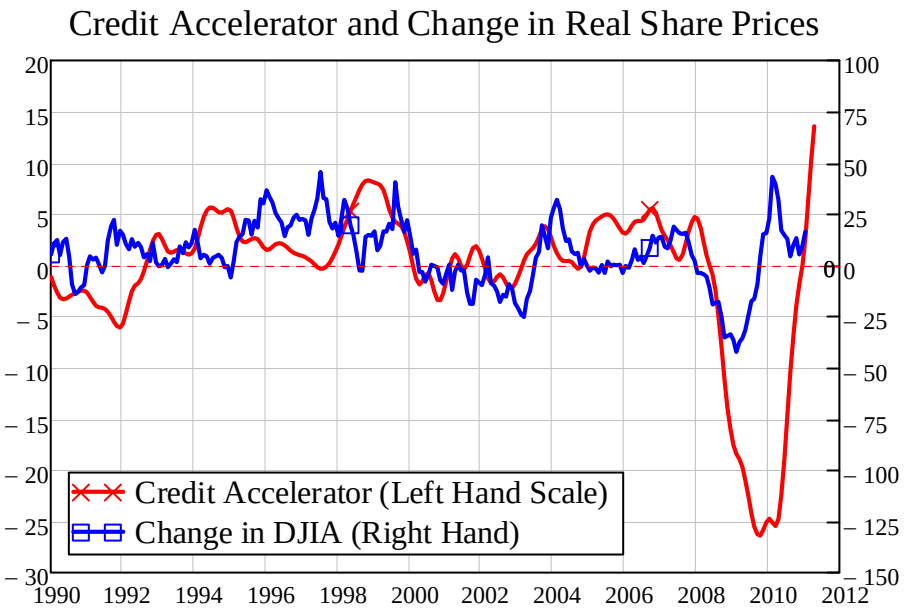
The Credit Accelerator also caused the temporary recovery in house prices:

Figure 7



And it was the primary factor driving the Bear Market rally in the stock market:

Figure 8



www.debtdeflation.com/blogs

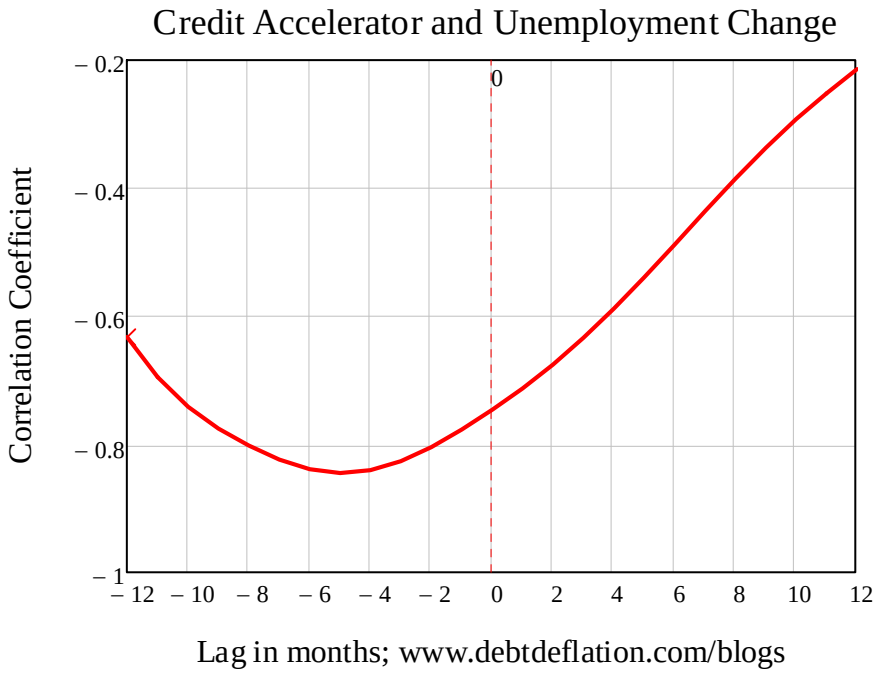
Leads and Lags

I use the change in the change in debt over a year because the monthly and quarterly data is simply too volatile; the annual change data smooths out much of the noise. Consequently the data shown for change in unemployment, house prices and the stock market are also for the change the previous year.

However the change in the change in debt operates can impact rapidly on some markets—notably the Stock Market. So though the correlations in the above graphs are already high, they are higher still when we consider the causal role of the debt accelerator in changing the level of aggregate demand by lagging the data.

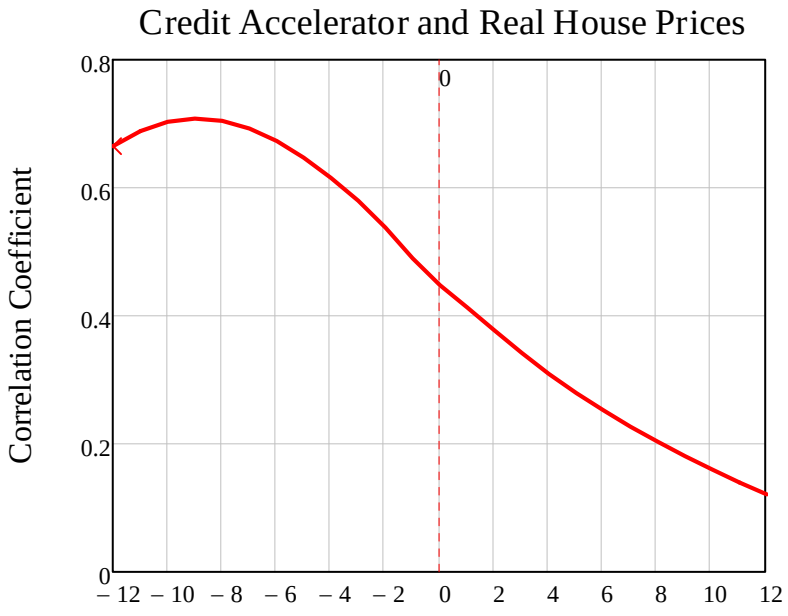
This shows that the annual Credit Accelerator leads annual changes in unemployment by roughly 5 months, and its maximum correlation is a staggering -0.85 (negative because an acceleration in debt causes a fall in unemployment by boosting aggregate demand, while a deceleration in debt causes a rise in unemployment by reducing aggregate demand).

Figure 9



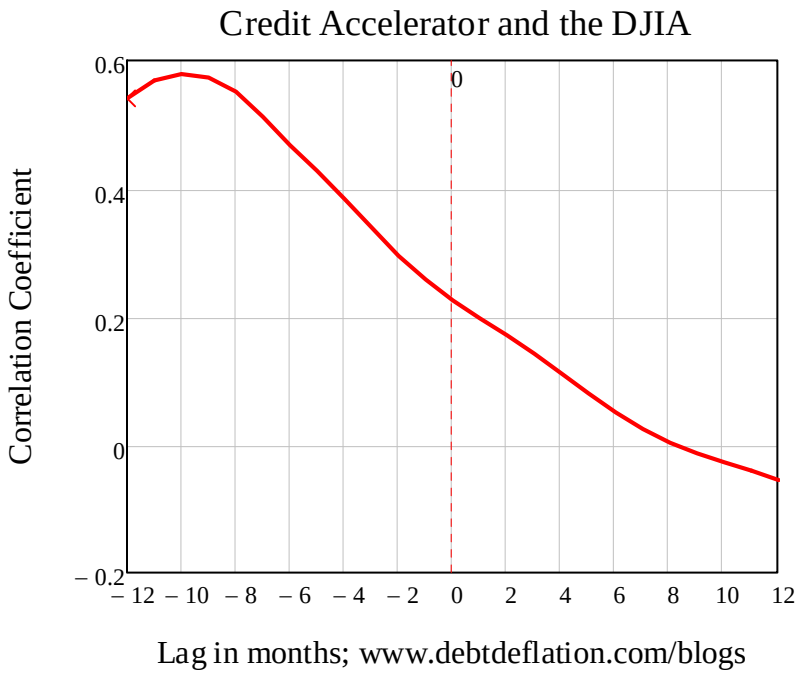
The correlation between the annual Credit Accelerator and annual change in real house prices peaks at about 0.7 roughly 9 months ahead:

Figure 10



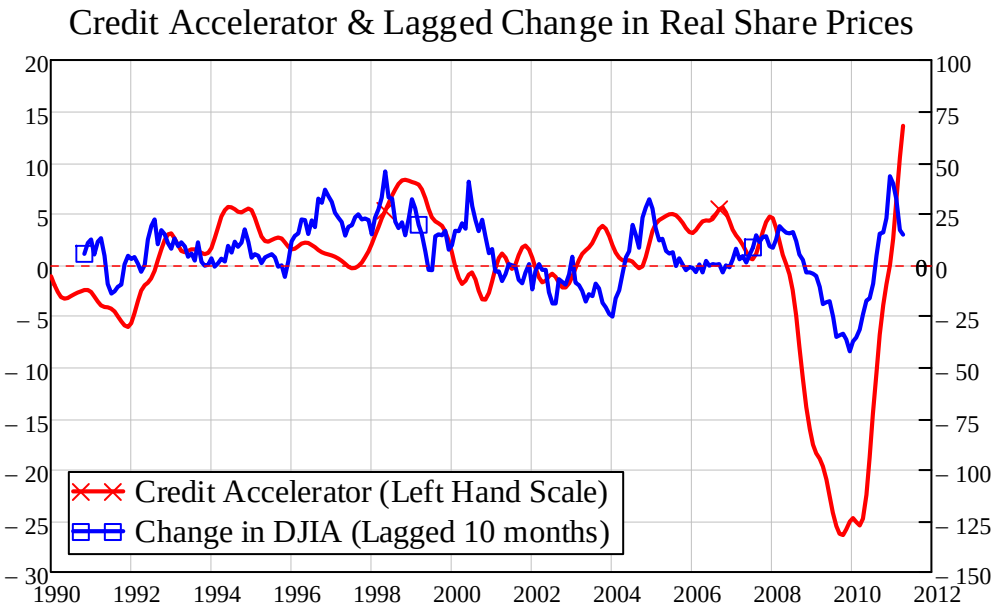
And the Stock Market is also a creature of the Credit Impulse, where the lead is about 10 months and the correlation peaks at just under 0.6:

Figure 11



The causal relationship between the acceleration of debt and change in stock prices is more obvious when the 10 month lag is taken into account:

Figure 12



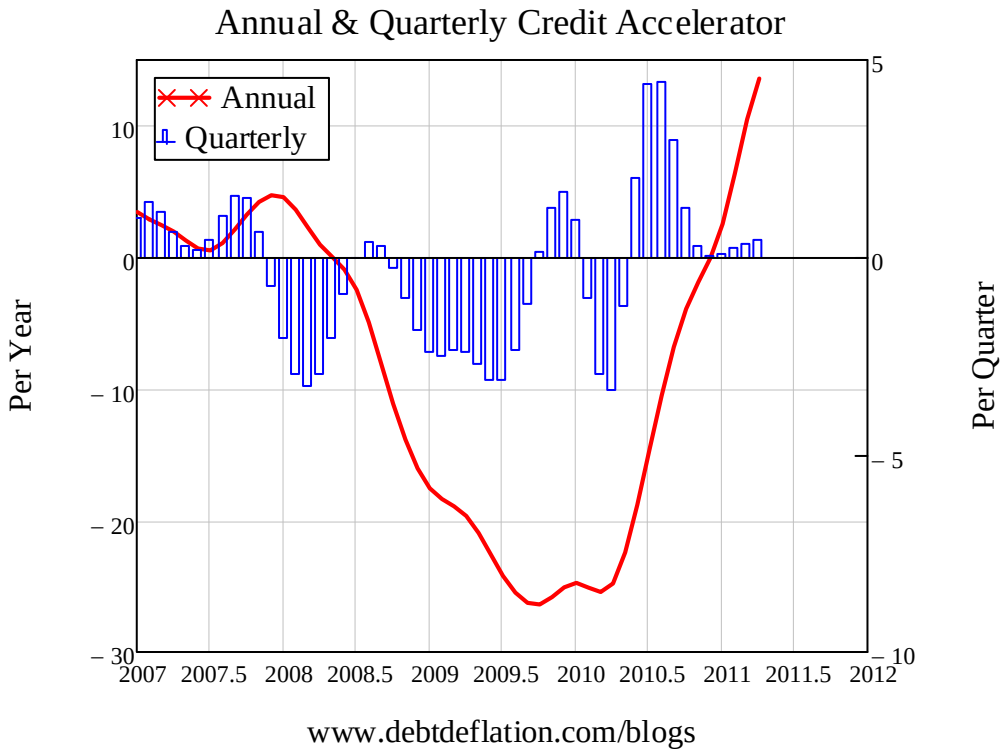
These correlations, which confirm the causal argument made between the acceleration of debt and the change in asset prices, expose the dangerous positive feedback loop in which the economy has been trapped. This is similar to what George Soros calls a

reflexive process: we borrow money to gamble on rising asset prices, and the acceleration of debt causes asset prices to rise.

This is the basis of a Ponzi Scheme, and it is also why the Scheme must eventually fail. Because it relies not merely on growing debt, but accelerating debt, ultimately that acceleration must end—because otherwise debt would become infinite. When the acceleration of debt ceases, asset prices collapse.

` The annual Credit Accelerator is still very strong right now—so why is unemployment rising and both housing and stocks falling? Here we have to look at the more recent quarterly changes in the Credit Accelerator—even though there is too much noise in the data to use it as a decent indicator (the quarterly levels shown in **Figure 13** are from month to month—so that the bar for March 2011 indicates the acceleration of debt between January and March 2011). It's apparent that the strong acceleration of debt in mid to late 2010 is petering out. Another quarter of that low a rate of acceleration in debt—or a return to more deceleration—will drive the annual Credit Accelerator down or even negative again. The lead between the annual Credit Accelerator and the annualized rates of change of unemployment and asset prices means that this diminished stimulus from accelerating debt is turning up in the data now.

Figure 13

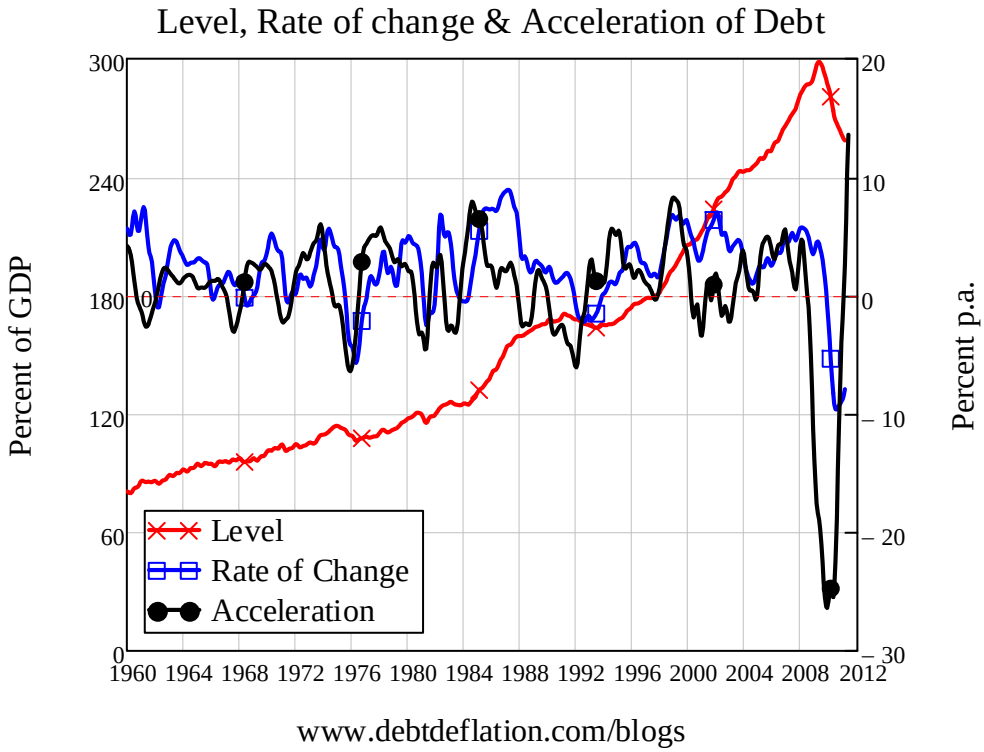


This tendency for the Credit Accelerator to turn negative after a brief bout of being positive is likely to be with us for some time. In a well-functioning economy, the Credit Accelerator would fluctuate around slightly above zero. It would be above zero when a Schumpeterian boom was in progress, below during a slump, and tend to exceed zero slightly over time because positive credit growth is needed to sustain economic growth. This would result in a private debt to GDP level that fluctuated around a positive level, as output grew cyclically in proportion to the rising debt.

Instead, it has been kept positive over an unprecedented period by a Ponzi-oriented financial sector, which was allowed to get away with it by naïve neoclassical economists in positions of authority. The consequence was a secular tendency for the debt to GDP ratio to rise. This was the danger Minsky tried to raise awareness of in his Financial Instability Hypothesis (Hyman P. Minsky, 1972)—which neoclassical economists like Bernanke ignored.

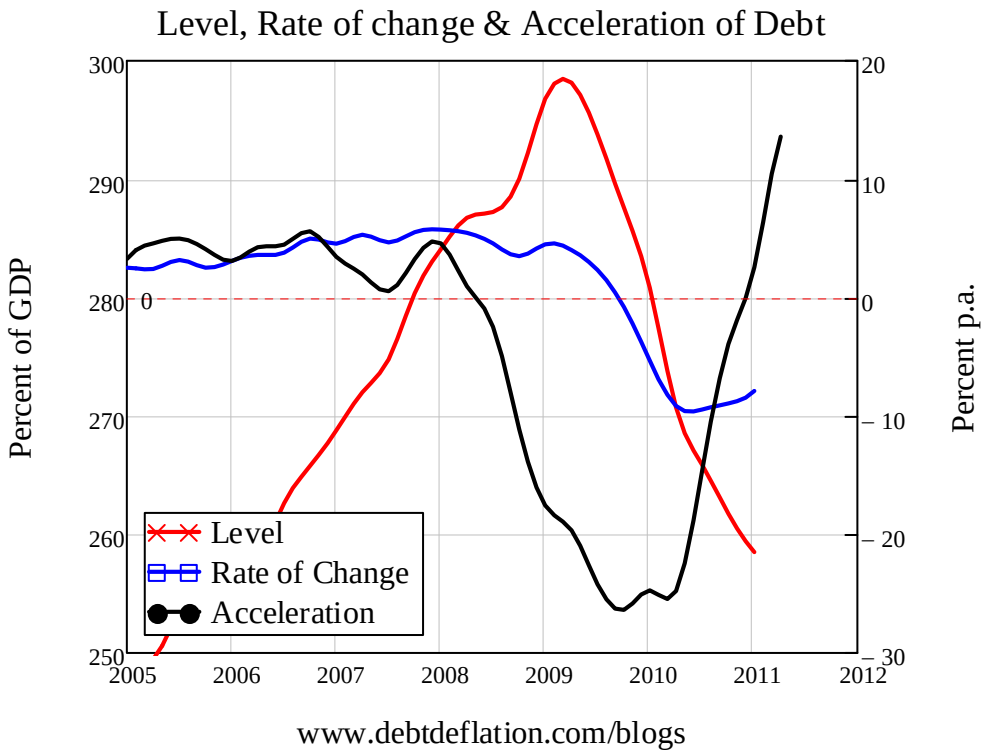
The false prosperity this accelerating debt caused led to the fantasy of "The Great Moderation" taking hold amongst neoclassical economists. Ultimately, in 2008, this fantasy came crashing down when the impossibility of maintaining a positive acceleration in debt forever hit—and the Great Recession began.

Figure 14



From now on, unless we do the sensible thing of abolishing debt that should never have been created in the first place, we are likely to be subject to wild gyrations in the Credit Accelerator, and a general tendency for it to be negative rather than positive. With debt still at levels that dwarf previous speculative peaks, the positive feedback between accelerating debt and rising asset prices can only last for a short time, since it if were to persist, debt levels would ultimately have to rise once more. Instead, what is likely to happen is a a period of strong acceleration in debt (caused by a slowdown in the rate of decline of debt) and rising asset prices—followed by a decline in the acceleration as the velocity of debt approaches zero.

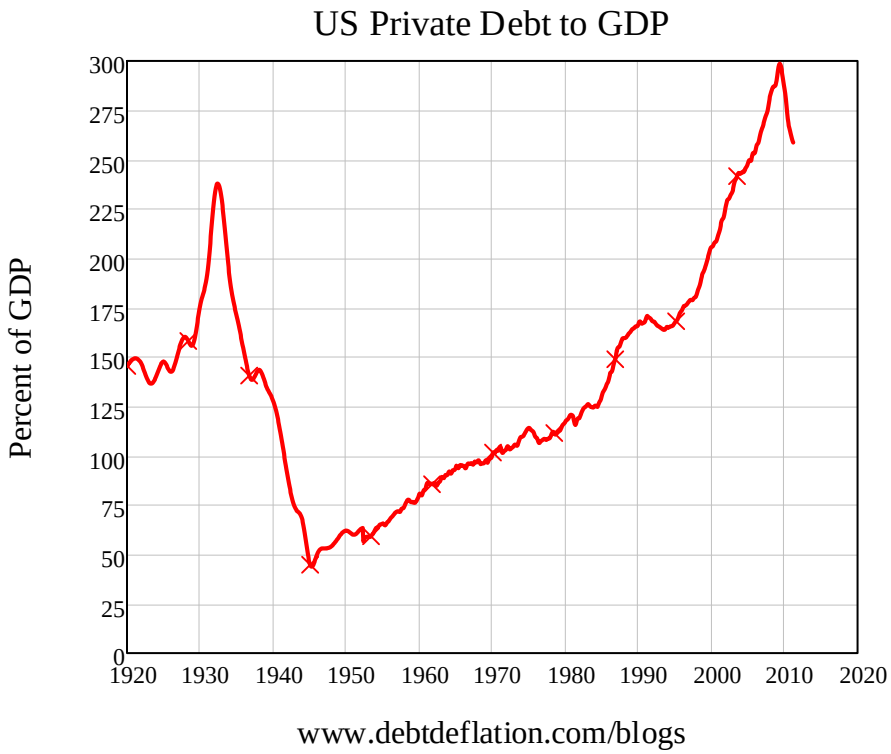
Figure 15



Here Soros's reflexivity starts to work in reverse. With the Credit Accelerator going into reverse, asset prices plunge—which further reduces the public's willingness to take on debt, which causes asset prices to fall even further.

The process eventually exhausts itself as the debt to GDP ratio falls. But given that the current private debt level is perhaps 170% of GDP above where it should be (the level that finances entrepreneurial investment rather than Ponzi Schemes), the end game here will be many years in the future. The only sure road to recovery is debt abolition—but that will require defeating the political power of the finance sector, and ending the influence of neoclassical economists on economic policy. That day is still a long way off.

Figure 16



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The financial sector and the real economy

Dietmar Peetz and Heribert Genreith (Institute for Applied Risk Management, Germany)

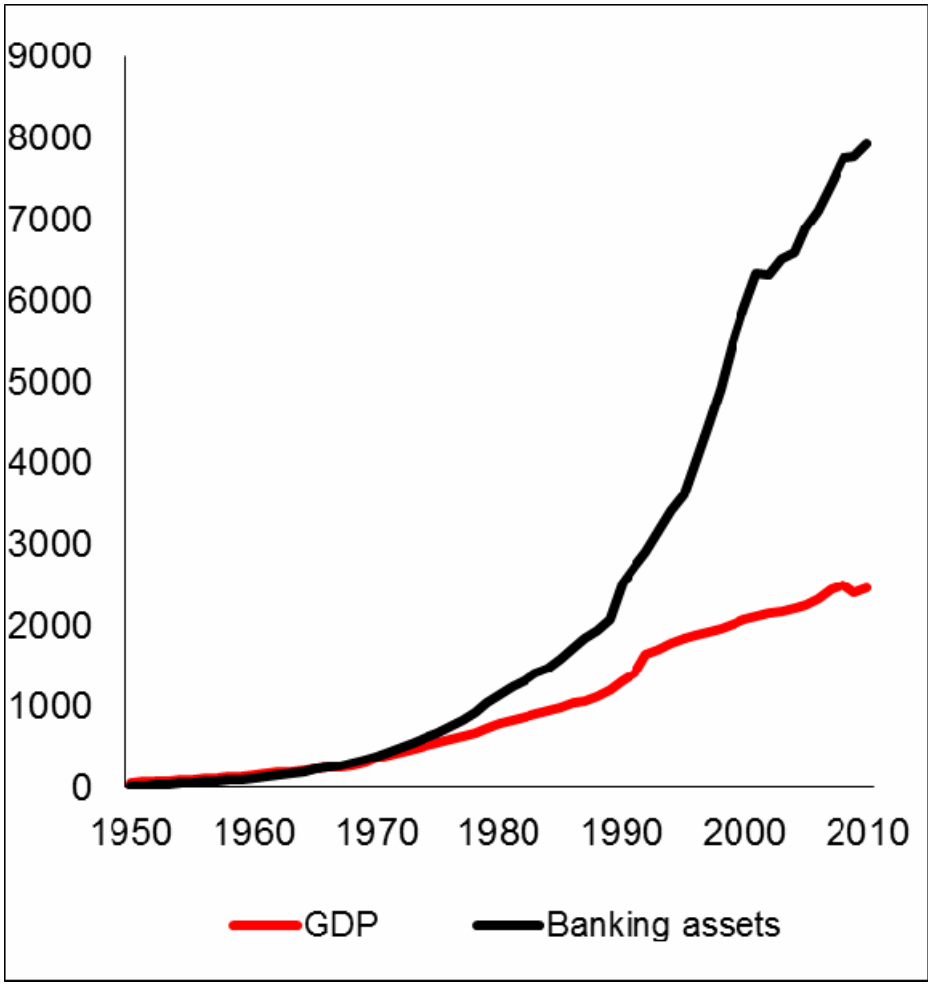
Abstract
The uncertainty precipitated by the lingering fallout from the financial, economic, and debt crises increases daily. Meanwhile, leading mainstream economists are being criticized for their divided positions on the correct diagnosis of and viable solutions for these crises. Classical economic growth theories were unable to predict these dilemmas, as they did not adequately take into account factors such as the macroeconomic impact of outsized financial sector developments. Classical economic models are still considered by many economists to be the correct tools for dealing with the consequences of the 2008-2011 credit crisis ("crisis"). Meanwhile, others view crisis as stemming from the global imbalances precipitated by the application of these classic macro models. This contradiction seems irreconcilable. A new approach is therefore necessary. In this review, we present an alternative growth model. Specifically, one which helps to analyze the interdependence between the financial and the real economy and which also yields analytical statements about the causes of crises.

Introduction

Sufficient capital is the basic prerequisite for enabling economic processes. Innovation is impossible without the availability of adequate capital. Mainstream economic growth models assume that categorical positive relationship exists between the two. However, as the recent financial and economic crises revealed, there is a fundamental interaction between the financial sector and the gross domestic product (GDP) of an economy. The relationship between the two is, however far away from being linear. This is demonstrated in chart 1 for Germany.

In the case of Germany, financial assets - measured by total bank assets - grew significantly faster than the gross domestic product (see chart 1). Interestingly, a tendency for stagnating and (in 2009) even falling growth rates for GDP can be ascertained. Allow us a brief historic synopsis. At the end of the 80s there was a surge in GDP due to the integration of the East German economy. At the same time, nominal assets increased due to the conversion of Ost-Marks into Deutsch-Marks. Afterwards, GDP grew only linearly, while financial assets experienced massive exponential growth. As of the 90s, growth rates in the real economy fell by such a degree that capital could no longer earn the high returns of the past. As a result, capital increasingly gravitated to the higher return potential of the financial markets (equities, private equities, hedge funds etc.). This caused the so-called "savings glut," a situation wherein too much capital is chasing too few investment opportunities. It is in this context that the term "financialization" is often used by economists. Financialization describes the process by which increasingly more corporate earnings and personal income result from financial transactions and not from real economic growth, i.e., increased production and related growth in employment.

Chart 1: Development of nominal gross domestic product and banking assets in € billion



Source: German Bundesbank, total assets of all German banks, time series OU0308, GDP data: www.destatis.de

Noteworthy in chart 1 is the onset of exponential growth in financial wealth after the collapse of the tech bubble in early 2000. The financial and economic crises have also left their marks. Between 2008 and 2009, both GDP and financial asset valuations fell. Valuations fell from a peak of 8093 billion EUR in October 2008 to 7472 billion EUR at the end of October 2010. Due to unprecedented interventions by central banks and policy makers, a sharper decline has thus far been prevented. Central banks continue to attempt to kick start economic growth by expanding the money supply. Economic growth, as expounded by classical macro models (especially the IMF model of 2005[1]) should have risen proportionally with monetary expansion. Unfortunately, empirical observations show that just the opposite happens when the debt to GDP ratio has already grown too large (as is currently

[1] http://www.imf.org/external/pubs/ft/weo/2005/02/pdf/chapter2.pdf, pp 118, 121, and in addition page 105: „The investment equation is less successful than the saving equation in tracking recent developments. This result is similar to other recent studies, which have found that traditional econometric models of investment have difficulty explaining recent trends. The equation over predicts investment in both the industrial and emerging market regions, in some cases by large margins. For instance, while the equation predicts that investment should have increased in industrial countries—largely as a result of the decline in the cost of capital—investment in several key industrial countries, including Japan and the Large Euro countries fell. Similarly, the equation fails to explain the drop in investment in emerging markets, particularly in the east Asian countries. The equation suggests that the investment accelerator—whereby investment rates and output growth move in the same direction—has not worked as strongly as expected in recent years in these countries, most likely because corporates have focused on reducing debt and strengthening balance sheets, rather than on investing in capital."

the case in Greece, the US, and other countries). How can this conflict between theory and reality be resolved?

A new macro-model

Models display cause and effect principles. In this review, we endeavor to determine the relationship between GDP *Y* and financial assets *K*. We will revisit the increasingly contested relationship between these two functions. In so doing, we shall deploy the very mathematical modeling procedures which are well known in the natural sciences. For mathematical reasons we need at least two linearly independent equations to define the relationship. Our basic equation system has the following structure:

$$\frac{dY}{dt} = b_0(t) + p_B(t)Y(t) + p_Y(t)K(t) \quad \text{and} \quad \frac{dK}{dt} = a_0(t) + p_S(t)Y(t) + p_K(t)K(t)$$

with initial conditions $Y(0) = Y0$ and $K(0) = K0$. In the case of Germany, $Y0 = Y$ (1950) and $K0 = K$ (1950).

This coupled system of differential equations describes the effect, i.e., the growth rates of *Y* and *K* as autonomously generated data points. Said data points stem a) from independent causes (a_0, b_0) and b) from the function (*Y*, *K*), which is itself causal. In this sense, the parameter functions have to be determined. These are in principle - as are the sought unknown functions *Y* and *K* - functions of time.

The parameters a_0 and b_0 describe independent causes for the growth of GDP or capital. For example, a_0 could represent the inflow or outflow of foreign capital (such as financial support from the IMF) and b_0 could be an exogenous GDP inflow (e.g., grain donations from abroad).

p_n is what we call the net business investment rate of the banking industry and the function $-p_n$, therefore, represents the net rate of investment in the real economy. p_S denotes the savings rate, p_B the population growth, p_Y the investment in the real economy, and p_K the actual return on financial assets. There is, however, a causal link between the parameters and the functions p_Y and p_K. The interest/capital gains for financial assets ultimately have to be generated by the real economy (GDP). Therefore, our equation: $p_K = - p_Y := p_n (t)$.

We distinguish between interest payments for financial assets and those for loans. Furthermore, we differentiate between capital that circulates in the financial system and the portion of capital which finds its way into loans for the real economy (either for consumption or investment purposes). The latter is called "net business rate" p_n where $p_n = p_v - p_r$ (written in units of an interest rate).

To determine the specific representation of the "net business investment rate" p_n we need information about investments in the real economy as well as information about "proprietary business investment," which the financial system processes within itself.[2] The share of loans going into the real economy's total business ("p_{rel}") stood at 75% in 1950 ac-

2. We interpret the financial systems as a subsystem of our social system. See Niklas Luhmann "Social Systems" (1996).

cording to the Bundesbank (time series OU0115). Today, 60 years later, the figure has fallen to about 40%. Since we are interested in comparing "real economy loans" with overall asset growth (which represents the entire economy), we express pr as a portion of interest payments or p_v. The share of interest remaining after reinvestment in the real economy is given by:

$$p_n(t) = p_v(t) - p_r(t)$$
$$= p_v(t)(1 - p_{rel}(t)) - p_v(t)\,p_{rel}(t)$$
$$= p_v(t)(1 - 2\,p_{rel}(t))$$

We can interpret p_n(t) as follows: because (accumulated) capital is growing faster than GDP, its relative capacity for making loans into the real economy declines. Assuming an exponential half-life (in this case T_h = 80 years), p_{rel} can be phenomenologically stated as:

$$p_{rel} = \frac{1}{e}\exp(-\frac{t - T_h}{T_h})$$

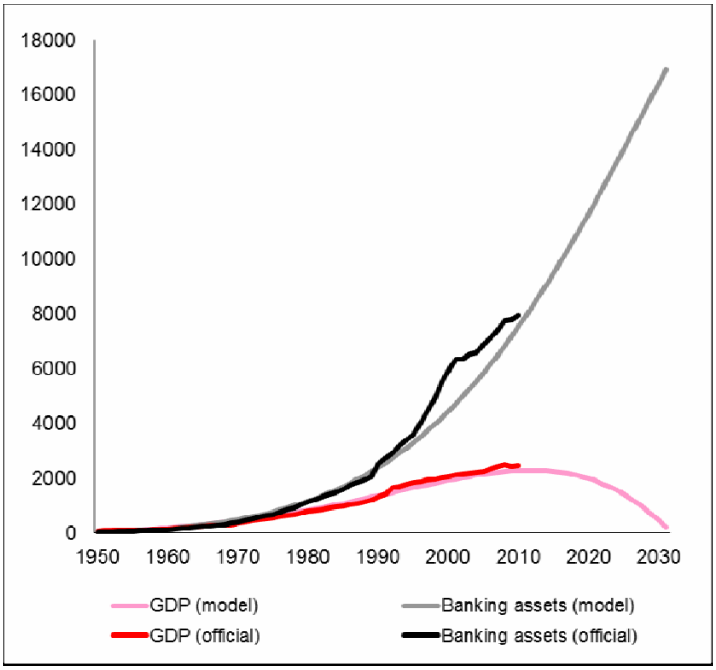
This yields p_{rel} (0) = 1 = 100% and p_{rel} (80) = 1 / e = 0.37 = 37% and p_{rel} (∞) = 0. Inserting this into p_n (t) results in:

$$p_n(t) = p_{v0}(1 - \frac{2}{e}\exp(-\frac{t - T_h}{T_h}))$$

as an approximate function based on empirical experience for the real data.

We have calibrated the parameters in the model with the empirical Bundesbank data from 1950 to 2010 and have made an extrapolation with the synthetic function (for detailed explanation see the technical paper[3]). The results can be seen in chart 2:

Chart 2: simplified macro model for Germany calibrated with the data 1950-2010 and model forecast through 2030



Source: Empirical data: Bundesbank and the Federal Statistical Office, model values: own calculations.

[3] Available for download at www.ifara.eu

Our simplified macro model shows the significant effects of the core and net business savings rate on the interaction between financial assets and the real economy and has the following basic structure:

$$\frac{dY}{dt} = -p_n(t)K(t) \quad \text{and} \quad \frac{dK}{dt} = p_S(t)Y(t) + p_n(t)K(t)$$

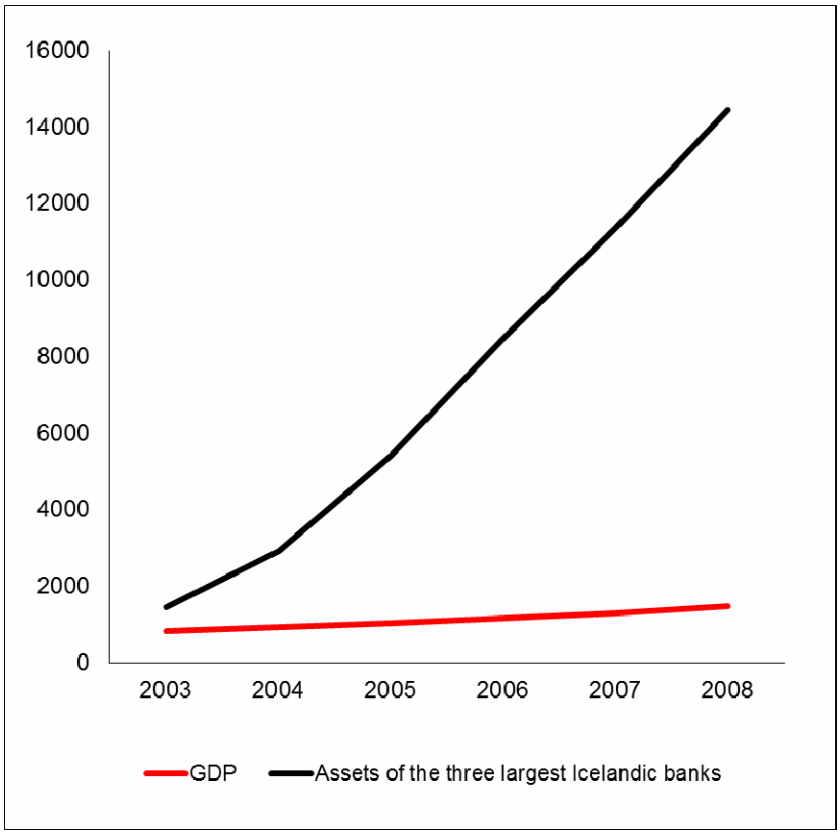
Flattening GDP growth in the final developmental phase is due to the fact that the required rate of return on investment can no longer be attained via sufficient growth in the real economy. Therefore, ever increasing amounts of debt need to be assumed to underpin GDP. This effect is ultimately self-reinforcing because the reduced (and finally negative) economic growth is accompanied by exponential growth in financial assets along with the related reduction in capital available for reinvestment in the productive capacity of the real economy. As a result, GDP shrinks. The model shows that sustained growth in financial assets as a percentage of the economy increases the very "financialization" necessary to meet the demands of financial asset growth.

The case of Iceland

Iceland, a country with approximately 300,000 inhabitants, makes for an excellent case study for "when such a process gets out of control". The pace of financialization in Iceland can be described as one of the fastest in the history of mankind. In only a few years, the assets of the three largest Icelandic banks increased to nearly ten times the country's GDP, as can be seen in chart 3. Icelandic banks funded their expansion with short-term loans in the interbank market and, in the later stages, through foreign depositors. In order to fight speculation and inflation, the Icelandic central bank increased interest rates to over 15%. But these very high interest rates attracted even more foreign savings, which in turn increased the Icelandic money supply and thus further fueled economic stress. When international banks ultimately refused to roll over loans in the interbank market, the whole system collapsed like a house of cards. The result of this crisis was soaring unemployment and inflation. The claims of foreign savers had to be written off to an unprecedented extent.

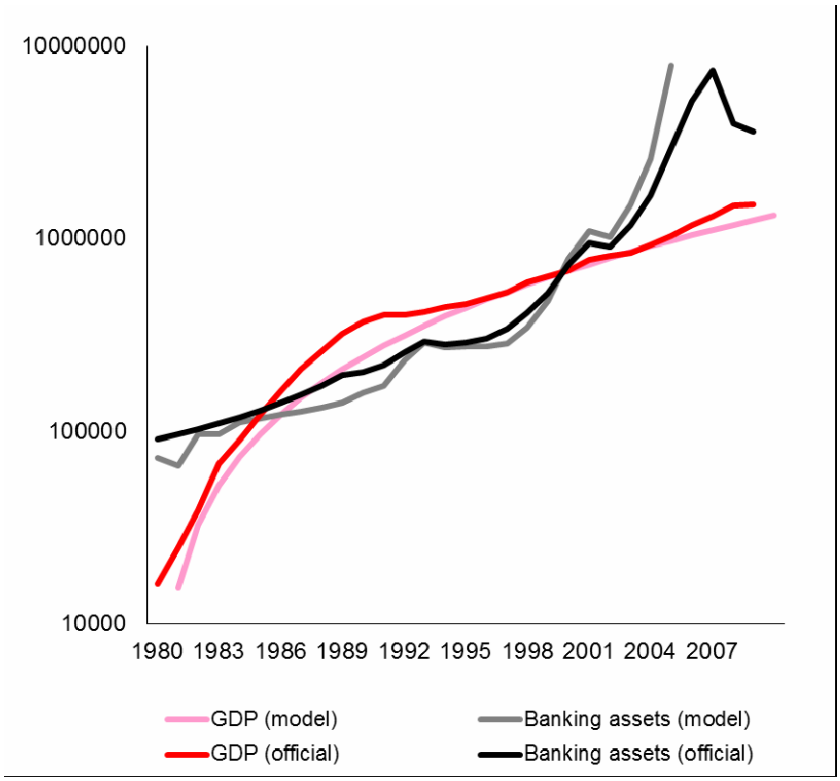
Noteworthy: even a simplistic version of our macro model reveals impressive predictive results when we "reproduce" the developments in Iceland, as can readily be seen in chart 4. For a more insightful depiction, a logarithmic representation was chosen.

Chart 3: Financialization in Iceland: Nominal GDP versus total assets of the three largest banks (2003-2008) in billion Icelandic kronas



Source: Iceland Central Bank

Chart 4: Simplified macro model for Iceland



Source: Empirical data (1980-2009): Icelandic Central Bank, Iceland's statistics office, model values (1980 - 2005); Own calculations.

The discrepancies between official data and model results stem from the fact that the underlying data of the Icelandic statistics compared to those of Germany are incomplete and had to be partially interpolated. In particular, during the final stages of development, the parameters a_0 and b_0 had non-zero values due to numerous rescue packages. However, these parameters could not be considered in the model due to the lack of official data for this same time period. Under these circumstances, material rescue packages in such states of economic development are necessary to prevent - or at least postpone - systemic collapse.
The case of Iceland drastically illustrates what can or could happen as a result of exponential financial asset growth. Most economists conclude that a similar development in Germany can be categorically ruled out because the local economy is far more robust and the industrial base much healthier. Although this statement is correct in principle, we should not forget that financialization has taken hold of Germany as well. Take for example corporate profits, which have increased steadily since 2003, in large part due to stagnating real wages in Germany. These profits, however, were not primarily reinvested into the real economy but were instead invested in financial assets (predominantly in higher yielding bonds of deficit countries in the Euro area). Between 2004 and 2009, the annual cumulative inflows of foreign net financial wealth climbed to 982 billion Euros. However, due to the recent write-downs this value has decreased by 455 billion Euros.[4]

Summary and outlook

A close mutual relationship exists between the financial sector and real economy. Capital can trigger economic growth. On the other hand, financial wealth cannot sustain itself indefinitely without an adequate "real economy" foundation. Since the financial sector is not represented in the mainstream macro models developed over the last 40 years, those models do not anticipate the shocks that spread through the entire financial system and affect the real economy. The goal of our macro model is to reveal the interactions between financial assets and the real economy in order to better understand the causes of systemic crises. For a better understanding of the economic balance sheet and the cause-effect chains of economic change, we can derive a number of interesting applications. Case in point: the model allows political and economic decision makers to measure the impact of their interactions within the whole system. In this way, systemic crisis can be forecasted and implications for investment strategies be examined. This topic will be discussed in a paper in progress.

Author contacts: D_Peetz@hotmail.com; Heribert.Genreith@t-online.de

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[4] See Schulmeister „Deutschland verbrennt sein Vermögen im Ausland", Handelsblatt 26.11.2010

The Return of the Bear

Steve Keen (University of Western Sydney, Australia)

Far be it from me to underestimate the stock market's capacity to pluck the embers of delusion from the fire of reality. However, the crash in prices and explosion in volatility that began in late July 2011 may be evidence that sanity is finally making a comeback. What many hoped was a new Bull Market from the depths of the 52% crash from October 2007 till March 2009 was instead a classic Bear Market rally, fuelled by the market's capacity for self-delusion, accelerating private debt, and—thanks to QE2—an ample supply of government-created liquidity. The 85% rise from March 2009 till April 2011 was enough to restore Wall Street's euphoria, but still fell short of the 110% rally needed to restore the 2007 peak.

That rally ended brutally in the last week of July. The S&P500 has fallen almost 250 points in less than a month, and is just a couple of per cent from a fully-fledged Bear Market.

Figure 15: Asset prices versus consumer prices since 1890

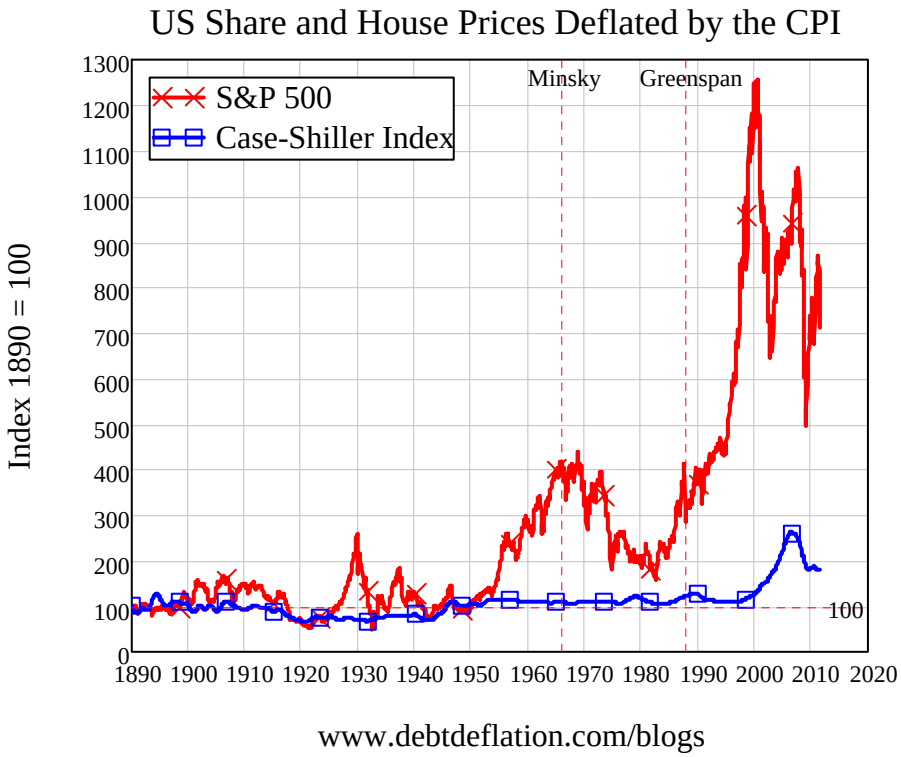
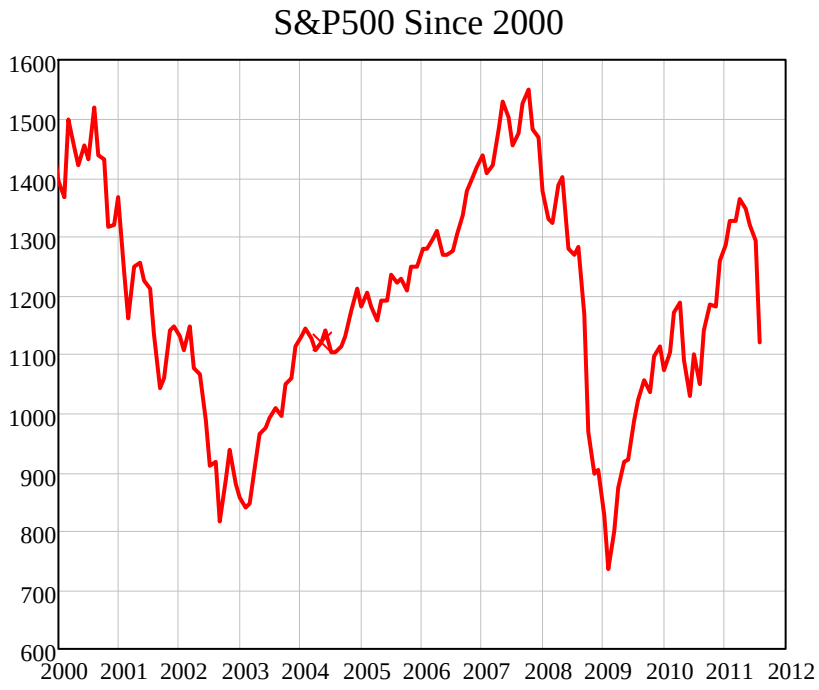


Figure 2: "Buy & Hold" anyone?



The belief that the financial crisis was behind us, that growth had resumed, and that a new bull market was wa ranted, have finally wilted in the face of the reality that growth is tepid at best, and likely to give way to the dreaded "Double Dip". The "Great Recession"—which Kenneth Rogoff correctly noted should really be called the Second Great Contraction—is therefore still with us, and will not end until private debt levels are dramatically lower than today's 260 per cent of GDP (see Figure 4).

Figure 3: Growth peters out

With reality back in vogue, it's time to revisit some of the key insights of the one great economic realist of the last 50 years, Hyman Minsky. A good place to start is Figure 1 above, which shows the relationship between asset prices and consumer prices in America over the last 120 years.

One essential aspect of Minsky's Financial Instability Hypothesis was the argument that there are two price levels in capitalism: consumer prices, which are largely set by a mark-up on the costs of production, and asset prices, which are determined by expectations and leverage. This argument originated with Keynes in Chapter 17 of the General Theory, when he noted that investment is motivated by the desire to produce "those assets of which the normal supply-price is less than the demand price" (J. M. Keynes, 1936, p. 228), and expressed more clearly in "The General Theory of Employment", where he argued that the scale of production of capital assets "depends, of course, on the relation between their costs of production and the prices which they are expected to realise in the market." (J. M. Keynes, 1937, p. 217). Minsky significantly elaborated upon this point, and this—as much as his focus upon uncertainty—was a key point of divergence from the neoclassical interpretation of Keynes:

> The perception that the quantity of money determines the price level of capital assets, for any given set of expectations with respect to quasi-rents and state of uncertainty, because it affects the financing conditions for positions in capital assets, implies that in a capitalist economy there are two "price levels," one of current output and the second of capital assets. A fundamental insight of Keynes is that an economic theory that is relevant to a capitalist economy must explicitly deal with these two sets of prices. Economic theory must be based upon a perception that there are two sets of prices to be determined, and they are determined in different markets and react to quite different phenomena. Thus, the relation of these prices-say, the ratio-varies, and the variations affect system behavior." When economic theory followed Sir John Hicks and phrased the liquidity preference function as a relation between the money supply and the interest rate, the deep significance of Keynesian theory as a theory of behavior of a capitalist economy was lost. (Hyman P. Minsky, 1982, p. 79)

Over the very long term, these two price levels have to converge, because ultimately the debt that finances asset purchases must be serviced by the sale of goods and services—you can't forever delay the Day of Reckoning by borrowing more money. But in the short term, a wedge can be driven between them by rising leverage.

Unfortunately, in modern capitalism, the short term can last a very long time. In America's case, this short term lasted 50 years, as debt rose from 43 per cent of GDP in 1945 to over 300 per cent in early 2009. The finance sector always has a proclivity to fund Ponzi Schemes, but since World War II this has been aided and abetted by a government and central bank nexus that sees rising asset prices as a good thing.

The most egregious cheerleader for asset price inflation was Alan Greenspan. That's why I've marked Greenspan on Figure 1and Figure 4: if his rescue of Wall Street after the 1987 Stock Market Crash hadn't occurred, it is quite possible that the unwinding of this speculative debt bubble could have begun twenty years earlier.

Figure 4: US private debt to GDP since 1920

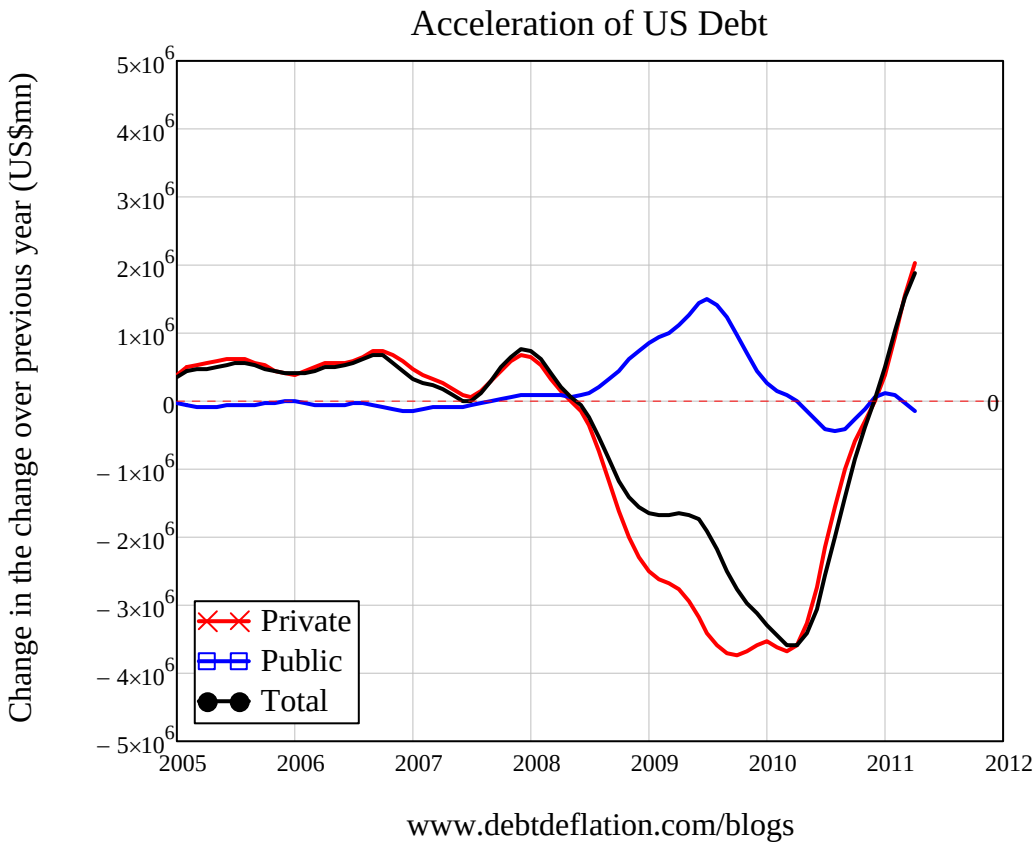
A mini-Depression would have resulted, as deleveraging drove aggregate demand below aggregate supply, but it would have been a much milder event than both the Great Depression and what we are experiencing now. The debt to GDP ratio in 1987 was slightly lower than at the start of the Great Depression (159 versus 172 per cent), inflation was higher (4.5 per cent versus half a per cent), and the "automatic stabilizers" of government spending and taxation would have attenuated the severity of the drop in aggregate demand.

Instead, Greenspan's rescue—and the "Greenspan Put" that resulted from numerous other rescues—encouraged the greatest debt bubble in history to form. This in turn drove the greatest divergence between asset and consumer prices that we've ever seen.

The crisis began in late 2007 because rising asset prices require not merely rising debt, but accelerating debt. The great acceleration in debt that the Federal Reserve encouraged and the US financial system eagerly financed, ended in 2008 (see Figure). From 1950 till 2008, the Credit Accelerator[1] averaged 1.1 per cent. In the depths of the downturn, it hit minus 26 per cent. With the motive force of accelerating debt removed, asset prices began their long overdue crash back to earth.

[1] This is the ratio of the acceleration in private debt to GDP. The concept was originally called the Credit Impulse by Biggs, Meyer et al 2010 (Biggs, Michael; Thomas Mayer and Andreas Pick. 2010. "Credit and Economic Recovery: Demystifying Phoenix Miracles." *SSRN eLibrary*.); I believe that Accelerator is a better term than Impulse. I am still refining the concept, and—as a dynamic modeler rather than a statistician—I may make some stumbles along the way. Nevertheless, the correlation between the Credit Accelerator and change in stock indices shown in Figure 7 is 0.26 over a 25 year period, and it is highly significant.

Figure 5: Acceleration of debt and the bear market rally



However the share market rebounded again because, partly under the influence of government and Central Bank policy, private debt accelerated once more even though, in the aggregate, *private debt was still falling*. The annual Credit Accelerator turned around from minus 26 per cent in 2010 to plus 3 per cent in early 2011.

This in turn fed into the stock market, causing one of the biggest year-on-year rallies ever seen (see Figure). But it could not be sustained because, if debt continued to accelerate, then ultimately the level of debt relative to income would again start to rise. With all sectors of the US economy maxed out on credit (apart from the Government itself), this wasn't going to happen. The impetus from the Credit Accelerator thus ran out, and the Stock Market began its plunge back toward reality.

Figure 6: Private debt accelerated even though the level was still falling

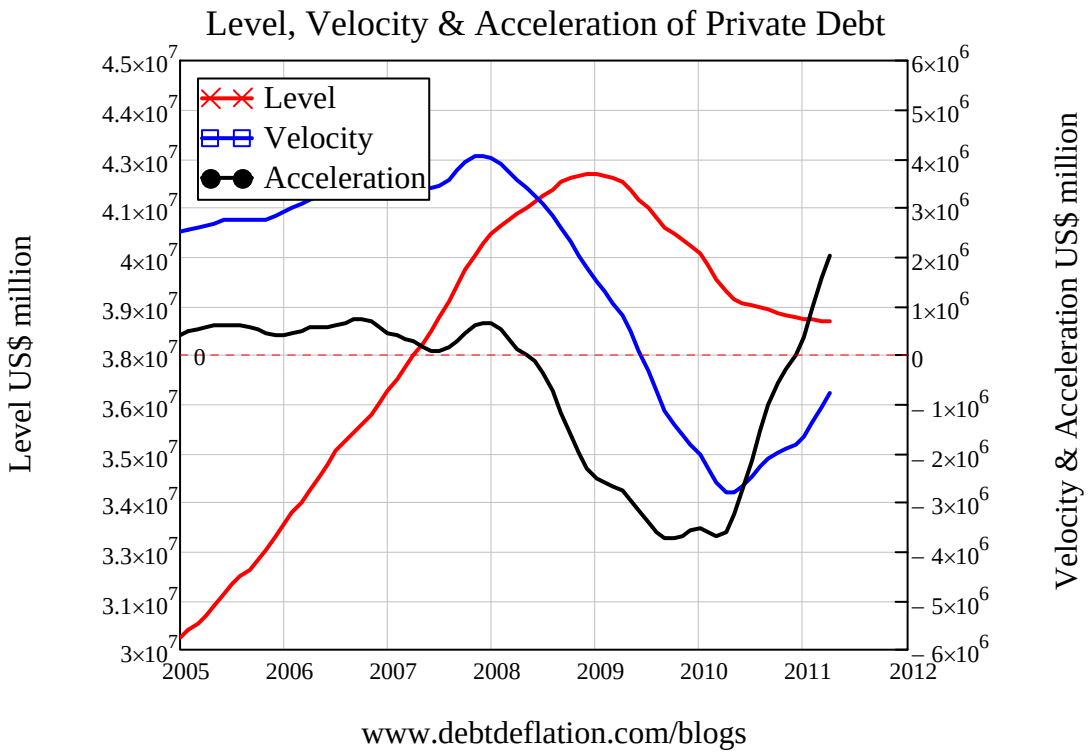
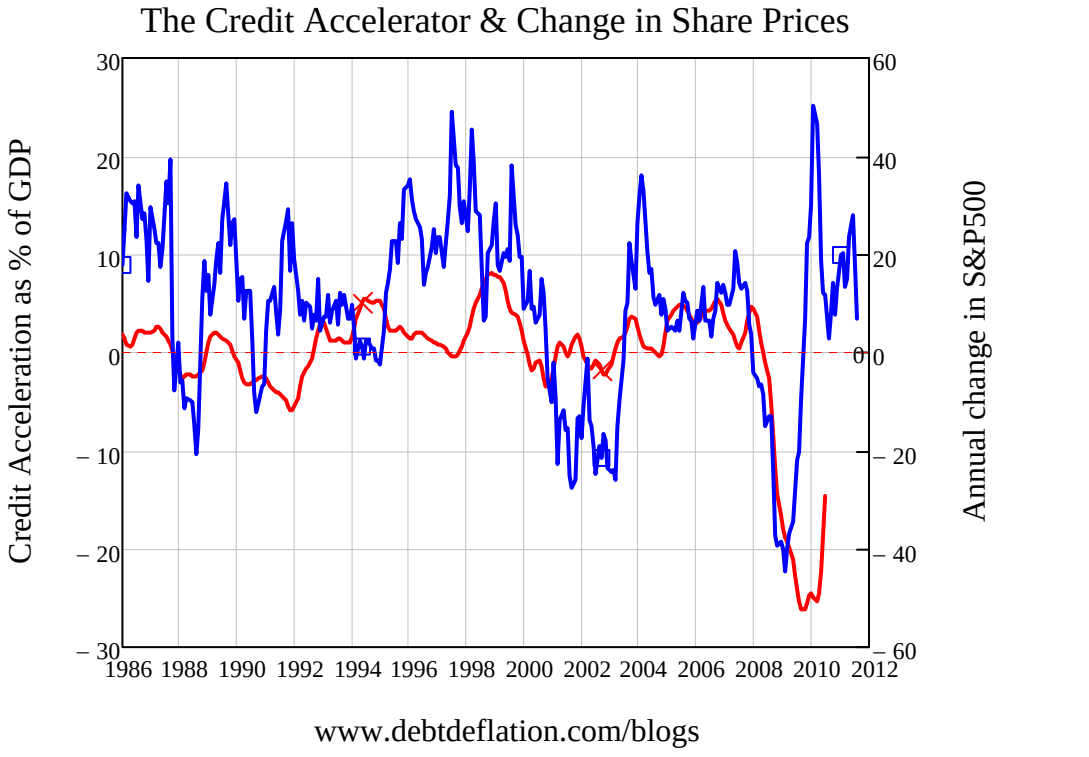


Figure 7: Accelerating debt drives rising share prices--and decelerating debt causes crashes



The stock market could easily bounce again from its current levels if, once again, the rate of decline of debt slows down. But in an environment where deleveraging dominates, deceleration will be the dominant trend in debt, and the unwinding of asset prices back towards consumer prices will continue.

How far could it go? Take another look at Figure 1. The CPI-deflated share market index averaged 113 from 1890 till 1950, with no trend at all: by 1950 it was back to the level of 1890. But from 1950 on, it rose till a peak of 438 in 1966—which is the year that Hyman Minsky identified as the point at which the US passed from a financially robust to a financially fragile system. Writing in 1982, he observed that:

> A close examination of experience since World War II shows that the era quite naturally falls into two parts. The first part, which ran for almost twenty years (1948-1966), was an era of largely tranquil progress. This was followed by an era of increasing turbulence, which has continued until today. (Hyman P. Minsky, 1982, p. 6)[2]

From then, it slid back towards the long term norm, under the influence of the economic chaos of the late 60s to early 80s, only to take off in 1984 when debt began to accelerate markedly once more (See the inflexion point in 1984 in Figure 4). From its post-1966 low of 157 in mid-1982, the CPI-deflated S&P500 index rose to 471 in 1994 as the 1990s recession ended, and then took off towards the stratosphere during the Telecommunications and DotCom bubbles of the 1990s. Its peak of 1256 in mid-2000 was more than ten times the pre-1950 average.

Even after the falls of the past week, it is still at 709, while private debt, even after falling by 40% of GDP since 2009, is still 90 per cent of GDP above the level that precipitated the Great Depression—leaving plenty of energy in the debt-deleveraging process to take asset prices further down.

There CPI-deflated share index doesn't have to return to the level of 1890-1950—especially since companies like Berkshire-Hathaway that don't pay dividends give a legitimate reason for share prices to rise relative to consumer prices over time.[3] But a fall of at least 50 per cent is needed simply to bring the ratio back to its 1960s level.

Welcome to the Bear Market and the Second Great Contraction.

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Biggs, Michael; Thomas Mayer and Andreas Pick. 2010. "Credit and Economic Recovery: Demystifying Phoenix Miracles." SSRN eLibrary.

[2] Minsky elaborated that "Instead of an inflationary explosion at the war's end, there was a gradual and often tentative expansion of debt-financed spending by households and business firms. The newfound liquidity was gradually absorbed, and the regulations and standards that determined permissible contracts were gradually relaxed. Only as the successful performance of the economy attenuated the fear of another great depression did households, businesses, and financial institutions increase the ratios of debts to income and of debts to liquid assets so that these ratios rose to levels that had ruled prior to the Great Depression. **As the financial system became more heavily weighted with layered private debts, the susceptibility of the financial structure to disturbances increased. With these disturbances, the economy moved to the turbulent regime that still rules**." (pp. 7- 8; emphasis added)

[3] However these firms are in the minority; they attenuate the degree of divergence between share and consumer prices, but they are a sideshow compared to the explosion in the ratio since 1982.

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Tax havens, secrecy jurisdictions and the breakdown of corporation tax

Richard Murphy[1] (Tax Research, UK)

United Kingdom: a case history

In March 2011, the Chancellor of the Exchequer, the British cabinet minister who is responsible for all economic and financial matters, announced in his budget statement three major changes to UK corporation tax.

The first was that the rate for large companies in the UK was set to fall to 23%. The second was that the UK would move to a corporate tax system where only the profits of companies arising in the UK would be subject to UK corporation tax; this representing a compete reversal of the situation that existed prior to 2009 when UK companies were (albeit convolutedly) taxable on their worldwide income. And thirdly he announced that if in the future a UK company runs its internal banking arrangements through a tax haven subsidiary then that company will benefit from a special UK tax rate of just 5.75 per cent of the resulting profits.

Such a thing has never happened before. First, the Chancellor has swept aside a tradition dating from just after capital account liberalisation took place in the UK[2] in 1979. In 1984 the UK introduced what are known as Controlled Foreign Company (CFC) rules[3] into its tax code. These allowed it to deem subsidiaries of UK parent companies located in tax havens to be UK tax resident, and so UK taxable. The whole purpose was to prevent a company relocating its profits, and most especially those arising on financing charges, to tax havens. And yet the new UK law is designed to encourage precisely this tax haven activity by UK owned parent companies by allowing it to be undertaken and to be deemed to be in the UK but to then be taxed at a new tax rate that is exceptionally low: the lowest indeed offered on corporate profits anywhere within the European Union or Organisation for Economic Cooperation and Development[4]. Extraordinarily, this activity has always been considered aggressive tax avoidance to date.

As a result in one announcement Osborne summarised a change in attitude in UK taxation that will delight corporate tax avoiders everywhere: what he was saying was that the UK will now condone tax haven activity undertaken by UK parent companies in locations such as the Cayman Islands, Jersey and the Isle of Man. By 2016 it is expected that more than one

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[1] Richard Murphy is a co-author of 'Tax Havens: How Globalization Really Works', Cornell University Press, 2009.

[2] See, for example, Quinn, D. and Voth, H., 2007, Free Flows, Limited Diversification: Explaining the Fall and Rise of Stock Market Correlations, 1890-2001 http://www.cepr.org/meets/wkcn/1/1688/papers/Voth.pdf accessed 25-5-11

[3] http://www.ukbudget.com/UKBudget2010/business/UKBudget2010-business-Controlled-foreign-companies-reform.cfm accessed 25-5-11.

[4] Based on a review of rates noted in KPMG's annual survey of corporate tax rates at http://www.kpmg.com/Global/en/IssuesAndInsights/ArticlesPublications/Documents/Corp-and-Indirect-Tax-Oct12-2010.pdf

sixth of UK corporation tax will come from the offshore activities of UK companies[5]. It is an astonishing change in attitude to tax haven activity.

Definitions of 'tax haven'

It's all the more astonishing because no one has yet offered a definition of 'tax haven' on which everyone can agree[6]. The IMF, the OECD and the other main agencies tend to adopt the language they think acceptable to their own constituency. The term 'tax haven' is too obviously value laden, as the French translation (*paradis fiscal*) makes clear. 'Offshore', too, conjures images of island paradises, and besides, some of the locations involved – Liechtenstein, for example – are landlocked. 'International financial centre', a creation of the financial services industry, seems designed solely to give an air of respectability.

The reality is that there are at least four primary uses for 'tax haven' locations[7]. First, they are used by those wishing to avoid or evade their obligation to pay tax. Tax avoidance is legal, but outside the spirit of taxation law, while tax evasion is always an illegal activity involving the non-disclosure of a source of income to a taxation authority that has a legal right to know about it.

Second, they are used to hide criminal activities from view. That criminal activity might be tax evasion itself, but might also be money-laundering or crimes generating cash that needs to be laundered – theft, fraud, corruption, insider dealing, piracy, financing of terrorism, drug trafficking, human trafficking, counterfeiting, bribery and extortion.

Third, they are used by those who want their activities to be anonymous, even if they are entirely legitimate. Some people wish to hide their wealth from their spouses, for example; others might want to conduct trade which, though legitimate, might risk their reputation.

Fourth, they are used by those seeking somewhere cheaper to do business; in these locations they can usually avoid the costly obligation to comply with regulations that would apply if the transaction in question were undertaken.

Secrecy jurisdictions

The need for anonymity is common to all these cases. Transactions in these locations take place in what one might call the 'secrecy world'[8]. Secrecy is a property right like any other. To create and protect it requires the rule of law. Governments that choose to create laws permitting the existence of the secrecy world must have status as international

[5] Table c.3 of HM Treasury March 2011 Budget Statement http://cdn.hm-treasury.gov.uk/2011budget_complete.pdf , accessed 25-5-11.

[6] Palan, R., Murphy, R., and Chavagneuc, C. 2010 'Tax Havens: How globalisation really works', Cornell University Press, pages 18 – 30.

[7] Murphy, R. 2008 'Creating Turmoil', Tax Justice Network, p34 http://www.taxresearch.org.uk/Documents/CreatingTurmoil.pdf , accessed 25-5-11.

[8] Much of the liguistic analysis that follows is based on Murphy, R, 2009, Rethinking the language of 'offshore', Tax Justice Network http://www.secrecyjurisdictions.com/PDF/SecrecyWorld.pdf

jurisdictions (although not necessarily as countries, as the British Crown Dependencies demonstrate). Since no jurisdiction willingly undermines its own laws, the secrecy such a jurisdiction provides can be used only by people residing outside its own domain. The regulations created by these 'secrecy jurisdictions' are designed to undermine the legislation or regulations of another jurisdiction. To facilitate matters, secrecy jurisdictions also create a legally backed veil of secrecy to ensure that those making use of its regulations cannot be identified as doing so.

Secrecy jurisdictions undertake this activity to raise revenue by collecting fees from registering companies. They may also charge fees for the regulation of the financial services industry located in their domain. And they may well collect significant amounts of tax on the personal earnings of anyone working in that industry, through income tax or sales taxes. In some locations, such as Jersey, taxes on the profits of banks comprise a significant part of the state's revenue and the financial services industry accounts for half of GDP[9].

All this is possible because secrecy jurisdictions create the structures that the financial services industry sells access to from these locations[10]. Typical among these structures are tax haven companies. These are extremely secretive: no information about them is made available on any public register, and very often the local tax authorities know nothing about them either. Yet even that level of secrecy tends to be insufficient for those engaged in offshore activities. The tax haven companies are almost invariably owned by trusts, which trusts are also registered offshore, and are run by the local financial services industry through specialist companies. The trusts are completely anonymous: there is no record of them on any public register; they are not taxed locally and so local tax authorities know nothing of them. The person creating them is not identified in the trust documentation, and the documentation never specifies who the beneficiaries are. An offshore company owned by an offshore trust creates an almost impermeable barrier to inquiry, equivalent to the banking secrecy offered by places like Switzerland, not least to law enforcement agencies and tax authorities around the world – hence the reputation offshore has for assisting crime.

The bankers, lawyers and accountants who operate from secrecy jurisdictions, who I collectively term the 'secrecy providers', provide 'secrecy services' to their clients. Collectively these secrecy providers comprise what have been called 'offshore finance centres' or 'international finance centres'. Both terms suggest a focus on finance, but that is misleading. Secrecy is the primary product sold by secrecy providers from secrecy jurisdictions. Without it the other services sold would not be viable.

It is important to realise that the customers for secrecy services will never be found in the secrecy jurisdiction in which their secrecy provider is located. They are always located 'elsewhere' – that is, somewhere outside the secrecy jurisdiction's domain. 'Elsewhere' is, in many ways, a more appropriate term than 'offshore'. The concept of 'elsewhere' allows secrecy jurisdictions, secrecy providers and their customers to maintain the claim that they are conducting legitimate, well-regulated business activity, because the substance of the transactions arranged by secrecy providers always takes place 'elsewhere' as far as the secrecy jurisdiction is concerned. Regulatory compliance within the secrecy jurisdiction is, as a result, easy to engineer, because nothing happens there. But, owing to the secrecy that the

[9] See Meinzer, M. 2009, Share of Financial Services in GDP, Tax Justice Network http://www.secrecyjurisdictions.com/PDF/FS_to_GDP.pdf

[10] Palan, Murphy & Chavagneux, Chapter 3.

secrecy jurisdiction provides, transactions undertaken 'elsewhere' will also fall outside regulation in the place where their substance really occurs: that, of course, is the intention.

So, for example, secrecy jurisdictions argue that because the transactions secrecy providers arrange take place 'elsewhere', they are not taxable within the secrecy jurisdiction because those places choose not to tax transactions outside their domain. They then insist that declaring these transactions where their substance really arises – wherever 'elsewhere' might be – is the responsibility of their clients. That way the secrecy providers are able to argue that they are fully tax compliant.

We might think of this domain, in which the real transactions arranged by real secrecy providers take place, as the 'secrecy space'. It is always 'elsewhere', and in that sense does not exist, but the willingness of secrecy providers, their clients, governments and authorities to behave as if it did creates the libertarian dream of an ungoverned domain for the making of unregulated profit. What this means though is that multinational corporations do not really have offshore operations: they simply record some transactions in the secrecy space. George Osborne's corporation taxation reforms give the clearest possible indication that the UK Treasury has accepted the legitimacy of the secrecy space.

Those changes will inevitably result in a loss of tax revenue to the UK. Serious as that is, there will be other consequences too. The UK is actively encouraging companies to conduct transactions in the secrecy world, but who will regulate the resulting trade? Just as important, what are the implications for governance when a government and major corporations condone the use of a space that exists only as a legal fabrication? How can we even estimate, still less do anything about the risks associated with the secrecy space but which can, and so emphatically did in 2008, have domestic and global implications?

Conclusion

Unaccountably, professional economists have almost entirely ignored the issue of tax havens. The few tax academics who have examined them argue that tax havens are beneficial[11]. And yet it is obvious that tax havens, by denying access to information, are an aberration in neoclassical economic theory bound to result in the misallocation of resources in a market system. To some in the market – individuals as well as corporations – tax havens are, needless to say, of enormous benefit. Those who have access to them will, given the prices charged, be those with access to significant wealth. They reduce their effective tax rates by cloaking their tax avoidance and tax evasions in secrecy; their capital increases exponentially quicker than others' as a result; this fact is hidden from view and, as a result, does not attract comment. No wonder tax havens continue to survive. But the question that needs to be asked is, who is paying the price of that survival, and should they be doing so?

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[11] A perfect example comes from Prof James R Hines of University of Michigan, a regular apologist for tax haven activity, in an article entitled 'Treasure Islands', 2010, Journal of Economic Perspectives—Volume 24, Number 4—Fall 2010—Pages 103–126 http://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.24.4.103

China and India:

A comparative analysis of their integration into the global economy

Mazhar Siraj (Save the Children, Pakistan)

Abstract
Global integration of China and India has had quite different effects on the structural pattern of their economic growth. Manufacturing became the engine of economic growth in the former whereas the latter thrived due to the rapid growth of services sector. The implications of their present patterns of growth seem to be very favourable for long-term development. However, employment effects of their integration into the global economy are quite similar, and are evident in fast growth of labour, migration of skilled labour force to developed countries, decline of employment in formal sector and slow growth of regular wage employment. In this context, sustainability of the fast economic growth of China and India depends largely on the extent to which they are able to generate a process for steady expansion of regular wage employment and productivity of low skilled labour force.

Key Words: economic growth, employment, labour, China, India

Introduction

Over the past two to three decades, China and India have attained spectacular prominence due to their rapid and sustained economic progress. The Chinese economy has been thriving at almost double-digit growth rates since 1980. Although the Indian economy did not grow as fast as China's, it has nevertheless been among the ten fastest growing economies in the world over each of the two decades, 1980-1990 and 1990-2000 (Izurieta and Singh, 2008, p.2). The unprecedented economic success is popularly attributed, largely, to the integration of these countries into the global economy (see Chow, 2007, p.9; Nolan, 2004, p.2; Mahtaney, 2007, p.14; Rodrik and Subramanian, 2004, p.1; Ahluwalia, 2002, p.87). Increasingly, the effects of their integration, particularly on economic growth and employment, are becoming an important terrain of academic inquiry. On this topic, a broad-brush review of the recent literature suggests that increased integration into the global economy has had quite different effects on economic growth in China and India. However, employment effects of the integration are quite similar for both countries. This review points out a paradox which calls for a cautious analysis of empirical facts in a comparative perspective.

In this context, I attempt to assess the above proposition empirically and discuss its implications. I begin by outlining an analytical framework which is generally applied to explain the empirical effects of increased integration into the global economy in light of the predictions of mainstream economic theory. The rationale for this framework derives from the need to identify some important dimensions of economic growth and employment that need to be taken into account in the analysis. Then, differences in effects of global integration on economic growth and similarities in employment outcomes are discussed in two separate sections. Obviously, the employment effects cannot be explained without a reference to the economic growth effects, and therefore, linkages will be drawn between the two sections. The last section summarizes key points of the analysis and draws conclusions.

Before proceeding further, it seems pertinent to delineate three important caveats. First, the statistical data on employment suffer from a number of important limitations (Ghose, 2008, p.47), and therefore do not allow a coherent comparison between China and India. Particularly, the data for same periods on a given set of variables are not readily available, but

an effort has been made to include statistics from a variety of sources to plug in the gaps in years as much as possible. Secondly, our discussion begins within a broad analytical context, but then gradually concentrates on two dimensions of economic growth (composition of Gross Domestic Product [GDP] and international trade, mainly exports) and two dimensions of employment (employment by sector and by type). Thirdly, it is presumed that the reader is familiar with key terms and categories related to economic growth and employment (such as formal and informal sector, regular wage employment, manufacturing, merchandise, etc.), as they are used in the literature on China and India. These categories are not defined here, except in such cases where a non-standard definition is used.

Analytical Framework

What does economic theory tell us as far as the effects of increased integration on economic growth and employment are concerned? In order to answer this question, we need to first specify, what is meant by "integration"? In general, the term refers to liberalisation and openness of an economy in the corridors of market-driven globalisation (Kozul-Wright and Rayment, 2007, p.29). The term has been defined more concisely by Izurieta and Singh (2008, p.1) in the specific context of China and India as follows: China's and India's "integration is taking place under 'current globalisation,' which consists of free-trade, free capital movements and domestic labour market flexibility (instead of free international movement of labour)". In this sense, the term "integration" is distinct from "globalisation"; the latter is an instrumentality for achieving the former (Mahtaney, 2007, p.197). This distinction guides our discussion in the remainder of the article.

Ghose, Majid and Ernst (2008, p.102) explain that at the domestic level, orthodox economic theory predicts that increased integration into the global economy creates the basic stimulus for structural change in the formal sector of the economy and defines the role of foreign capital. The motivation to increase exports brings comparative advantage in labour-intensive industries into play and fosters competition from imports thereby creating pressure for technological improvement in import-substitution industries. Moreover, free trade has a stimulating effect on output growth in developing countries through higher labour productivity by promoting specialization, encouraging the economies of scale, and facilitating technological innovations. As a result, employment growth in the formal sector takes place when labour-intensive industries expand faster than capital-intensive industries. Thus, employment per unit of output increases. However, when capital- and skill-intensive industries displace labour-intensive industries, employment growth in the formal sector is restrained, but accompanied by growth of productivity.

Ghose et al. (2008, pp.103-06) further elaborate that the employment effects of foreign capital and trade growth are largely confined to the formal sector, given that most tradable goods and services are produced in this sector. In the informal sector, neither capital inflow nor trade growth directly affects the output nor employment, as it largely produces goods and services for domestic consumption. Moreover, it does not receive inflows of foreign capital. However, export-orientation of a country necessitates a reallocation of investment from sectors producing non-tradable goods and services into sectors producing tradable goods and services.

At the global level, the analytical framework is derived from the standard trade theory. According to Ghose (2003, pp.43-45), the theory assumes that the advanced countries have

a higher proportion of skilled workers and therefore, have a potential comparative advantage in the production of skill-intensive manufactured goods. By contrast, the developing countries have a potential comparative advantage in the production of unskilled-labour-intensive manufactured goods. The theory predicts that free trade adversely affects employment conditions of unskilled labour in industrialized countries but benefits unskilled labour in developing countries. The opposite is true for skilled labour. The overall effects on employment depend on labour market regulations and institutions. If wages are difficult to change, total employment falls. It is important to note that such predictions are based on important assumptions, which may not correspond to realities. The comparative advantage of skilled-labour of advanced countries as predicted by the trade theory, for example, does not hold true for China and India due to increased outsourcing. This point will be further elaborated in the following sections.

Differences in effects of global integration on economic growth

During the past two to three decades, China and India have attained extraordinary levels of economic progress by any standard. During 1980-90, China's and India's GDP grew at an average rate of 10.3 per cent and 5.7 per cent per year, respectively (Srinivasan, 2006, p.3716). During 2005-07, the average growth rates were even higher at 11.7 per cent for China and 9.6 per cent for India (World Bank, 2009). Although India's GDP growth has been lower than China, it is still remarkable as compared to its so-called 'Hindu growth rate' of 3.6 per cent per year between 1951-52 and 1980-81 (Acharya, 2004, p.4537). Indeed, as Srinivasan (2006, p.3716) has observed, China and India are the only countries in the world which have been able to sustain their rapid growth over two and a half decades since 1980, regardless of occasional fluctuations.

As indicated earlier, it is widely believed that the spectacular economic performance of China and India is a result, largely, of their market-oriented reforms that were geared towards integration into the global economy. Apparently, the integration is characterized by some common dimensions. For example, both countries have traversed the path to openness and liberalisation quite slowly, unlike most developing countries. This strategy is aptly described for China in terms of “crossing the river while feeling the rocks” (Deng in Chow, 2007, p.59) and in terms of “gradualism” for India (Ahluwalia, 2002, p.67). More importantly, GDP grew sharply in both countries as a result of their transition towards market economy. This phenomenon urges one to think that the integration may have similar effects on economic growth in China and India, but it may be misleading because the change in mere growth rates in similar (upward) direction hides many deeper and differential effects of the integration process. But what are those effects?

The answer to this question must be explored through the lens of broader context in which the integration process was initiated in both countries. Substantial initial differences are documented in a vast body of literature. In China, the transition from the planned economy to market economy began with the introduction of wide-ranging economic reforms in 1978. Unpopularity of the Cultural Revolution, greater realization of the shortcomings of the planned economy, inspiration from success of market-oriented economies in East Asian countries, and the urge in Chinese people for a change were the four main reasons that motivated the Community Party of China to move away from the centrally planned economy (Chow, 2007, p.46). The reforms led to the widespread introduction of contract system, wider enterprise autonomy, corporatization, and floatation of part of companies' equity on domestic and

international stock markets by 1990s. “Market forces, including market-driven prices and entrepreneurship gradually permeated the economy...[c]ontrols over foreign trade were relaxed slowly over the course of two decades, and given a final impetus by China finally joining the WTO at the end of 2001” (Nolan, 2004, p.2).

By contrast, India embarked on economic reforms in a systematic way only in 1991 in the wake of an exceptionally severe balance of payment crisis (Ahluwalia, 2002, p.67). However, a spate of analytical papers have confirmed that India had already begun to move away from the socialist economy to market-economy which caused the break in trend growth rate in 1980-81 (see, for example, Sinha and Tejani 2004; Rodrik and Subramanian 2004; Panagariya 2004; Virmani 2004; Kohli 2006). Two waves of reforms – first in the early 1980s and the second in 1991 - substantially changed fundamental structure of the Indian economy through elimination of quantitative controls on imports of industrial machinery, reduction in tariffs on imports of capital goods, modest tax system rationalization, reduction in number of industries subject to government licensing, increase in foreign direct investment, expansion of the role of private sector, dismantling of import controls, lowering of customs duties, flexible exchange rate, and foreign investment, and a restructuring of government’s role in the Indian economy.

Although India entered into the global economy after a decade than China, the literature treats the pre- and early 1980s as the pre-reform era and post-1991 as the post-reform era for both countries (see, for example, Nolan, 2004; Knight and Song, 3005; Ahluwalia, 2002). The reason is obvious, i.e. although the economic reforms began in early 1980s, it was not until early 1990s that the integration process deepened through more open economy with greater reliance on market forces, larger role for the private sector and foreign direct investment in China (Chow, 2007, p.58) and in India (Ahluwalia, 2002, p.67). I shall use these reference periods for our comparative analysis below.

Despite some similarities in the nature of reforms, China and India pursued quite divergent growth strategies from the very beginning, which led to different outputs as the integration proceeded. This is evident from sharp differences in the sectoral composition of GDP. The share of agriculture in GDP was not much different in China (36.1 per cent) and India (38.1 per cent) in the pre-reform period. The share reduced dramatically during 1990s in both countries, but more so in China. In 2005, agriculture constituted just 11.4 per cent of China's GDP, as compared to India's 19.6 per cent (Table 1). While industrialisation in the wake of increased integration led to reduction of agriculture’s share in GDP, effects have had been quite different on the shares of industry and services sectors.

Table 1: Sectoral Composition of GDP of China and India (% of GDP)

	China				India			
	1980	1990	1997	2005	1980	1990	1997	2005
Agriculture	36.1	26.8	17.1	11.4	38.1	33.0	24.5	19.6
Manufacturing	25.4	25.3	31.1	34.1	17.7	16.7	17.7	15.1
Other industries	08.2	08.6	13.8	14.3	03.2	n/a	05.0	04.3
Services	30.3	39.3	38.0	40.2	41.0	41.0	50.6	61.1

Sources: (1) China: Calculated by Ghose 2009, from World Bank's World Development Indicators database.
(2) India: Reserve Bank of India 2008; Panagriya 2008: 283.

When the reforms began, China was already substantially industrialized, as manufacturing and other industries together were 33.6 per cent of its GDP in 1980. China's manufacturing sector has grown steadily since 1980 along with other industries. By contrast, industry's share in India's GDP was just 20.9 per cent in 1980 and has not registered significant growth. In sharp contrast with manufacturing-led growth of China, India's growth is led by the services sector. Nevertheless, the share of services in China's GDP was also significant at 30.3 per cent in 1980, it increased to 40.2 per cent in 2005. By contrast, India's services sector expanded more than twice the growth of China's services sector during the same period.

If we examine this output structure in relation to key measures of integration, the differences become clearer. China's share of exports in GDP was 18 per cent in 1990, which jumped to 34 per cent in 2004. India's share of exports in GDP rose to 19 per cent from 7 per cent during the same period, indicating that India remains less export-oriented as compared to China. Conversely, India is less dependent on imports than China, measured as a percentage of GDP. The share of world merchandise exports has also risen in the post-reform period, much faster in China. Similarly, the share in world exports of commercial services has increased from 1.6 per cent in 1994 to 2.9 per cent in 2004 for China and from 0.6 per cent to 1.9 per cent for India during the same period (Table 2).

The increase in share of exports hides many differences in the effects of integration on comparative advantages of China and India in trade. The shares of agricultural products, merchandise and services in total exports steadily decreased whereas that of manufactures sharply increased in China between 1984 and 2005. The bulk (91.1 per cent) of total exports of China in 2005 comprised manufactures and other merchandise. The picture of India is quite different in the sense that the exports of both manufactures and services increased substantially in the post-reform period, but its manufactures exports were about a half of China's. On the other hand, its share of services exports was almost three times higher than that of China in 2005 (Table 3).

Table 2: Measures of China's and India's Integration with World Economy (% of Total)

	China			India		
	1983	1994	2004	1983	1994	2004
Share in GDP of exports of goods and services	n/a 1	18 2	34	n/a	7 2	19
Share in GDP of imports of goods and services	n/a	16 2	31	n/a	9 2	23
Share in world merchandise exports	1.2	2.8	6.7	0.5	0.6	0.8
Share in world merchandise imports	1.1	2.6	6.1	0.7	0.6	1.1
Country share in world exports of commercial services	n/a	1.6	2.9	n/a	0.6	1.9
Country share in world imports of commercial services	n/a	1.5	3.4	n/a	0.8	2.0

Notes: (1) Data are not available; (2) Shares are for 1990.
Source: Srinivasan, 2006.

Table 3: Export Structure of China and India by Sector (% of total exports)

	Agriculture	Manufactures	Merchandise 1	Services
China				
1984	18.9	43.0	47.3	9.7
1990	14.7	65.4	26.0	8.6
1997	7.5	75.2	12.9	11.8
2005	3.4	83.7	7.4	8.9
India				
1983	16.8	31.0	30.2	21.9
1990	13.5	48.6	20.2	17.7
1993	13.2	51.8	18.4	16.6
2000	9.2	49.9	15.3	25.7
2005	6.3	42.2	17.8	33.7

Note: (1) Includes primary commodities and non-manufactured goods.
Source: Ghose, 2009.

What are the implications of the differential impact of increased integration on economic growth of China and India? Internationally, the economic growth of these two countries has taken the advanced countries by surprise because the former poses formidable competition in the manufacturing sector and the latter in the services sector. It is believed that China and India will have much larger impact on the composition of world trade than Japan and South Korea (Mahtaney, 2007, p.170). Nationally, the implications of the present patterns of growth in China and India seem to be quite favourable for long-term development, but serious concerns exist about the employment effects of their global integration.

Similarities in effects of global integration on employment

Prior to the economic reforms in 1978, unemployment was not a problem in China because workers were guaranteed employment through direct allocation of jobs, administrative control of remuneration and strict restrictions on migration between rural and urban areas (Ghose, 2008, p.49). Thus, in effect, there was no labour market wherein demand and supply factors could interact to determine the employment conditions (Knight and Song, 2005, p.3). The state control on labour supply prevented open unemployment to emerge, but led to a gradual accumulation of surplus labour in production units in both urban and rural areas. As China's integration into the global economy progressed, the rigid labour policies were gradually dismantled giving way to contracted tenure, minimum wage laws, migration between urban and rural areas and privatisation of small and medium state-owned enterprises (SOEs) and shedding of workers from state enterprises (Ghose, 2004, pp.49-50). Knight and Song (2005, p.3) note that the emergence of private enterprises created greater flexibility, but China still does not have a free labour market. By contrast, a labour market existed in India at the onset of its first wave of economic reforms in the early 1980s. However, it has had been far from perfect due to rigid labour laws, which effectively convert labour from a variable to a fixed factor of production (Acharya, 2004, p.4538). Nevertheless, India's need to reform labour market in line with the liberalisation policies was lesser, as compared to China, as the allocation of the Indian labour force was not controlled by the state.

A major effect accompanied by the increased integration is the rise of unemployment as a key problem in both China and India. According to Ghose (2008, p.50), employment in China grew at a rate of one per cent per annum, but the rate of unemployment increased from less than one per cent in 1990 to 2.7 per cent in 2005. In urban areas, the rate of unemployment was higher, as it increased from 3.4 per cent in 1990 to 7.1 per cent in 2005. The growth of unemployment was due to a process of speedy reduction of the surplus labour that the state and collective enterprises in both urban and rural areas had accumulated in the pre-reform period. Both types of enterprises shed labour hugely, resulting in a loss of 66 million jobs between 1997 and 2005. Most of the shed skilled-workers moved either to new formal jobs in the emerging non-state enterprises, or to non-formal jobs in the growing Township and Village Enterprises (TVEs) and private enterprises and individual businesses (PEIB). However, many of the low-skilled urban workers failed to find new jobs which increased unemployment (Ghose, 2008, p.51).

India's unemployment problem is not as serious as in China up till now, but it poses a serious policy challenge in the near future. Ghose's (2004, p.5111) estimates indicate that the rate of unemployment in India was just 2.8 per cent in 2000, which would be taken to indicate full employment by the standards of advanced countries. This led him to conclude, “unemployment is clearly not a problem that deserves priority attention” (Ghose 2004, p.5112). But according to his latest estimates, the rate of unemployment in India increased to 4.5 per cent in 2004-05 (Ghose, 2009). This increase indicates that, even if unemployment were not a serious problem now, it is fast becoming a source of apprehension, which could best be explained by looking at the inter-sector shifts as follows.

The bulk of the labour force was in agriculture in both China and India in the early 1980s, more so in India (Table 4). Thus, surplus labour was potentially available to both countries for Lewis-type growth, surplus workers could be transferred from agriculture to industry. Since 1980, labour force has steadily decreased in agriculture, but substantial part of it has been absorbed by industry in China and to a lesser extent in India. This is because the manufacturing sector of China is more processing-oriented, and therefore is more labour-intensive as compared to that of India (Ghose and Matsumoto, 2002, in Ghose, 2003, p.50). However, overall, the share of industry and services in labour force has increased in both countries, as these sectors grew in the wake of increase in export-orientation led by the integration process.

Table 4: Distribution of Labour Force of China and India by Sector (% of labour force)

	Agriculture	Industry	Services
China			
1980	69	18	13
1990	60	21	19
2000	50	23	27
India			
1983	86.6	14.7	16.7
1987-88	64.9	17.1	18.0
1992-93	64.0	19.9	20.1
1990-2000	60.4	17.5	22.1

Source: Nagaraj, 2005.

The effects of inter-sector transfer of labour on employment are associated with the corresponding output growth of these sectors (Table 1). Its implications appear to be far more serious for India than China. Dasgupta and Singh (2005) argue that India defies the Kaldorian pattern of growth, as its economic growth is led by services. This is in sharp contrast to historical evidence which suggests that the engine of growth in a country with per capita income level of India has to be manufacturing, rather than services. The concern of Dasgupta and Singh (2005) is that this phenomenon is creating "jobless growth" in the organized manufacturing as well as the services sector when the Indian labour force is increasing at 2 per cent per annum. Although India's relatively younger labour force promises greater demographic dividend (Rodrik and Subramanian in Acharya, 2004, p.4538), it also requires that more jobs will have to be created. Otherwise, most of the excess labour in agriculture will either remain in agriculture or will have to be absorbed by the low-productivity informal sector.

It is further argued that, because the growth of India's services sector is predominantly led by information technology (IT), it has limited value as far as employment is concerned. The IT sector employs less than one million people in a total labour force of 450 million. It cannot absorb much additional labour due to the unique nature of IT services which require only educated and skilled people who constitute a minor proportion of the total labour force. Only five per cent of India's relevant age group receives college education. Other services such as hoteling, transport, real estate, restaurants and community services could have absorbed unskilled labour, but evidence suggests that they did not register significant acceleration in growth in 1990s (Dasgupta and Singh, 2005). The concern about the employment challenge appears to be more relevant in the wake of recent financial crisis. The second major effect of increased integration lies in the distribution of employment by type. This effect is similar both in China and India. Self-employment has steadily decreased in both countries, more so in China as a result of increase in wage employment. But the bulk of labour freed from self-employment has been absorbed in the informal sector in both countries. In China, this sector largely comprises of TVEs and private PEIBs wherein 14.7 per cent of the total employees were working in 1990. This number has increased to 23.2 per cent in 2005, due largely to the decline in wage employment in the state enterprises. The emergence of non-state enterprises became a source of formal wage employment, but their potential to absorb the labour relieved from the state enterprises has been limited so far (Table 4 and Table 5).

Table 5: Distribution of Employment by Type in China (% of total employment)

	1990	1997	2005
Self-employment	51.2	46.1	39.5
Informal wage employment			
TVEs	11.2	14.3	19.0
PEIB	03.5	09.8	14.2
Formal wage employment			
State	21.5	19.5	09.3
Non-state	0.2	1.5	5.1

Source: Ghose 2008.

The changes are similar in India. While the decrease in self-employment is fairly low, the share of employment in the formal sector has fallen substantially since 1983 (Table 6). A

major reason is that India's labour force is still largely low-skilled and therefore, is largely employed in the informal sector (Ghose, 2004, p.5108). Moreover, fewer new workers were employed by the formal sector as the technological improvements and transition towards the economies of scale as a result of pressure from trade-openness increased labour productivity significantly in both China and India (Ghose et al., 2008, pp.104-06).

Table 6: Distribution of Employment by Type in India (% of total employment)

	1983	1993-94	2004-05
Self-employment	57.3	56.4	56.6
Causal wage employment	28.9	31.8	28.4
Regular wage employment	13.8	13.6	15.2
Formal sector employment	7.9	7.3	5.8

Source: Ghose, 2009.

A major implication of the low capacity of formal sector to absorb high-skilled labour is the increase in “brain drain” in China and India. The data compiled by Ghose (2008, pp.54-55) show that a huge proportion of the skilled labour force is migrating to developed countries. In 2000, the number of skilled migrants was about 0.8 million each in China and India. The number of high-skilled migrants (0.4 million in China and 0.5 million in India) was much higher than the low- and medium-skilled migrants.

Globally, entry of China and India into the global economy has come to be seen as a major threat in advanced countries. The pioneering work in this regard has been done by Richard Freeman (2005) who argues that in the past, the advanced countries' trade with these two economies may not have harmed the workers in the former but the situation has now changed. The entry of China, India and the former Soviet Bloc countries into the global economy has doubled the globalized labour force. In 2000, the globalized labour force comprised of 1.5 billion workers, but has swelled to nearly 3 billion after their integration. Freeman argues that the success of China in manufacturing and India in services may ultimately affect 10 per cent of the United States' labour force.

Izurieta and Singh (2008) make a case against Freeman (2005) by arguing that, overall, the integration of China and India into the global economy is likely to be more complementary, rather than competitive, with that of the United States and other advanced countries. The fast growth of these two economies is beneficial for the whole world, as it is essential to meet the employment needs and provide basic necessities to their huge population. Moreover, the growth in these two countries has spurred demand for raw materials and commodities from other countries, which is ultimately helping them also to grow faster

Conclusion

Empirical evidence suggests that the increased integration of China and India into global economy has had quite different effects on economic growth, but somewhat similar effects on employment. In respect of economic growth, the effects are conspicuously different in output structure, i.e. the engine of growth in China is manufacturing sector whereas in India, the growth is led by the services sector. Accordingly, the composition of their

international trade is strikingly different; the largest share of China's exports comprises of manufactures, whereas in India, both manufactures and services constitute major proportion of the exports but the latter's share is increasing rapidly. By contrast, employment effects are quite similar, and are evident in the rise of unemployment problem, decline of employment in the formal sector, and slow growth of regular wage employment. There is a need to generate a steady process in both China and India that leads to the growth of regular wage employment which exceeds the rate of labour force growth.

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The radical implications of a zero growth economy[1]

Ted Trainer (University of New South Wales, Australia)

For 50 years literature has been accumulating pointing out the contradiction between the pursuit of economic growth and ecological sustainability, although this has had negligible impact on economic theory or practice. A few, notably Herman Daly (2008), have continued to attempt to get the notion of a steady-state economy onto the agenda but it has only been in the last few years that discussion has begun to gain momentum. Jackson's *Prosperity Without Growth* (200) has been widely recognised, there is now a substantial European "De-growth" movement (Latouche, 2007), and CASSE (2010) has emerged.

The argument in this paper is that the implications of a steady-state economy have not been understood at all well, especially by its advocates. Most proceed as if we can and should eliminate the growth element of the present economy while leaving the rest more or less as it is. It will be argued firstly that this is not possible, because this is not an economy which *has* growth; it is a *growth-economy*, a system in which most of the core structures and processes involve growth. If growth is eliminated then radically different ways of carrying out many fundamental processes will have to be found. Secondly, the critics of growth typically proceed as if it is the only or the primary or the sufficient thing that has to be fixed, but it will be argued that the major global problems facing us cannot be solved unless several fundamental systems and structures within consumer-capitalist society are radically remade. What is required is much greater social change than Western society has undergone in several hundred years.

Before offering support for these claims it is important to sketch the general "limits to growth" situation confronting us. The magnitude and seriousness of the global resource and environmental problem is not generally appreciated. Only when this is grasped is it possible to understand that the social changes required must be huge, radical and far reaching. The initial claim being argued here (and detailed in Trainer 2010b) is that consumer-capitalist society cannot be reformed or fixed; it has to be largely scrapped and remade along quite different lines.

The "limits to growth" case: An outline

The planet is now racing into many massive problems, any one of which could bring about the collapse of civilization before long. The most serious are the destruction of the environment, the deprivation of the Third World, resource depletion, conflict and war, and the breakdown of social cohesion. The main cause of all these problems *is over-production and over-consumption* – people are trying to live at levels of affluence that are far too high to be sustained or for all to share.

Our society is grossly unsustainable – the levels of consumption, resource use and ecological impact we have in rich countries like Australia are far beyond levels that could be kept up for long or extended to all people. Yet almost everyone's supreme goal is to *increase*

[1] This paper elaborates and extends a discussion of themes published in *The International Journal of Inclusive Democracy,* Fall, 2010; see Trainer 2010a.

material living standards and the GDP and production and consumption, investment, trade, etc., as fast as possible and without any limit in sight. There is no element in our suicidal condition that is more important than this mindless obsession with accelerating the main factor causing the condition.

The following points drive home the magnitude of the overshoot.

- If the 9 billion people we will have on earth within about 50 years were to use resources at the per capita rate of the rich countries, annual resource production would have to be about 8 times as great as it is now.

- If 9 billion people were to have a North American diet we would need about 4.5 billion ha of cropland, but there are only 1.4 billion ha of cropland on the planet.

- Water resources are scarce and dwindling. What will the situation be if 9 billion people try to use water as we in rich countries do, while the greenhouse problem reduces water resources.

- The world's fisheries are in serious trouble now, most of them overfished and in decline. What happens if 9 billion people try to eat fish at the rate Australian's do now?

- Several mineral and other resources are likely to be very scarce soon, including gallium, indium, helium, and there are worries about copper, zinc, silver and phosphorous.

- Oil and gas are likely to be in decline soon, and largely unavailable in the second half of the century. If 9 billion were to consume oil at the Australian per capita rate, world demand would be about 5 times as great as it is now. The seriousness of this is extreme, given the heavy dependence of our society on liquid fuels.

- Recent "Footprint" analysis indicates that it takes 8 ha of productive land to provide water, energy, settlement area and food for one person living in Australia. (World Wildlife Fund, 2009.) So if 9 billion people were to live as we do about 72 billion ha of productive land would be needed. But *that is about 10 times all the available productive land on the planet*.

- The most disturbing argument is to do with the greenhouse problem. It is very likely that in order to stop the carbon content of the atmosphere rising to dangerous levels CO2 emissions will have to be totally eliminated by 2050 (Hansen says 2030). (Hansen, 2009, Meinschausen et al., 2009.) Geo-sequestration can't enable this, if only because it can only capture about 85% of the 50% of emissions that come from stationary sources like power stations.

These kinds of figures make it abundantly clear that rich world material "living standards" are grossly unsustainable. We are living in ways that it is impossible for all to share. We are not just a little beyond sustainable levels of resource consumption -- we have

overshot by a factor of 5 to 10. Few seem to realise the magnitude of the overshoot, nor therefore about the enormous reductions that must be made.

Now add the implications of growth

The above figures refer to *the present* situation, but that does not define the problem we face. The problem is *what will the situation be in future given the determination to increase production and consumption continuously and without limit*?

At least 3% p.a. economic growth is demanded and usually achieved in this society. If Australia had 3% p.a. increase in output to 2050 and by then all 9 billion people expected had risen to the material living standards Australians would have, the world would be producing almost 20 times as much as it does today. Yet the present level is alarmingly unsustainable.

"Technical advance will make it all possible."

We come now to the crucial assumption most people make, i.e., that there is no need to even think about questioning growth, let alone reducing consumption or economic output, let alone cutting GDP by a factor of 5 to 10. The generally assumed view is, "We will all be able to go on buying lots of goods, living in gigantic houses, driving long distances, going away for holidays, jetting around the world, having elaborate wardrobes etc., and increasing our consumption of those things every year – because our wizard technologists will find ways of producing goods and running cars etc. without causing significant problems. Indeed the technologies already exist; it's just that our dull-witted politicians have failed to implement them."

However, the overshoot is far too great for any plausible technical advances to be able to reduce the problems to tolerable proportions. Perhaps the best known "technical fix" optimist, Amory Lovins, claims that we could at least double global output while halving the resource and environmental impacts, i.e., we could achieve a "Factor Four" reduction. (Von Weisacher and Lovins, 1997. More recently a Factor Five reduction is argued.) But this would be nowhere near enough to solve the problems.

Let us assume that present global resource and ecological impacts must be halved. It has been explained that if we in rich countries average 3% growth, and 9 billion rose to the living standards we would then have by 2050, total world output would be almost 20 times as great as it is today. It is highly implausible that technical advance will make it possible to multiply total world economic output by 20 while halving impacts, i.e., to enable *a Factor 40 reduction*?

"But what about renewable energy sources?"

No technical-fix assumption is more common nor more unexamined than that renewable energy sources can be substituted for fossil fuels, thereby enabling abundant energy affluence while eliminating the greenhouse and other problems. A case to the contrary is detailed in *Renewable Energy Cannot Sustain A Consumer Society* (Trainer 2007, and updated in Trainer, 2008. See also Trainer, 2009 and 2010.) For example, following is

an indication of the reasons why there is no chance that all people could have vehicles fuelled by biomass.

It will probably become possible to derive 7 tonnes of biomass per ha from very large scale production, and 7 GJ of ethanol per tonne of biomass. Thus it would take 2.6 ha to produce the 128 GJ each Australian uses each year as oil plus gas. If 9 billion people were to live as Australians do now, *23 billion ha of forest would be needed on a planet that has only 13 billion ha of land.*

This does not mean we should forget about renewables. They are the sources we should be moving to full dependence on as soon as possible. But they can't fuel a consumer society for all. They have to be part of the "simpler way sketched below.

The failure of the Greens

Despite the overwhelming case against growth, and the argument that there is no possibility of solving the environment problem unless we shift to a zero-growth economy, green movements and political parties have almost totally ignored the issue. The original German Green Party saw the need for vast and radical system change away from consumer-capitalist society. However, now almost all green effort goes into merely trying to reform that society, so that its damage to the environment will be reduced somewhat, and virtually no green campaigning is directed at moving towards a kind of society that does not inevitably and increasingly destroy the environment. Almost none of their attention is given to the topic of growth. (For instance Geoff Mosley's recent book details the continued refusal over many years of the Australian Conservation Foundation to deal with it. Mosley, 2010.)

Similarly Green political parties will not discuss economic or population growth and instead focus on reforms which never challenge growth and affluence. Green people are among those who make the strongest claims that technology can solve the problems eliminating any need to face up to system change...and the politicians are at fault for not implementing the available solutions.

The reason for this failure/refusal is of course that if they spoke up against the pursuit of growth and affluence in a society that is fiercely obsessed with these goals, they would quickly lose their subscribers.

The wider context

The gross unsustainability of consumer-capitalist society is only the first of two crushing arguments against its acceptability. The other is to do with the extreme and brutal injustice built into the global economy, and without which we in rich countries could not have such high material living standards.

The global economy delivers most of the world's resource wealth, e.g., oil, to the rich countries. It does this simply because it is a market system and in a market most scarce and valuable things go to the rich, because they can pay most for resources and goods.

The same principle ensures that the development taking place in the Third World is little more than development that will enrich the corporations from the rich countries, Third World elites and the people who shop in rich world supermarkets.

The global economy totally ignores the needs and the rights of people and ecosystems. It allows, guarantees, that 850 million people starve while 600 million tonnes of grain are fed to animals in rich countries every year and most of the best land in many hungry countries is devoted to export crops. Conventional development, i.e., development determined by market forces and profit, is therefore clearly *a form of plunder* – it puts the productive capacity of the Third World into enriching us not them.

Conventional development theory and practice are based on the idea of "growth and trickle down", i.e., the assumption that if we all enthusiastically pursue growth within the market place then this will be the best way to raise the Third World to satisfactory living standards. What a delight for the very rich! "No need to think about redistributing existing wealth, or producing what's needed rather than what's profitable…just produce whatever most enriches the already rich and wealth will trickle down to enrich all." This is to say we should be content with an approach to development which delivers almost all of the Third World's produced wealth to us in rich countries while a tiny fraction of it benefits Third World people.

The greatest blind spot in this conventional development theory and practice is that its goal is utterly impossible. The discussion above makes clear that there is no possibility of the Third World developing to be like the rich countries or to have rich world "living standards"; there are nowhere near enough resources for that.

"But look at China!" Yes there are places in the global economy where some people are winning spectacularly, and where significant benefits are going to poorer people. There is strong evidence that the 'living standards" of large numbers of people in the Third World are indeed rising significantly. (See for instance Rosling, 2009.) However this does not mean the Trickle Down approach is acceptable or that it could solve the basic problems.

Firstly the booming export markets the Chinese now enjoy have been taken from many in poor countries who once had them but now can't earn from exporting the things they used to sell. Also it is easy to overlook the fact that 800 million Chinese are not sharing in the new wealth. (Hutton, 2007) Market based systems mostly benefit the middle class and the rich, and create limited opportunities for some to rise to the middle class. Ask 500 million in Africa, or most people in Haiti and Tuvalu about the miracles of growth and trickle down. Most of them are probably enjoying declining GDP per capita. (…which of course just means they need to work harder, cut their export prices, log more forest…) Very little ever trickles down to the poorest, and globalisation has increased the rate at which the resources of the very poorest are transferred to the rich. (For extensive documentation see Note 2.)

Even for those poor classes benefiting from the growth and trickle down approach to development, the rates evident show that it would take hundreds of years for them to rise to rich world "living standards". Meanwhile the rich countries would have risen to stratospheric levels...and the ecosystems of the planet would have collapsed long ago.

Even if the growth and trickle down approach was solving the most serious problems it is obviously an extremely wasteful and unjust strategy. For every crumb it delivers to the poor majority, great wealth is heaped on the already rich.

The rich countries go to a lot of trouble to keep the unjust global economy in place. They use aid, support for brutally dictatorial Third World regimes, World Bank Structural Adjustment Packages, and provision of arms, and they resort to military invasion, in order to maintain the governments and systems that ensure that our corporations and shoppers continue to get most of the world's resource wealth and to take most of the markets. The rich countries deliberately prevent appropriate development, i.e., the application of the Third World's productive capacity, its labour, land, skills and capital, to developing the simple things that would do most to quickly increase the welfare of its people. The conditions written into the World Bank's Structural Adjustment Packages explicitly rule this out and decree that productive capacity must be free for market forces to determine what it will be put into -- that is free for corporations to use in whatever way will maximise their global profits.

Our high material "living standards" cannot continue to be provided unless these appallingly unjust systems and processes remain. We could not live anywhere near as well as we do if you were not getting most of the available tin, coffee, oil etc. The problem of Third World deprivation cannot be solved unless the rich world reduces its consumption dramatically and lives on something like its fair share of world resource wealth. Yet its supreme goal is to increase its levels of production, consumption and GDP.

Thus growth is a major cause of global problems.

This "limits to growth" analysis is crucial if one is to understand the nature of the environmental problem, the Third World problem, resource depletion and armed conflict in the world. Although there may also be other causal factors at work, all these problems are directly and primarily due to the fact that there is far too much producing and consuming going on.

For instance, we have an environment problem because far too many resources are being drawn out of nature and far too many wastes dumped back in, at rates technical advance cannot cut to sustainable levels. We have an impoverished and underdeveloped Third World because people in rich countries insist on taking most of the resources, including those in the Third World that should be being used by Third World people to meet their own needs. And how likely is it that we will ever have peace in the world if resources are very scarce and all cannot use them at the rate a few do now, yet all insist on getting richer and richer all the time without limit? If you insist on remaining affluent then you should arm yourselves heavily, you will need arms if you want to continue to take far more than your fair share.

The quality of life

The ultimate paradox is that for decades it has been clear in the literature that increasing the GDP of rich countries does not increase the quality of life. (Eckersley, 1997; Speth, 2001.) In fact we are now probably seeing a falling quality of life in the richest countries. What then is the point of striving for economic growth?

"But growth will make us so rich we will be able to afford to save the environment."

This statement is characteristic of the conventional economic mind …just create more monetary wealth and we can solve all problems with it. The fatal mistake in the argument is transparent. *If we don't reduce "wealth" production dramatically and quickly the environmental consequences will soon eliminate our capacity to produce any wealth at all.*

The conclusion?

To repeat, the point of the foregoing sketch has been to make clear the magnitude of the problem. The volumes of producing and consuming going on in the world are many times beyond levels that might be sustainable. It is not just a matter of getting to an economy that does not grow any further; the imperative is to reach a steady state economy in which production, consumption, investment, trade and GDP are very small fractions of their present quantities. The following discussion seeks to show that this means that most of the core structures and systems in this society will therefore need to be scrapped.

The far reaching and profoundly radical implications of zero-growth

The growth problem is not just that the economy has grown to be too big, now depleting resources and damaging and eventually destroying ecosystems. The more central problem is that growth is integral to the system. Most of the systems basic structures and mechanisms are driven by growth and cannot operate without it. Growth cannot be removed leaving the rest of the economy more or less as it is. Unfortunately people in the current "De-growth" movement tend to think growth is like a faulty air conditioning unit in a house, which can be taken away and the rest of the house will function more or less as it did before.

- If you do away with growth then there can be no interest payments. If more has to be paid back than was lent or invested, then the total amount of capital to invest will inevitably grow over time. The present economy literally runs on interest payments of one form or another; an economy without interest payments would have to have totally different mechanisms for carrying out many processes.

- Therefore *almost* the entire finance industry has to be scrapped, and replaced by arrangements whereby money is made available, lent, invested etc., without increasing the wealth of the lender. That is incomprehensible to most current economists, politicians and ordinary people.

- Among related problems is how to provide for old age, when this can't be done via superannuation schemes relying on returns on invested savings?

- The present economy is literally driven by the quest to get richer; this motive is what ensures energetic search for options, taking of risks, construction and development, etc. The most obvious alternative is for these actions to be motivated by a collective effort to work out what society needs, and organise to produce and develop those things. This involves an utterly different world view and driving mechanism. Such a society would have to find another way to ensure innovation, entrepreneurial initiative

and risk taking when people can't look forward to getting richer from their efforts. (This is not necessarily a difficult problem; See Trainer 2010a, Ch. 5.)

- The problem of inequality would become acute and would demand attention. It could not be dealt with by assuming that "the rising tide will lift all boats". In the present economy, growth "legitimises" inequality and defuses the problem. Extreme inequality is not a source of significant discontent, because it can be said that economic growth is raising everyone's "living standards". But if the pie remains at a constant size, and everyone is driven by a competitive struggle to get richer all the time, before long the most energetic/talented/ruthless few will have taken most of the pie. Thus inequality would have to be addressed and dealt consciously and deliberately, involving social decisions regarding distribution and fair shares...which again would involve a very different kind of society.

- Above all, if there is to be no growth *there can be no role for market forces*. Many people who oppose growth do not seem to realise this. The market is about maximising; i.e., about producing, selling, and investing in order to make as much money as possible from the deal, and then seeking to invest, produce and sell more, in order to again make as much money as possible. In other words there is an inseparable relation between growth, the market system and the accumulation imperative that defines capitalism. If we must cease growth we must scrap the market system.

- The above changes could not be made unless there was also a profound cultural change, involving nothing less than the abandonment of the desire to gain. For more than two hundred years our Western society has been focussed on the quest to get richer, to accumulate wealth and property. (The point is focal in the writings of Polanyi, 1944, and Tawney 1922, in the emergence of capitalist society from Medieval society.) This is what drives all economic activity, such as the innovative and development behaviour of firms and the behaviour of individuals and firms in the market, and it is at the core of national policy. People work to get as much money as possible. Firms strive to make as much profit as possible and to get as big as possible. People trade in order to end up richer than they were. Nations strive to become richer all the time.

- The logically inescapable point here is that in a zero-growth economy there could be no place whatsoever for this psychological motive or economic process. People would have to be concerned to produce and acquire only that stable quantity of goods and services that is sufficient for a satisfactory quality of life, and to seek no increase whatsoever in savings, wealth, possessions etc. It would be difficult to exaggerate the magnitude of this cultural transition. A zero-growth economy cannot exist unless there is enormous change from the mentality that is typical in consumer society and that has been the dominant driving force in Western culture for several hundred years.

Subsistence, gift, reciprocity...sufficiency

The alternative to a growth economy is in fact a subsistence economy, that is, one in which people produce to meet stable needs and not to accumulate wealth. In tribal, peasant,

ancient and Medieval societies and in many communes today items are not made to sell in order to gain, to accumulate money over time. (See Polanyi's discussion, 1944.) They are produced to exchange for other needed items of equal "value". Market day enables all to acquire the things they need, in exchange for a contribution to meeting the needs of others. No one intends to gain from the exchange; they just intend to exchange items of a certain "value" for others of the same "value" (usually measured in labour time needed to produce them.) People do not go into the market to get rich. (Merchants visiting the town, usually with non-necessities, luxuries, to sell, did trade to gain, but in Medieval Europe were an almost irrelevant minority on the fringe of the mainstream economy, and were not respected.)

In these subsistence economies the basic operation was not getting, it was giving...knowing that others would give to you. In other words the key economic mechanism was gift and reciprocity. In tribes elaborate rules govern the giving and receiving, ensuring that all are provided for. (No one in tribal society is poor or hungry, unless times are difficult for all.)

These are the economic principles that must exist, whether we like it or not in a satisfactory, viable economy in the coming era of intense and irremediable scarcity, in which we must develop mostly small local cooperative stable economies focussed on meeting needs. The focal concerns must be organising local resources and productive capacities to provide well for all, without any notion of gain or getting richer over time. The basic mechanism must be giving to others and the community, knowing that you will be given what you need. (for instance contributing to voluntary working bees that maintain the community orchards.)

History can be seen in terms of the damage that the drive to gain eventually does. Often a civilization emerges and for a while has considerable equity, but in time some become more wealthy and powerful, and develop into a class with increasing power and privileges and then dominate the rest. Their desire to gain drives a quest for more and more land, opulence, slaves...and foreign sources of wealth. An imperial phase begins. The wealth of other regions is plundered. Because there is no concept of enough, before long there is over-reach; it becomes impossible to maintain the empire, and the civilization self-destructs. At present the West is passing through the over-reach phase into decline, while China is rising past us, driven by the same old single-minded obsession with getting richer and more powerful. This sorry story will not cease until humans learn to be content with enough.

This is a core theme in "The Simpler Way" analysis -- this society cannot be fixed; its major elements must be scrapped and replaced. (Trainer 2010b) Most obviously, you cannot reform a growth economy to be a zero-growth economy, and you cannot remove the growth element from the economy while leaving the rest of it as it was; you have to build a completely different economy. Above all, you will not solve the many problems the quest for growth is causing without scrapping core structures in our culture, that is until people in general come to be content with what is sufficient and design and run economies that are about subsistence, gift and reciprocity.

Thus most people calling for a stable economy seem not to grasp the implications of their campaign, nor the reasons for thinking that it has a negligible chance of success. Above all they do not seem to have thought through the many and profound associated social changes that must be achieved if growth is to be eliminated.

Is capitalism compatible with a zero-growth economy?

It should now be obvious that a stable or zero-growth economy cannot be a capitalist economy. Capitalism is by definition about accumulation, making more money than was invested, in order to invest the surplus to have even more...to invest to get even richer. It would be possible in a stable economy for a few to still own most capital and factories, and live on the income from these investments, but they would be like rentiers or landlords who draw an income from their property. They could not be driven to accumulate, get richer, increase the amount of capital they possess and invest to get richer. If they did, a very few would quickly take almost all of the fixed amount of income and wealth available...and the system would soon self-destruct.

Some people, such as Herman Daly believe that "productivity" growth would enable capitalism to continue in a zero-growth economy. The counter-argument is that there would be a tendency for this to happen, but that the effect would be trivial and short lived

Many in the emerging "De-growth" movement do not wish to face up to the conclusion that if you get rid of growth then you will also have got rid of capitalism and you will inevitably have (some kind of) "socialism". That is, the economy could not then be left to competition between people who own capital operating in free markets. At least the main economic decisions would have to be made by deliberate social discussion, debate and planning...because this is the only logical alternative to leaving them to "free markets" and the owners of capital competing to gain.

It is crucial to immediately stress that this does not have to mean we must accept a big authoritarian, bureaucratic state running everything...which no one is likely to prefer. A new economy is sketched below (and detailed in Chapter 4 of Trainer 2010a.) It has the main decisions made collectively, by all people within small community economies (but with most of the economy in the form of private firms.)

What is the alternative?

If we must abandon growth and greatly reduce production and consumption then there is no alternative but to develop an economy which is basically under social control, i.e., in which we discuss, decide, plan and organise to produce that stable quantity of the basic things we need to enable a high quality of life for all. In the coming conditions of intense resource scarcity, viable communities will have to be mostly small, self-sufficient local economies using local resources to produce what local people need. Such economies can only work well if control is in the hands of all citizens, via participatory-democracy exercised through whole town assemblies. This vision would enable most of the firms and farms to be privately owned or community cooperatives, and would involve little role for councils, state or federal governments.

Although the case against the wisdom of pursuing growth and affluence has in my opinion been overwhelmingly convincing for decades, it has been almost totally ignored. Although it is now gaining more attention, on the fringes of the economics profession, unfortunately there is little recognition of just how profoundly radical the notion of zero-growth is. It logically entails the termination of several fundamental structures and processes, values and taken for granted ideas, which have developed over hundreds of years. If the limits

analysis is valid we have only decades to make the enormous transitions. Given that the mainstream, resolutely led by the economics profession, shows no sign of ever attending to these issues, it is difficult to maintain belief that we have the wit or the will to save ourselves.

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From rigged carbon markets to investing in green growth

Hazel Henderson (Ethical Markets Media, USA and Brazil)

Abstract
Reviews failure of global carbon trading under Kyoto and reasons why alternatives emerged. Assesses prospects for climate policies beyond Kyoto and covers shifts toward green growth in governments and private sector investments.

The Kyoto Protocol and its global carbon emission-trading scheme expire in 2012. The World Bank in State and Trends of the Carbon Market found that the market declined in 2010 and is at a crossroads, due to loss of political momentum. There are many new signs of a re-focusing the 20 year international effort to craft national policies and international agreements to curb human (anthropogenic) caused changes to the Earth's climate. As a longtime theorist and participant in this hugely complex set of issues, I will try to connect most of the dots necessary to explain why the Kyoto Protocol design led to the disappointing UN conferences at Copenhagen (2009) and Cancun (2010). Unlike the scorn UN diplomats and many NGOs heaped on "fragmented" pacts and regional "side deals" that have emerged, I applaud them, as does expert David Victor in *Global Warming Gridlock* (2011). These smaller "clubs" of powerful emitter nations are now creating pragmatic agreements, such as those between China and the USA to cooperate on green technologies and Norway's pact with Indonesia to cooperate on managing and protecting forests. Such bottom-up deals reflect local and regional realities and may involve more logically, other pollutants such as soot, ozone-producing VOCs and methane. Curbing these pollutants can actually lower total CO_2 emissions faster and cheaper while protecting the health of those directly exposed, such as providing solar cook stoves to rural women to avoid families inhaling smoke.

The Kyoto Protocol's targets for controlling CO_2 emissions worldwide by creating a global emissions trading structure was a visionary and ingenious plan devised by brilliant economists and mathematical modelers, notably Dr. Graciela Chichilnisky of Columbia University, inventor of catastrophe bonds. Kyoto promised financial markets a bonanza by creating a new asset class for carbon and many CO_2 derivatives, auctionable emissions permits, free allowances, offsets and the alphabet soup of CDMs, CERs, secondary CERs, RECs, along with trade on new exchanges: ETS, ECZ, RGGI, as well as those in China, India, Brazil, Australia and New Zealand. Today, with evidence that CO_2 emissions increased to the highest ever in 2010 of 30.6 gigatons from the International Energy Agency (IEA), new approaches are vital. Carbon markets are blamed for scandalous profits on CDM offsets related to perverse incentives encouraging the burning of HCFC-23, a greenhouse gas 11,700 times more polluting than CO_2 garnered by JP Morgan Chase, Citigroup, Goldman Sachs, Rabobank, Fortis, along with energy companies, E.ON, Enel, Nuon, RWE and Electrabel. European governments of Italy, Holland and Britain, along with these companies, bought these CDM "offsets" which actually increased polluting emissions. Only whistle-blowing by NGOs brought this to the attention of Jos Delbeke, director general of the European Commission for Climate Action, who called for ending "usurious profits" that are "repugnant". Meanwhile, a judge in California is forcing the state to analyze alternative measures to its proposed "cap and trade" plan which experts at a recent carbon expo agree will delay carbon trading there (Reuters). The upcoming conference in Durban, South Africa,

is expected to be a showdown over the Kyoto Protocol and between developing countries and NGOs versus fossil fuel lobbies and carbon traders.

The deeper reasons why this theoretical Kyoto vision of a seamless global emissions trading market, assumed to provide efficient reductions of actual CO_2 emissions, has failed, are explained by Prof. Victor. Creating new markets (and most markets are created by humans not by God's "invisible hand") is in reality, a complex governmental task involving new laws, monitoring compliance, fairness and regulating free riders. Powerful incumbent fossil-fueled industries must be brought into compliance while compensating blameless low or non-emitters, mostly in developing countries. The financial markets geared up to compete for their share of trading the new carbon "asset class" after the UN Framework Convention on Climate Change was set up in Kyoto in 1997. Trading desks at most big banks on Wall Street, in London and a bevy of new firms appeared – as well as early voluntary trading platforms like the Chicago Climate Exchange (CCX) now merged into ICE.

The economic theory behind Kyoto's global emissions trading followed the same expansion of global financial markets after the deregulations of the 1980s led by Britain's Margaret Thatcher and US President Ronald Reagan. This market ideology was underpinned by the Arrow-Debreu model assuming these expansions were part of the desirable goal of "market completion." This goal is now questioned since the bubble in financial markets which burst in 2007-2008 and the rise of theories of the global commons which acknowledge vital global public goods beyond the reach of markets (Transforming Finance). Such planetary resources as air, oceans and biodiversity are essential to human survival and indivisible common property along with the electromagnetic spectrum. Tax payers' publicly funded infrastructure of communications networks, satellites and the internet are all crucial platforms underlying global finance.

The financial debacles of 2007-2008 called the huge expansion of global financial trading into question as shadow banking, securitization, high-frequency trading and derivatives grew as a percentage of GDP in Britain and the USA. Processes of securitization and financial innovation created ever more exotic instruments still proliferating along with volatility. After the May 6, 2010, "flash crash" on Wall Street, it became clear that increased high-frequency trading provided only "faux liquidity" which disappeared when needed. Not surprisingly, CO_2 emissions trading came into question as well. INTERPOL warned that CO_2 derivatives trading could become the next global white collar crime wave. Even conservatives and Republicans in the US taunted "if you like credit default swaps, you're going to love carbon derivatives!" CDM offsets were too often revealed as fraudulent "hot air" credits. Powerful electric utilities gamed the ETS and wangled so many free emissions allowances from compliant politicians, that they actually crashed the price of CO_2 on that exchange. Rolling Stone's Matt Taibbi targeted carbon derivatives trading as Goldman Sachs' next big attempt to create a new bonanza after the housing mortgage securitization game exploded.

Kyoto never produced that envisioned global emissions trading regime despite all the expectations and hype. Instead, diverse national, regional, local and corporate interests devised their own mixes of trading, direct regulating and taxing of emissions, as analyzed by David Victor in *Global Warming Gridlock*. However, he misses most of the reasons emissions trading fails that stem from inside the box of finance itself and all the problems and failures revealed by the 2007-2008 crises – still unresolved by Dodd-Frank, Basel III, G-20, the European Commission and British regulators. Pragmatic use of the other market mechanism:

carbon taxes, was promoted by *The Economist* and others including the May 2011 report of Australia's Climate Commission, *The Critical Decade*. Citing effects of climate change already impacting Australia with extreme weather, the Commission supports Prime Minister Julia Gillard's plan to tax carbon emissions by big polluters after the failure of cap and trade schemes.

The international diplomatic efforts from Kyoto to Copenhagen to Cancun and the agreements on binding caps, targets and time tables have produced the perverse results mentioned earlier. Their rigidity caused national governments, which could not control domestic sources politically, to simply renege on their commitments, as Victor documents. He also explains why the climate issue is less an environmental issue than one of the energy sector – and more amenable to WTO-like negotiations on trade – an imaginative new approach. Many engineering and technology approaches have been hampered by incumbent fossil-fueled industries and sectors. It's time to acknowledge as president Jeffrey Leonard of the Global Environment Fund does in *Washington Monthly*, the 90% of historic subsidies to fossil and nuclear energy that dwarf those to solar, geothermal, wind and energy efficiencies. Feed-in tariffs and renewable energy portfolio standards which address CO_2 emissions directly were needed to help offset the blockages to growing and scaling the many technologies based on capturing the sun's free daily flow of photons: abundant, renewable solar, wind, ocean as well as geothermal sources. The success of such policies in Britain has created energy-efficiency companies that complete globally (NY Times) in this industry, now providing rapid paybacks ("Efficiency: Bedrock of Green Transition").

Transition to uses of lower-carbon natural gas and co-generation are necessary in the short run. The effects of Japan's Fukushima plants make unlikely future reliance on nuclear energy with Japan now shifting to wind, solar, efficiency and I expect also its abundant geothermal resources. Germany has also shifted from nuclear to expanding its green economy. Carbon sequestration of CO_2 from burning coal is unproven, hugely costly and reduces the energy efficiency of power plants. China's research on in situ methods of mining coal may prove viable (Atlantic Monthly, 2010). Most conventional analyses miss the carbon sequestration possible from well-managed lands and forests, as demonstrated by Dr. Allan Savory's holistic management approaches to land-restoration in many countries. Conventional centralized models still overlook the many efficiencies in distributed, smaller scale solar PV, thermal CSP, wind, shallow geothermal, and low-head hydro now gaining market share from central electric utilities. Such *Small is Beautiful* approaches reflect E. F. Schumacher's deep analyses of issues of scale and how decentralization yields many more jobs while saving capital and revitalizing communities.

Thus, I agree with political scientist Victor's characterization of current emissions trading as "Potemkin markets" and that carbon taxes are the best market mechanism – allowing governments to set prices rather than quantities of pollution emitted. He also acknowledges realistically that direct regulations will always have a place and that these will grow – along with the growth of regulation-driven industries in recycling, remanufacturing and reuse, as well as companies like Waste Management. The recycling industry in the USA employs more people today than the auto industry (E Magazine). I recall speaking on a panel with Waste Management's president who began by acknowledging that his was a regulation-driven company in a regulation-driven industry.

Old arguments about markets versus regulation (vilified as "command and control") are now countered by the truth that all economies are mixed (mixtures of markets and

regulations) determined by their value-systems I termed "cultural DNA" (*Politics of the Solar Age*, *Building a Win-Win World*). These realities emerge quickly with on-the-ground field trips rather than in GDP and macro-economic aggregations as well as more in-depth understanding of energy markets and technology options. All these real world details were researched by the US Congress Office of Technology Assessment (OTA), multi-disciplinary studies of technological choices and second-order consequences, from 1974 until 1996 when Republicans, led by then Speaker Newt Gingrich, shut OTA down. The OTA's many ground-breaking studies of all these issues are now archived at the Government Printing Office, the Library of Congress, Princeton University, University of Maryland and at the Henderson-Schumacher Library at Ethical Markets Media in St. Augustine, FL.

I served on the Technology Assessment Advisory Council of the OTA from its inception in 1974 until 1980 and helped develop the systems approach to technology assessment – now emulated in many government and academic settings worldwide. From this research experience, I learned that the most systemic approaches to climate change would be to tax all pollutants (not just carbon or its CO_2) by shifting taxes from incomes and payrolls in revenue-neutral ways ("Introduce Green Tax" *Christian Science Monitor*). Such new approaches are now offered by US Senators Maria Cantwell (D-WA) and Susan Collins (R-ME). So far, powerful incumbent fossil fuel and nuclear lobbies have prevented this logical approach – far superior to capping and trading emissions schemes which they promoted then captured. The Waxman-Markey bill in the US Congress in 2008 failed due to this gaming by incumbents, leading to giveaways of emissions permits that were supposed to be auctioned, distrust of the big polluters and Wall Street and the impossibility of meeting Kyoto targets and timetables.

The UN Climate Summit in Copenhagen was thus set up by over-expectations for the train wreck that occurred. Projecting this, Ethical Markets had begun tracking private investments in green companies and technologies since 2007 in its Green Transition Scoreboard. Our first total of $1.6 trillion already committed and in the pipeline, helped push the pragmatic side agreements, also favored by many NGOs and the Climate Bonds Initiative, the Climate Prosperity Alliance, CERES, IIGCC and other investor groups. They included agreements between the US and China on sharing low-carbon, green technologies and the government commitments of multi-billion dollar funds for low-carbon investments, mitigation and adaptation. Government-pledged funds have not yet materialized – largely because obsolete economic models see them only as "costs" since they omit multiple "externalities." The Stern Report showed that these failed economic models had created the world's largest market failure. Direct investment by conventionally trained portfolio managers were still inhibited by these false models ("efficient markets," "rational actors") which omitted externalities. Thus, the risks were misunderstood in their over reliance on Value at Risk models – failing to see the real costs overhanging the balance sheets of polluting companies. As quantitative easing in Britain and the USA printed money for big banks which failed to "trickle down" to revitalize Main Streets, it became clear that such future funds should be directed at investing in greener, future economies.).

Governments were also misled by these incorrect economic models still underlying portfolio analysis and GDP national accounts. All fail to account for the costs avoided by direct investments in growing greener economies. While initial capital costs are higher for all new technologies, in the case of solar, wind, ocean, geothermal and other renewable energy, the fuel is free. Beyond climate stabilization, green development promotes health and avoids huge costs of remediation, mitigation and other "defensive" strategies to both companies and

governments. Further evidence of how omitting "externalities" can lead to systemic inefficiencies is the May 2011 UNEP report Metals Recycling Rates, documenting the waste, unnecessary over-extraction across most of the world's mining and manufacturing – and the overlooked opportunities in re-manufacturing, re-use, recycling and product redesign. At last, the Inter-American Development Bank (IDB) is learning from cities, notably pioneer Curitiba, Brazil, and other cities in Argentina, Bolivia, Columbia and Peru that the 4 million informal workers who recycle materials can be properly compensated as a vital part of the global recycling industry. Job creation and qualitative, healthier growth was also highlighted in the OECD report on Global Green Growth.

Ethical Markets' Green Transition Scoreboard has become a focal point for private retail and institutional investors to analyze the growth of green sectors and deepen their due diligence using updated asset valuation models. It provides a guide to the winning technologies that are part of the evolutionary succession from the 300 years of fossil-fueled Industrial Age to the cleaner, greener, information-rich Solar Age. We have recommended that pension funds and other institutional investors shift at least 10% of their portfolios away from risky hedge funds and commodity ETFs to investments in growing green companies. The Mercer report for fourteen global institutional investors representing AUM of over $2 trillion called for a similar switch of 40% of their assets as beneficial for both hedging climate risks and in opportunities to share in the green transition. John Doerr of US venture capital firm Kleiner Perkins estimated this to be nothing less than the $45 trillion reindustrialization of the world's economies. The CERES investor coalition's letter to its members and other shareowners stresses its Roadmap to Sustainability. Mayor Michael Bloomberg, along with 40 other mayors of the world's largest cities (which consumes 2/3rds of the world's energy and emit over 70% of greenhouse gases), meeting in Sao Paulo, will join the Rio+20 Summit in Rio De Janeiro in 2012 in promoting the shift to a green economy and sustainable jobs (C40 for Rio+20).

We agree that this green transition is necessary, viable and inevitable – as those "Potemkin markets" for trading carbon have failed to even slow the total carbon emissions ("Worst-ever Carbon Emissions," IEA). Private investments now at over $2 trillion are still leading the way and encouraging pension funds, as well as governments and international financial institutions to set up guarantees and green bonds. The leadership of UNEP-FI in helping create the UN Global Compact and the UN Principles of Responsible Investment (UN PRI, with 800 firms and assets under management of over $25 trillion) has been unappreciated and hardly mentioned in mainstream media. UN PRI has now helped launch reforms in business school curricula, similar to the RI Academy in Australia. These curricula reforms will address the blockage of obsolete portfolio management and asset-allocation models ("Changing the Game of Finance," SRI in the Rockies) by offering re-training courses for portfolio managers in ESG "triple bottom line" accounting and integrated valuation models of EIRIS and the Global Reporting Initiative (GRI). In truth, there are few "black swans" or "perfect storms" since these labels are simply excuses, concealing narrow, inadequate models and the pernicious practice in economics and too many business models of "externalizing" social and environmental costs (World Affairs). Responsible, ethical investors developed the new accounting protocols in the GRI. Accountants and micro-economists developed the new models at the company level, while the LSE's Paul Woolley Center for the Study of Capital Market Dysfunctionality promotes a set of Principles for Institutional Investors to address the glaring conflicts of interest in the financial system between agents and their principals so familiar in corporate law (Future of Finance review).

Today, at last, governments are facing up to the task of similar reforms to national accounts: GNP/GDP stemming from the Beyond GDP conference in the European Parliament in 2007 (www.beyond-gdp.eu) and the Ethical Markets-Globescan surveys showing large majorities in 12 countries, of the public's understanding of the need to include indicators of health, education, poverty gaps and the environment in GDP and all national indicators. The OECD's new Better Life Index moves in the right direction – and its next revision will include indicators of poverty gaps (GINI coefficients) as cross-cutting measures of inequality and gender. Relying on GDP's averaging of incomes will give way to more granular views of other forms of wealth beyond money: healthy, educated workforces; efficient infrastructure, and productive ecosystems, all set at zero in GDP. Luckily, we can now overcome the persistent objections of macroeconomists ever since 170 nations agreed to reform their GDP in Rio's Earth Summit in the 1992 Agenda 21, Article 40. With the development of the internet and the web, we no longer need macroeconomic models of national accounts in GDP used since World War II. These obsolete methods of measuring war production were never intended to measure national well-being, as warned by their developer Simon Kuznets. Now the website "dashboards" displaying all indicators of well being, quality of life in many disciplines and metrics beyond money-coefficients are growing at the OECD, the EC with Jochen Jesinghaus' MDG Dashboard, in Sweden with Hans Rosling's dynamic displays, Brazil's many new "observatories," and in the USA the pioneering Calvert Henderson Quality of Life Indicators since 2000, still regularly updated at www.calvert-henderson.com.

An indispensable roadmap beyond the Kyoto protocols and the "Potemkin markets" inadvertently created is David Victor's *Global Warming Gridlock*. While explaining the wrong approaches of the past, Victor also sees that the world "requires a massive re-engineering of energy systems." He even calls for geo-engineering, which we see as risky and unnecessary. Kyoto's obsession with carbon and CO_2 was required by financial traders to create a single new "asset class." This was pushed by the market fundamentalists, including economists as well as entrepreneurial economic guilds in the US and Britain, along with big banks and the financing sectors, and elite US environmental groups, led by the Environmental Defense Fund. We now need to go straight to the green transition and continue growing the infrastructures of the global green economy: smart grids; public transport; compact, pedestrian-friendly cities and sustainable forests, land management and organic agriculture. Progress is bringing better batteries, LED lighting and direct conversion of solar energy based on photosynthesis. We can re-frame "low-carbon" industries properly as "low entropy" since sustainability and eventual climate stabilization is about reducing throughput of energy and materials in economies to the minimum – across the board – beyond the dismal of Jevon's Paradox.

Even the UNFCCC and the IPCC have now changed course in the right direction as others advocate. The UN's IPCC with the World Meteorological Organization have recommended policy-makers shift toward addressing emissions of soot, VOCs and methane in local hotspots – thus lowering CO_2 emissions more swiftly and cheaply, based on the local and regional agreements that are politically practical. Victor's main strategic advice in *Global Warming Gridlock* on forming smaller "clubs" of those willing and enthusiastic about addressing climate change is widely visible: in US-China green technology accords, Britain's legally-binding "Green Deal" and green bank, the World Bank, local trading systems, private green bonds in the Climate Bonds Initiative and daily shifts in institutional portfolios toward growing the green economies. The UNEP's Green Economy Report, based on its Green Economy Initiative which was launched in Geneva in 2009, has gathered adopters and led to greater interest in Rio+20 to be held in Brazil in 2012. NGOs continue to provide most of the

pressure with WWF, IUCN, Global Footprint, IISD and the Green Economy Coalition leading the way. The UNEP report on *Recycling Rates of Metals* mentioned earlier provides another landmark, describing another huge market failure in properly pricing these metals and accounting for the full costs of their extraction and use – still widely "externalized" from company and government balance sheets. Correction of these pricing errors will reduce virgin extraction rates and lead to expansion of today's recycling, reuse and remanufacturing industries – already employing millions of workers worldwide. IISD has exposed the absurdities of massive subsidies to fossil fuels even as governments try to cap their emissions and is now correctly fostering more sensible procurement of green technologies.

A seminar in the USA's prestigious Council on Foreign Relations asks "Are Economists Necessary?" My view has always gone beyond economics, since all public and private decisions must be based in multi-disciplinary systems models such as we pioneered at OTA and later at the Calvert Group. Adam Smith was right about "the human propensity to barter," but more and faster trading is not always better. We are aware of market failures and false prices, as well as special interests and tax policy manipulation. Economics can be useful at the micro-level, but macro-economics has failed and is in disrepute. Economics' focus on money transactions – only one form of wealth – misses all the others. Internalizing all those externalities can help get prices corrected as Trucost is proving. But all the other forms of wealth need the multiple metrics and disciplines now used in indicators of well-being, social and ecological assets and quality of life.

Beyond helping develop the newer, more practical approaches needed for the eventual controlling of further carbon-emitting, lies the ultimate industrial design revolution toward biomimicry: learning the efficiency principles in Nature's billion year experimentation and innovative use of materials and design. Britain's Tomorrow's Company has launched its Tomorrow's Natural Business program to familiarize corporate managers with these deeper principles of long-term success and sustainability. Beyond costly methods promoted by coal companies, we can use Nature's carbon sequestration through proper land-management such as pioneered by Allan Savory and shift to forest-saving and the working business models of biomimicry in human production as pioneered by Janine Benyus, John Todd, Gunter Pauli, the Bioneers and others showcased at www.ethicalmarkets.com and by the Buckminster Fuller Awards. All these design reforms and new metrics will reform and re-shape financial markets for the future.

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Mathematics and real-world knowledge

Nicolas Bouleau (Ecole des Ponts - Paris Tech, France)

Several articles on the misuse of mathematics in economics have already appeared in this journal. They all denounce this excess and list numerous weaknesses of liberal economics and theoretical economics that are due to, or at least related to, too much math.

This subject is worthy of further comment because it seems to me that these articles have mostly described symptoms, albeit a great many symptoms, but have barely begun to diagnose the causes and have given no hint of the kind of knowledge that would enable us to escape this no-man's-land of using a little math but not too much.

The most recent contribution, by Michael Hudson (RWER No. 54), focuses on the important issues that escape mathematical models, such as the structural and historical evolution of societies, prevention of crises, psychological phenomena, long-term thinking. It emphasizes the normative nature of marginal analysis and equilibrium models, and denounces rough quantifications such as GNP and the staggering increase in debt. He acknowledges Marx's openness to the big issues in society that are currently excluded from political debate by an economic philosophy that tries to impress its opponents with sophisticated mathematics. These questions are analyzed thoroughly. On several occasions, however, one feels that the criticism is that the math is being misused and should be developed in some other direction (e.g. a statistical analysis of the financial tendencies that polarize wealth and income, or a study of the positive feedback mechanisms, etc.). This leaves a certain dissatisfaction — on a philosophical level — a feeling that the problem of excess math has not been addressed in all its aspects.

My thesis is that economics adds its own particular difficulties to these issues (because of its status as "conseiller du prince", and because through teaching it gives useful professional skills, etc.) and that things become clearer when we step back and frame the question in terms of knowledge in general. As the reader will see, this enables us to trace, with great epistemological force, the direction of a different type of knowledge. This allows us to escape from the addiction of mathematization while building a better quality knowledge.

We will take in a number of examples in economics and finance, but the fact remains that economics has many distinctive characteristics, as several authors have noted, which tend to prevent a reasoned consideration of its social function. Consequently there remain several points that will need to be developed further.

A. The contribution of mathematics to knowledge: some history and preliminary remarks.

Since the beginnings of civilization mathematics has been associated with most forms of knowledge. Early examples are Archimedes's work in engineering and, from the

same era, *The Nine Chapters* about land measures and economy in China[1]. Few areas have not been influenced in some way by mathematics. From this long and multi-faceted history we extract some key features.

I. The Baconian program served by mathematics.

It is in *Il Saggiatore* (The Assayer) in 1623 that Galileo posits that the universe is written in the language of mathematics. This $\alpha\pi o\phi\tau\varepsilon\gamma\mu\alpha$ as it is called, became the foundation of all Western science. This clarifies Francis Bacon's program, which asserts that man has a Promethean perspective, because he is subject to God choosing to share his power. He can conquer, dominate and transform nature. Galileo tells us how he can know and understand it. In fact later in his work — as Alexander Koyre has clearly shown[2] — Galileo proceeds essentially by thought experiments following mathematical reasoning, not by experiments providing data for subsequent modeling.

He believed that mathematics was a sufficient sign of the essence of God in nature that nature would reveal its secrets purely by geometric and algebraic deductions. Over a century later, Kant built his philosophy around the explicit idea that mathematics, although not based in sensory experience (*a priori* judgments), nevertheless teaches about the world (synthetic judgments). Subsequently mathematics has gradually yielded the philosophical throne of *synthetic a priori judgments*, but without ever losing the prestige of a natural fertility. In the early 19th century there was a separation with mathematics on one side, taking a modern and rigorous turn in the writings of Gauss, Cauchy and Bolzano, and philosophy on the other side, which, with Hegel's *Logic*, had no mathematical element. But then the emergence of non-Euclidean geometries and crises in the foundations of mathematics gave rise to a plurality of views about mathematics and its role in the development of scientific knowledge. At the end of the 19th and 20th centuries, with the development of physics that became the focus of epistemology, mathematics is, with variations depending on the authors, mainly considered as a servant of the natural sciences; we refer to this as its ancillary role.

II. The appearance of mathematics in economics.

Sociology, as introduced by Auguste Comte, takes a non-mathematical road, except through the use of statistics, particularly by Durkheim. Subsequently it acquired its own methodological bases with Max Weber in the early 20th century. Economics, on the other hand, was mathematized as early as the mid 19th century with Jules Dupuit and Augustin Cournot, without really using statistics. Prior to this, economics presented itself as a kind of philosophy of accounting operations. After Dupuit and Cournot economics was full of talk of derivatives, equations and integrals. How did math come to be accepted into the very heart of this social science?

To answer this we follow the path of Jules Dupuit (1804-1865). A civil engineer, he realized that one can do better than simply fixing a single price for the tolls on a bridge since, whatever the price, some users will find it too expensive, while others would happily pay an even higher toll. He is the inventor of what today is called market segmentation. Having a good mathematical training he had the intuition that with a single price one cannot recover all

[1] SHEN Kangshen *The Nine Chapters on the Mathematical Art*, Oxford 1999; K. Chemla et G. Shuchun, *Les Neuf Chapitres,* Dunod, 2004.

[2] Cf. A. Koyré *Etudes d'histoire de la pensée scientifique* Gallimard 1973, and Galilée *Dialogues et lettres choisies* Hermann 1966.

of the integral of the curve that quantifies the willingness to pay; one can only recover that of a truncated curve. This idea of an integral is quite clear in his articles.

Yet we must note that this "willingness to pay" is a poorly defined concept. It depends on many factors, the weather, time of day, seasons, and a thousand social and economic causes. It seems impossible to measure. A collection of experiments measuring traffic against toll level would not provide a curve but *a cloud of points*. It also depends on the tolls levied on other crossings, and on whether users collude and sell their rights of crossing etc.

In the early 19th century, this concept was debated under the name "*utility*". Dupuit pursued the belief that the mathematical phenomenon that he had discovered *would help to clarify the concept*. He postulated the existence of this quantity as a property of the commodity being exchanged and its price, which is shared according to the benefits of the seller/manufacturer and the consumer. "Political economics," he wrote [as opposed to social economics],

> should measure the utility of an object by the sacrifice that each consumer is prepared to make in order to acquire it" and he took the still famous example of a bridge: "[the utility of a toll bridge] can be separated into two main parts: 1) the lost utility, which corresponds to those crossings that would have occurred if the toll were abolished but which do not take place with the current charge, and 2) the utility produced, which corresponds to the crossings which do take place. This latter splits into two further parts: a) utility for the producer, i.e., the money raised by the toll, and b) utility for the consumer, i.e., the excess value of the service over the price it costs. [3]

Dupuit explains:

> [In a shop we see] the fine, the very fine, the super fine, the extra fine, which, though from the same barrel and showing no difference other than the superlative of the label, are sold at very different prices"[4] and this changes the optimization of public taxes: "So when the bridge is built and the State establishes a tariff, it stops caring about production costs. It charges less for a heavy cart which wears out the bridge more, than for a carriage with good suspension. Why two different prices for the same service? Because the poor do not value the crossing as highly as the rich, and raising the tariff would only prevent them from using the bridge." He explains: "The goal is always the same: to charge for the service rendered, not what it costs, but what the buyer thinks its value to be." [5]

Dupuit fully realizes that, being defined by thought experiments, this notion of utility is difficult to measure. He acknowledges that it is abstract.

> It may be objected that the calculation for which we have given the formula is based on data that no statistics can provide, thus we will never be able to express precisely the utility provided by a machine, by a road, by any work ...

But he advances the famous argument, which has been repeated endlessly by neo-classicists ever since, that *economic science is only an approximation*. It is this argument that led to all

[3] J. Dupuit *Annales des Ponts et Chaussées* 1849.

[4] *Annales des Ponts et Chaussées* 1944.

[5] *Ibid*. Note that today's large online shops can charge "good" customers more than new customers, thanks to the information they receive from cookies. Good customers are those users attracted to this way of buying and can therefore be charged more for the service. The screen presented to the customer is not a public price tag, it depends on the user's IP number.

the ambiguities in the passage from descriptive to normative and to the performativity of discourse, and which opened economics up to all the mathematical refinements imaginable.

Dupuit starts from a mathematical property and uses it to account for the psychological, and it is interesting to compare his approach with that of Condorcet, who, at the end of the preceding century, proposed a different kind of mathematization of the social.

Condorcet, a great mathematician, aimed to use the calculus of probabilities to understand the propagation and sharing of a "reason to believe", a concept somewhat similar to that of utility but based on the truth or fallacy of judgments[6]. He pursued this program at length, making, along the way, the great discovery of the "paradox of the vote of an assembly". But he did not think that it would be possible to go so far as to calculate peoples' behavior.

> On the use of language of geometry, the amount of universal commodity, that of a particular commodity, these can be approximated by numbers, but the urge to buy and sell cannot be calculated. Yet the changes in price depend on this moral quantity which, in turn, depends on opinions and passions. It's a beautiful idea to try to calculate everything, but look at the greatest mathematicians of Europe, the likes of d'Alembert and Lagrange. They seek to understand the motion of three attracting bodies: they assume that these bodies are point masses, or are very nearly spherical, and yet this issue, despite being limited by a hundred conditions that make calculation easier, has occupied them for twenty years without an answer. The effect of the forces acting on the head of the dullest shopkeeper is much more difficult to calculate. [7]

Condorcet's approach starts from the psychological, the reason to believe, and attempts a mathematization of sociality by the calculus of probabilities. *His epistemology is an extension of that of Laplace*: we cannot determine everything — principles, laws of forces and their way of acting — only the calculation of probability is relevant. It is an approach with an *a priori* limitation of science. Condorcet had to spell out all his assumptions — independence or correlation of opinions etc. — before doing calculations.

Dupuit, on the other hand, can immediately perform calculations, and does so in his articles, he constructs concepts which interpret price curves (assumed to be obtained). His concepts require very strong assumptions of independence, but he leaves the details of these hypotheses to be spelt out and improved later.

These features — the independence of agents presented as approximation, the progression from prices and quantities to concepts and then, during the 19th century, production function, and problem-solving by local differentiation — these will be the backbone of the neo-classical theory with Stanley Jevons, Carl Menger, Léon Walras (general equilibrium), von Böhm-Bawerk, Vilfredo Pareto (theory of optimum), Irving Fisher, etc. creating an evocative and highly flexible language that is still in use today.

[6] The reason to believe is what we call today the degree of certainty. Condorcet studied how it accumulates when we collect uncertain information or when members of an assembly vote.

[7] Letter to P. Verri 1773.

III. Advanced mathematization of finance.

This is a very recent and well-known phenomenon, whose history I have recounted elsewhere[8]. I will simply explain how an apparently very clever mathematization of risk, helped lead financiers away from safe practices and facilitated the emergence of the subprime crisis[9].

The crisis has occured in an era when finance is thoroughly mathematized, as a result of the "Black-Scholes revolution". A rediscovery of the work of Bachelier and the use of Brownian motion in modeling, and developments of stochastic calculus after the Second World War, particularly the work of K. Itô (1915-2008), provided a mathematical language (that of semi-martingales) in which the non-arbitrage principle could be expressed under broad assumptions that were suitable for operational cases. Methods for pricing and hedging options were thus provided by partial differential equations. The simplest case is when volatility is constant, but it is clear to everyone that these methods are largely *perfectible*, a point which is epistemologically essential.

This led to three historical phenomena: the development of derivatives markets in the U.S. first, then Japan and Europe, a transformation of professional profiles in banks and a call for new mathematical skills, and an enhanced political role for finance which was felt during the construction of the European Union and then in the globalization movement.

From the hedging of (European or American) options on stocks and currencies, the mathematical formalization then spread to more delicate issues: rate models. In particular, the bond market and the term structure of interest rates. The Cox-Ingersoll-Ross and Heath-Jarrow-Morton models allow the non-arbitrage principle to be applied here. Furthermore the theory can make use of infinite-dimensional models that must be simplified and calibrated to the current data. These model the behavior of agents over five, ten or twenty years and are therefore highly uncertain, this uncertainty being expressed in the language of probability theory.

But the most ambitious level of mathematization goes even further and deals with securitization of debts and risk assessments. Putting risks on the market is *a priori* a good idea, in the sense that it is better not to put all your eggs in one basket. But this assumes that the players (banks, insurance companies) can assess the risks.

This gave rise to a mathematical innovation worth mentioning here. It was noted that to estimate the risk of a portfolio of contingent claims, the classical method known as "value at risk," based on a criterion of the form (level of losses, probability of this level), entailed some logical difficulties. It has been shown that any criterion satisfying the desired consistency was of a particular mathematical form called a "coherent risk measure"[10]. We emphasize that these tools allow calculations for complex portfolios assuming known probability of rare events, i.e., the tails of probability distributions which have great influence on the results. These methods, in other words, yield a quantification based on unknowns.

[8] *Financial Markets and Martingales, Observations on Science and Speculation,* Springer 1998.

[9] For more détails cf. N. Bouleau "Finance et opinion" *Esprit* nov. 1998 and "Malaise dans la finance, malaise dans la mathématisation" *Esprit* fév. 2009, p37-50.

[10] For details see N. Bouleau *Mathématiques et risques financiers* Odile Jacob 2010.

In the credit-risk market financial institutions have mathematical tools to estimate risks on reassembled portfolios for the purpose of exchanging them and improving the situation of each individual with respect to their own utility function and their aversion to risk. It has often been stressed in the commentaries on the crisis that the new tools of these markets especially CDO and CDS (credit default swaps) did not encourage operators to exercise caution. That is correct. The changes in the way agents dealt with risk when protected by insurance, termed "moral hazard" by the Anglo-Saxons, surely had a role in making the "soufflé" of the crisis rise. But equally important is the fact that it was wrong to think that the risk was "in the portfolio". The risk is interpretative in nature and just as "the beauty of the Parthenon is not found in the dust of the Parthenon", so these mathematical tools do not see the global economic interpretations related to the decline in U.S. household savings etc.

IV. The quantification of uncertainty is a removal of meaning.

From an epistemological point of view this fundamental fact needs to be stressed. It is *the significance* of the event that creates the risk. The probabilistic representation of risk is classically a pair of mathematical quantities: 1) a probability law that governs the states that can arise, 2) a random variable, i.e., a function that maps each state to the damage, that is to say the cost (counted algebraically if there are also benefits). This representation by a pair of quantities is a mathematical model both too simple and too ideal for thinking about risk. It is too ideal because we are almost never in a situation where this model is well informed. We do not know the tails of probability distributions because they concern rare events for which there is insufficient data. We do not know what correlations occur to assess the damage and we do not have a full description of what can happen. Moreover the model is too simplistic because it removes the reasons that make us interested in the events as if their translation into costs could be done automatically and objectively.

The true purpose of risk analysis is to move forward with a little foresight in organizing facts and social practices. It may be the risk that a child be knocked down while crossing the street, the risk that the air of Paris be toxic, that the failure of one business will cause that of others, etc. The intellectual operation of probabilizing a situation is fundamentally one of removing meaning. It is largely problematic for all matters concerning human behavior. Risk analysis necessarily involves *understanding* interpretations.

It is the meaning of the event that creates the risk. As an example, suppose a particular type of cancer is found in a certain proportion of the Swiss population. This proportion is then used to estimate the risk. If it is subsequently found that most of the people with this cancer had consumed cannabis twenty years ago, say, then all cannabis users become potential patients. The risk is much higher; the meaning of the event has changed. Reducing risk to a probability distribution of sums of money amounts to trusting mathematization as an approximation, as if it were describing a physical reality, whereas it is actually a question of meaning whose subjectivity permeates every interaction between the agents. This epistemological point is extremely important. They are interpretations, and hence meanings, that are replaced by numbers.

Recently there have been significant improvements in financial analysis, especially with the so-called coherent risk measures. *All these methods for making decisions in the face of uncertainty have the innate defect of assuming the interpretative process to be closed.* Yet, on the contrary, new interpretations are constantly emerging. Once a new reading is made, new risks are created, but perceived only by those who understand it. If in 2006, nobody had

seen the growth of house prices and the decline of household savings in the United States as a phenomenon open to several interpretations, the corresponding risk would not have been perceived. Mathematization of risk conceals these difficulties behind assumptions about the tails of probability distributions. It is not enough to say that those are poorly known. They are by nature provisional and changeable according to the interpretative knowledge that agents bring from their understanding of economic phenomena.

V. In liberal economics, every quantification opens a possible extension to the market.

There are numerous examples. The most recent is the quantification of research work. Up until the end of the last century, the quality of researchers was seen in terms of idiosyncratic talents that could only be truly appreciated by researchers themselves experienced in the same type of activities. Putting in place all the machinery of publication indices and journal citations has profoundly disrupted the working relations in the profession. I will say no more. The result has been the emergence of an international market for students, teachers and researchers, with Universities being faced with a new logic where their financial budgets determine what league of intellectual athletes they can afford.

Another example, one which is more serious in its long-term consequences, is biodiversity. Mathematization here is based on separating species into two categories. On the one hand are the *"remarkable"* species, those officially considered as threatened. For these species we calculate the cost of conservation much as for historical monuments. On the other hand for the *"ordinary"* species we calculate the *ecological service* they provide, from prokaryotes (bacteria) to eukaryotes (higher species) by standard methods of cost-benefit analysis. One can then buy and sell any part of nature or exchange it against goods or services already quantified by the economy.

B. When and how is there excessive mathematization?

We now examine the particular type of inefficiency and problem that suggests a diagnosis of excessive mathematization.

VI. We only realize after the fact.

The recent financial crisis is quite illustrative in this regard. While the crisis had not yet occurred — except in the eyes of some non-orthodox observers as there always are — every agent and every financial institution believed that they should estimate the risk of their portfolios (comprised of complex products such as credit derivatives) by the methods best suited to the very mathematical nature of these products. Coherent risk measures make assumptions on the tails of laws but enable one to handle multiple scenarios. The weak point is that they omit scenarios based on global interpretations where the value of each portfolio cannot be calculated by considering the others as *ne varietur*.

Once the crisis had started, and after the resultant upheavals, what happened was the result of political forces: on one hand a strong current of opinion emerged urging the adoption of regulatory measures in order to avoid future crises or at least limit their damage, on the other hand most financial workers felt that all that was needed was to take into account the interpretation that had been neglected, to improve, in other words, the global readings of risky situations by strengthening the role of rating agencies in particular. The latter have now

been warned, and have learnt to keep in mind the previously neglected facts (resistance to "stress" of the various institutions, etc.). For public opinion we are back where we started, with the same tools with the same defects. [11]

VII. Calculations conceal ignorance.

This is obvious for financial risks. Because we do not know how to quantify counterparty risks, or those related to market liquidity, and much less those which are due to human error or to changes in the law, very precise calculations are mixed with crude estimates hoping that they will have no appreciable impact on the outcome. Applying sophisticated calculations, such as coherent risk measures, to complex portfolios supposes that the risks are expressed perfectly in the ontology of the objects considered at the outset. In other words it adds a second level: one ignores one's ignorance. This affects the market (organized or OTC) in credits and their derivatives. By the market, portfolios acquire a value where everyone trusts everybody else's calculations though they are no better. This leads to an instability that may be called "methodological moral hazard" which is the belief that mathematics is able to capture new interpretations if the calculations are done by everyone. This kind of instability is worse than in conventional markets in assets and their options because the timescales are much longer (tens of years instead of tens of months) and the punishment of economic reality comes much more slowly.

VIII. The ancillary role of mathematics as servant is confused with that of the subjects being served.

The previous idea can be generalized to all situations of mathematized knowledge. Let us take the case of physics. It is obviously helpful to physics when the mathematics used by physicists is improved. There is a real fertility there which has been particularly emphasized by Gaston Bachelard. But it works with the same interpretations as the served science. We are in the syntactic part of normal science in Kuhn's sense. Although Bachelard, with his usual talent, shows that mathematics can suggest questions for physicists, it is impossible to get genuinely new interpretations of phenomena occuring in the domain of the master discipline in this way. Mathematization is an essential component in the phenomenon of scientific crisis as described by Thomas Kuhn.

IX. That a theoretical representation be perfectible does not mean it is the only way to deal with reality and does not guarantee that it is capable of taking into account every aspect of the situation in question.

By theoretical representation I mean a semi-artificial language using mathematics, as in physics or modeling. The fundamental point is that perfectibility gives the illusion of completeness. Ptolemy's geocentric planetary system provides a good example: the excess of mathematization lies in cycles and hypocycles that can be added at will. The original system was improved by Tycho Brahe and is infinitely perfectible, and the excess only became apparent after the new interpretation given by Copernicus. The only flaw in Ptolemy's system is that it has no place for this new interpretation. Yet the new interpretation was much less precise, at least initially, when Copernicus was proposing heliocentric circles. But this is

[11] It is impossible to predict the next crises, but we can guess that they will revolve around the failure to take into account limits. Bounds, finiteness of the world, resources, raw materials, agricultural land, etc. are all ignored by economics. Anticipation of increasing scarcities in an uncertain environment may provide unpredictable instabilities.

astronomy not planar geometry, and the new reading acquires legitimacy from the fact that it too could be a starting point for improvements; it also has room for possible enhancements. Galileo cannot depart from this new interpretation because he recognized in Jupiter and its satellites a Copernican system. Nevertheless, having, at that pre-Newtonian time, only a *kinematic* description of phenomena, he has no compelling argument against the geocentric system. He was accused during his trial of basing his position on "beliefs" that are not in the sacred texts. It is a case of one interpretation against another, a situation cleverly analysed by Augustin Cournot[12]. The position of Cardinal Robert Bellarmine is that faith has a monopoly of beliefs and that science must remain a means of describing what is allowed in God's creation.

X. There is confusion between creativity of the representation and creativity of the world.

Within a system of thought, especially one that is perfectible, one cannot see a reason to escape the system. This is related to Quine's remarks on ontological commitment and on the near impossibility of talking about things we either don't know about or deny the existence of. Quine emphasizes our strong tendency to "talk and think about objects"13 both in ordinary language and in physical or economic theories where agents and objects are subject to certain relationships. "It is hard to say how else there is to talk, not because our objectifying pattern is an invariable trait of human nature, but because we are bound to adapt any alien pattern to our own in the very process of understanding or translating the alien sentences."14 Quine also takes into account the ontological conflicts in order to clarify them. The novelty of the famous article "On What There Is"15 is the proposal of a definition of ontological commitment which in principle applies quite generally. In fact these fine arguments inspired by mathematical logic are based on the use of logical quantifiers and are quite abstract, and they do not focus on the emergence of new objects.

A more concrete historical example is very illuminating: the abandonment of the natural scale in music. The octave, fifth and other basic musical intervals correspond initially to the division of a vibrating string into simple fractions, one-half for an octave, two-thirds for the fifth, three-fourths for the fourth, etc. This is a strict mathematization of the harmony that is actually perceived by the ear through sound frequencies. If we move from fifth to fifth by iterating the operation of taking two-thirds of the length, then we find that twelve fifths are approximately seven octaves. Hence, translating these divisions back onto the original octave yields the twelve intervals of the so-called Pythagorean scale. It is approximate since 12 fifths are not exactly 7 octaves, but it is very close to the mathematics of vibrating strings, which is the natural (and scientific) basis of sound. It took more than twenty centuries before the natural scale and its improvements were abandoned and the so-called "even-tempered" scale, which gives exactly the same role to all intervals, was adopted. The instruments built on the even-tempered scale do not give preference to a particular key, but they do not respect fully the laws of vibrating strings. The creativity of the musicians has won over that of mathematics in music. The victory is in fact not total, because of some harmonics that are heard as dissonance, etc. But the point to emphasize here is that the idealized world of mathematics has been put to one side in favour of a world based on practice.

[12] cf. N. Bouleau *Risk and Meaning* Springer 2011, chap. II. Cournot's "philosophical probabilities".

[13] "Speaking of objects" in *Ontological Relativity and Other Essays,* Columbia University Press, 1969

[14] *Ibid*

[15] in *From a Logical Point of View* (1953), Harpers & Row 1963.

C. Why normal science and jolts of revolutions? Why orthodox economics and crises?

Things seem to move like tectonic plates, in jolts. Why is this? How can we implement a production of knowledge that goes beyond the Kuhnian epistemology?

XI. As Kuhn thought, normal science is very close to the Popperian vision.

Only the modalities of its functioning are seen with a more social emphasis on paradigms as shared understandings of scientific communities. The real difference with Popper is that the disorder that precedes a crisis is more complex than simply encountering a decisive experiment that could refute the theory: there are also attempts to negotiate with the forms of interpretations. Usually the plasticity of the paradigms allows the acceptance of new facts or events in the theory. Kuhn takes the example of a child learning to distinguish ducks, swans and geese in a zoo, with his father playing the role of experimental verdict. He stresses the importance of slightly fuzzy categories whose vagueness is not mathematically quantified[16]. But in certain historical situations, the various ways of arranging things lead to choices that are too artificial (properties of the ether, for example), which gives rise to the search for and the legitimization of more radical interpretative changes.

XII. But most mathematization situations are not Popperian.

Economic theories are not likely to be refuted by any observations of facts. The social environment is constantly changing and is never the same twice. Specialized models with predictive aims are probabilistic and cannot be falsified by a single event. More generally, mathematizations useful for studying changes in the environment (pollution, climate change) are always open to several competing models, each based on a different perspective (extrapolation from ice cores or CO2 emmissions), each perfectible as new data become available. The simplest generic example is that of modeling the flow of a river for flood forecasting. Families of models based on Gaussian ARMA factoring in 1) the water depth, 2) the flow rate, 3) the logarithm of the depth and 4) the logarithm of flow, are each infinitely perfectible if new measured data are available yet they do not give the same probabilities of reaching a certain level[17]. This does not mean that these models are useless, far from it. It just shows that it is not because reality is plural that it is not scientific. In fact, for one type of phenomenon, the data are always finite in number and a finite number of points can be matched either by polynomials or by combinations of real exponentials or trigonometric functions etc. If you think about the immense range of subjects opened up by modeling, then you quickly become convinced that it is the Popperian cases that are the exception. For a theory to be Popperian it must have a fixed number of parameters, each fixed numerically. It is hard to think of any apart from gravitation and some physical theories. Probabilistic theories never fall into this category because an infinite number of events is needed to determine a probability distribution.

[16] T. Kuhn "Second thoughts on paradigms" (1974), in *The Essential Tension*, Univ. of Chicago Press 1977.

[17] Auto-Regressive Moving Average processes are the simplest Gaussian models with linear recurrence used in theory of time series. Obviously to the above four families we could add linear alpha-stable models and models with quadratic recurrence (heteroscedasticity) etc. All these examples illustrate the relevance of the remarks of Quine on underdetermination of theories by experience.

This remark also applies equally well to normal science in the sense of Kuhn. It is an extremely restrictive view of knowledge. Let us be more precise.

XIII. It is the monism required at each step that causes the jolts.

Where does the new interpretation that is characteristic of a scientific revolution come from? It can only come from differences in the subject community. In other words, the jolts come from the absolute will that the community accept only one truth. Yet this is one particular vision of knowledge and social organization of science. If we accept instead that "reality" is also, and indeed primarily, people, groups, with their abilities, their habits, their psychology, and their means of interacting with their environment, we see that the only way to capture, or at least to take some account of, the innovation in the world is to make space for the instances where new representations are constructed : users' associations, professional groups, consulting experts, victims of unforeseen circumstances, etc. As Funtowicz and Ravetz have thoroughly analyzed, this route leads to *a better quality* of knowledge, more reliable and in which we can have more confidence[18].

It is a pluralistic knowledge, but that is not to say that it is relativistic. This distinction is crucial. Specifically, as soon as one demands a certain level of rigor and consistency, one is limited to a *small number* of different approaches, just as the major political ideas concern a limited number of parties in multiparty parliamentary systems. To say that departing from the monism of unique truth leads one into relativism is the coarse argument of dominant representations, which the jolts of scientific crises regularly refute.

Nevertheless, if the implementation of such pluralistic knowledge is progressing well in some areas such as climate change or the protection of sensitive areas (despite clashes with political power, which are nothing new), it presents particular difficulties for economics. With globalization, knowledge about economic exchanges has a strong tendency to monism. One would think, however, that the growing environmental problems should lead us to greater tolerance in the implementation of specific economic experiments and their running as a condition of better support for natural equilibriums.

D. Interpretative pluralism is not destructive of knowledge; it is a better type of knowledge.

We now propose to examine more thoroughly the features of that better quality and what role mathematics can play. This will necessitate a step back from science as it is currently most often understood and practiced. Beyond the concept of "confined research" introduced by Michel Callon[19], it appears that what is at stake is the *conquering* character of the Baconian program and the *masculine virtues* connected with them.

For convenience we shall use the term challenge-science to describe the view, held until recently by most scientists, that sees knowledge as *a challenge to nature*. It challenges nature to a duel. The honor in the game is to respect the assumptions that govern the rules for experiments. This includes Popperian science and Kuhn's normal science. In fact it is very old; the induction principle advocated by many philosophers and scientists to account for

[18] S. O. Funtowicz and J. R. Ravetz "Three Types of Risk Assessment and the Emergence of Post-Normal Science" in *Social Theory of Risk*, Sh. Krimsky and D. Golding eds, Preager 1992.

[19] Cf. M. Callon, P. Lascoumes et Y. Barthe *Agir dans un monde incertain, Essai sur la démocratie technique*, Seuil 2001.

knowledge is similar in nature. Put simply, Popper proposes an induction articulated on a theory. Instead of accepting the thesis that knowledge is essentially philosophical in its ability to spot a pattern and extrapolate it — an idea championed simultaneously (in 1843) by John Stuart Mill and by Augustin Cournot who finely analysed it — thus drawing from a large number of results, or a large number of circumstances, a prospective law that is to be evaluated, Popper strengthens the criterion by requiring that we move from observed facts to a representation with the dress of a theory, that is to say, based on a mathematical syntax like mechanics as formulated by Lagrange or Hamilton. Historically, it is indisputable that during the whole period where industrialization had not yet complexified technology too much, science was practiced with little experimentation and as many challenges were presented to colleagues as to nature. The discoveries at the time of Pascal, Fermat and Father Mersenne were often announced as puzzles, whose answer was known only to the finder, to challenge the wit of contemporaries[20].

In these early years of the 21st century, a new awareness, unique in the history of man, is happening. Endless continual growth is impossible, and even if the limit is not yet reached, the current pace is so destructive that it must be drastically curbed[21]. It is becoming less and less clear that using challenge-science vis-à-vis the environment, with new technical devices and a progressive mathematization to calculate the economic optimum by cost-benefit analyses in the context of democracy and liberal economy, can overcome the global challenges : arable land, species, climate change, pollution of soil and water, etc.. New options for production and consumption (e.g. use oriented product service systems, etc.) and for democratic structures (new bicameralism[22]) are probably essential. But, more fundamentally, we must also consider the question of what kind of knowledge. The epistemological question of how knowledge is produced also arises.

XIV. What logical status can the new knowledge have?

Is there “room” for anything else? What are the characteristics of forms of knowledge that are not falsifiable theories — are there any? They would eventually be forgotten but they are innumerable. Included in this field are all *useful discoveries* that form the logical category complementary to that of refutable hypotheses. The vast majority of knowledge about animal, mineral and vegetable, and a great deal of technical expertise, is of this type.

In this class we find most of the chemistry that has long been viewed as pre-scientific when compared with physics. The great chemist Henry Le Chatelier in the early twentieth century says: “These two sciences have a similar purpose, they both study phenomena that result in transformations of energy, i.e., mechanical, calorific, electrical or chemical power. In teaching physics one refers only to the laws of natural phenomena: the laws of Mariotte, Gay-Lussac, Ohm, Joule, Descartes, Carnot, etc.. [...] In chemistry, on the other hand, there is an endless list of small particular facts [...] the material thus accumulated will be very useful for

[20] See Koyré, *ibid*, on the fact that Galileo never experienced the stone that falls from the mast of a moving ship, and on the conundrum in which he announces to his contemporaries his discovery of the phases of Venus.

[21] Cf. D. Bourg and A. Papaux *Pour une société sobre et désirable* PUF, FNH, 2010.

[22] Cf. B. Latour *Politiques de la nature, Comment faire entrer les sciences en démocratie* La découverte 1999, et D. Bourg et K. Whiteside *Vers une démocratie écologique, Le citoyen, le savant et le politique* Seuil 2010.

the subsequent establishment of science but they do not yet constitute it in any way"[23]. Why such a disgrace? Is it justified in terms of services rendered?

This class also contains most medical and environmental knowledge. Long before Popper, Claude Bernard wrote the following about medicine: "in science you can make two kinds of discoveries. Some are predicted by theory; these suppose two conditions: a very advanced science, e.g., physics, and simplicity of the phenomena. The other kind are unexpected: they appear unexpectedly in the experiment, not as corollaries of the theory and devoted to confirm it, but always outside of it and therefore contrary to it." [24]

More generally, outside the challenge-science category lies all the knowledge about how the world *is*, what features make it the way we find it, and not another that follows the same laws. This is not inconsistent with general knowledge in Aristotle style, but these innumerable and fortuitous data, that reflect what life and history have made, are essential for nature and the society. Besides, without them challenge-science is nothing. Computers can help us to store them but they do not reduce to dimensions or coordinates. They are interpretative like the new paradigms that Kuhnian revolutions bring. We must therefore accept that some are complementary — plural answers to the same question, differing accounts written in different styles and emphasizing different points.

XV. A knowledge whose social function is not prediction but caution and care.

We have to make a place for stories, testimonies, for what makes our current understanding of the world in all its diversity. They are the basis for the uses and values that give meaning to representations, even scientific ones.

With regard to mathematics, there is no reason to exclude it, we need it here too. But symbols may be used more freely than in axiomatized theories. It is perfectly legitimate to reveal a phenomenon, to represent a trend or a natural evolution using existing scientific languages from the established sciences or from engineering which are semi-artificial languages with partial mathematization. For managing natural equilibriums of life and for working on collective decisions of social groups, it is necessary to allow various representations and even different rationalities to coexist. The use of mathematics as thought patterns, for the linguistic value of symbols and combinations thereof, is useful and desirable. They are not reserved for expressing the truths of challenge-science.

XVI. The main tool of a better quality science is critical and contradictory modeling.

The models are able first to take into account the distinctive features of situations and to apply proven knowledge to them and secondly to translate, by the ordinary language which forms the internal cement and the external context, an interpretation of the complexity into what we are interested in.

If they are not to be seen as low level or amateur challenge-science, it is essential that models be always viewed as a facet of a plurality. Firstly, they must be validated by data with the same rigor as usually required by scientists. This validation is not a test of truth, but

[23] H. Le Chatelier, *Leçons sur le carbone, la combustion, les lois chimiques*, preface, Paris, 1908.

[24] Cl. Bernard *Leçons de physiologie expérimentale appliquée à la médecine faites au collège de France*, Paris, 1885.

simply a process of eliminating the unlikely. Secondly they must be recognized as a social expression, i.e., a form of communication from an agent (be that a group, association, company, territorial entity, etc.) to an audience in order to contribute to a decision and therefore subject to criticism by other models. Knowledge is no longer formed exclusively by a struggle between theory and nature but by a contest between models. This process obviously requires a specific organizational context, just as challenge-science requires cautious experimental protocols. The "rules" are not currently codified, but the experiments are underway at international level for the IPCC and in the public debates, citizen juries etc., in a kind of applied living epistemology still under development.

To critique a model is difficult. The quantitative arguments are linked together, everything is connected. It is a huge task to draw out all the implicit assumptions of a model. Even though we know that every model is arbitrary in some aspects, we do not see this arbitrariness explicitly. When discussing one model, our thinking remains stuck in a rut. The best way is to build another model from scratch — the options are much clearer then.

To construct another model, the dualities introduced by the philosophy of science are relevant — they facilitate a dialectic setting for the occurence of what may be called co-truths. Let us consider a few examples.

Discrete / continuous. Much of the economic theory can be developed without individualizing agents or goods. Some scholars find it illuminating to derive global laws from a micro-economic individual rationality. When studying traffic, depending on the question we may use flow models or we may model each vehicle individually. Sometimes it is thought that discretization, spatial or temporal, simplifies the problems, with the recurrence rules being more elementary than differential equations and finite element algorithms reducing partial differential equations to simple algebra. But often the opposite happens: the discrete probabilities are sometimes intractable and some algorithms (such as Kalman), are best understood in continuous time.

Descriptive / explanatory. In 1970, two American authors, G. E. P. Box and G. M. Jenkins took methods invented by Wiener for signal processing and applied them to economic predictions. Treating annual series without any regard to their economic meaning, they sometimes obtained better predictions. This is the fundamental duality which we began with in this article. In the history of science, it often occurs in successive periods. The purely descriptive approach can be an advance when it frees us from certain loaded interpretations. On the other hand, explanations allow a reading to shed light on situations other than those already considered.

Quantitative / qualitative. The philosophical work of René Thom has brilliantly illustrated that mathematics provides representation tools that go far beyond the quantitative. A huge field of natural phenomena can be addressed qualitatively through a language adapted to the evolution of forms.

Deterministic / random. A huge number of modeling situations involve risks. The instinctive tendency of modelers is to probabilize the uncertainties — we have already discussed this tendency. This provides a very efficient syntax thanks to the stochastic calculus developed in the 20th century. But this, especially in the tails of laws, conceals ignorance. Uncertainty is sometimes better illustrated by some typical or extreme trajectories obtained from different scenarios.

Image / symbol. Let us take the example of dance. Dozens of notation systems have been developed by the choreographers to record ballets, either based on a limited vocabulary of successive steps (Feuillet system 1700) or more elaborate, noting the dancer's energy in each movement (Laban system 1927). The problem is one of modeling, with the usual constraints of relevance for the choreographer and dancers. *But is this not a false problem since film and video can provide us with an almost perfect image of the ballet* ? The image reproduces, it can provide the perfect illusion of reality, but it does not, by itself, allow choreographic creation. The notation systems have the immense superiority of enabling one to record a ballet that has never been danced.

Critiques of models cannot come from recipes or an *a priori* classification, especially since, as we have emphasized, their relevance depends on the social group that proposes them. *The quality* of the plural knowledge thus produced comes particularly from the things that it can draw out of reality but which challenge-science fails to see. Applied in good conditions of open democracy, it is likely to show hidden effects, unnoticed risks, possibly unsuspected solutions. Challenge-science instead, with the successive stages of its rockets, heads only in one direction.

Conclusion: The problem is not that there is too much mathematics, but that it is used exclusively as a framework for theories that claim univocal truth.

The propensity to mathematize more and more can occur in the development of a classical theoretical line of thought as much as one based on modeling, especially if one assigns a value of absolute truth to the interpretative framework we work in, so that syntactic developments will be seen as revealing reality. This occurs in modeling because the modelers tend to think that their models are reality. But faced with other models they are forced to acknowledge *the scope* of their approach. In contrast, in a Popperian conception, mathematization can be pursued without any restraint, until a crisis occurs. Our analysis of mathematization is an Ariadne's thread that opens up the philosophy of knowledge to a new and immense field of thought. It turns away from the jousts, catapults and knights-in-armor of the conquering knowledge, it takes a step back, whereupon challenge-science starts to look like a very particular way of understanding the world.

It is ultimately a choice between what is important and what is not. A river basin for example, may remain for centuries. But we are faced here with contradictory logics, politicians who want to develop jobs, farmers who want to irrigate, associations that want to respect the landscape, companies that want to build dams for electricity, etc. Often neither the economic interest nor the democratic vote, can overcome the basic dominance of selfishness. Maintaining the scenes of natural life involves intermediate languages between native speech and falsifiable science, languages which oppose but do not destroy each other, which, by their plurality, are open to the *interpretation of data* and the *imagination of eventualities*.

About mathematics itself, there is no need to worry. Real mathematicians know what drives them: the pleasure of an intellectual game[25]. Maths does not need to be the framework

[25] Cf. N. Bouleau, *Dialogues autour de la création mathématique*, in coll. with Laurent Schwartz, Gustave Choquet, Paul Malliavin, Paul André Meyer, David Nualart, Nicole El Karoui, Richard Gundy, Masatoshi Fukushima, Denis Feyel, Gabriel Mokobodzki, 1997, on line : http://www.enpc.fr/HomePages/bouleau/DialoguesInterferences.html

for a grand and unique building of knowledge. On the contrary, freedom from applications and doctrines has always been maintained : non-Euclidean geometries, non-standard analysis, etc. Explorations off the beaten track are rewarded with the surprise of the treasures discovered there.

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The Value of Simple Models

Geoff Davies (Australian National University, Australia)

Neoclassical economic theory predicts equilibrium, yet the prediction is based on a string of patently absurd assumptions. Furthermore, evidence for instability is pervasive in the behaviour of real economies, implying that real economies are far from equilibrium and their behaviour potentially complex or chaotic. Therefore the neoclassical approach to understanding the behaviour of economies is futile and misleading [1], as many heterodox economists understand.

However the development of better theories seems to be significantly hindered by a feeling that any superseding theory has to be thoroughly quantified before it can be useful, and a feeling that the neoclassical theory has set a benchmark for sophisticated mathematics that must be matched before another theory can be respectable. Less fundamentally there seems to be a common perception that empirical insights can only be gained through elaborate statistical treatments of observations.

Here I offer some discussion from my experience as a natural scientist, and some examples regarding the Global Financial Crisis, to counter these hindrances. Useful and relatively simple models can be constructed that can immediately overcome major neoclassical limitations, for example by permitting non-equilibrium behaviour. The solution of the mathematics can be done using very standard numerical integration methods that are readily available in commercial packages. Mathematical machismo is not required. There are also situations in which the empirical lesson is obvious with no analysis, as will be noted here.

I should be clear that there are certainly many modellers who operate outside neoclassical confines, reported for example in Beinhocker's excellent survey of "complexity economics" [2]. The lessons offered here will not be news to them. Also some of them are constructing quite complex models that are nevertheless very instructive, such as models with many interacting adaptive agents. This article is prompted by my reading of some heterodox blog discussions, and is addressed to anyone who may have some difficulty seeing how to move beyond the neoclassical approach. Nor are the models here are offered as original investigations, though they may lead to such.

General points on quantification and mathematics

Theories do not necessarily even have to be quantified to provide important insights. I have argued that the recognition of economies as self-organising systems with many possible states already implies three important conclusions: that economies can be restored to their appropriate place serving society, that there can be a diversity of economic styles rather than a monoculture, and that economies can be compatible with the living world.

Nor does quantification have to be comprehensive or to involve highly sophisticated mathematics to yield useful insights. Indeed when a field is new, useful insights can often be gained from rather simple models, even from back-of-the-envelope, order-of-magnitude

estimates. Some striking examples of this difference in outlook between physicists and economists are recounted by Waldrop in his excellent book *Complexity* [3].

Economics is new in this sense, as the recognition of its complexity (in the technical sense) requires that it be thoroughly re-explored and re-conceived. In the natural sciences quite rough approximations are frequently used in such situations to, in effect, roughly map out the territory. More careful quantifications can then be appropriate to clarify and refine early findings. Indeed, unless guided by clear preliminary concepts and rough estimates, a more elaborate quantification can turn out to be a waste of time, or even misleading, if inappropriate parameter values have been used.

An example from my own field is an estimate that a magma ocean, resulting from the collision of two proto-planets, might solidify within only a few thousand years [4]. Even if this estimate is uncertain by one or two orders of magnitude it still makes clear that the magma ocean will freeze much more quickly than the time it takes for the final planet to aggregate, which is tens of millions of years. That is an important insight.

More basically, neoclassical economists seem to have a fundamental misconception that if they are doing sophisticated mathematics then they are doing science. This misconception goes back, via Milton Friedman, to the founding work of Walras among others. In science, mathematics is a very useful tool, but it is only a tool. In science, a hypothesis is proposed and its implications are compared to observations of the world. The objective is to find a hypothesis (or theory or story) that provides a useful guide to how the world is observed to behave. Mathematics is very useful for deducing the implications of a hypothesis, which can then be compared to observations. It can also be useful for processing observations (e.g. via statistics). The crucial distinction between mathematics and science is the comparison with observations, and the subsequent judgement as to whether the hypothesis is proving to be a useful guide. Neoclassical economics seems to have missed this fundamental distinction at the beginning, well over a century ago, and never to have noticed the oversight.

The importance of dynamics, and the role of money and debt

A financial market bubble and subsequent crash is an intrinsically dynamical event. In other words the market is driven by internal forces or feedbacks that move it through and beyond any perceived “true” value or equilibrium state. In October 1987, financial market values changed by thirty to forty percent in a single day, though there was no corresponding external event affecting the real economy. This demonstrated, starkly and with no analysis required, that financial markets are strongly affected by internal forces, and that they must have been far from equilibrium before, after or both. Such events clearly cannot be modelled by the equilibrium or quasi-equilibrium concepts that are the foundation of neoclassical economics. Indeed it must be doubted if the highly volatile financial markets could ever be so modelled.

Money must play a pivotal role in the internal dynamics of economies; more specifically this applies to token money, which is money without its own intrinsic worth. This is because token money links the present to the future, so in dynamical terms it operates on the time-derivatives of economic variables. This can be explained as follows. If I receive a ten-dollar note I am, in effect, receiving a promise from the community that it can be

exchanged, in the future, for ten dollars' worth of real goods or services. Thus the token (the ten dollar note) amounts to an implicit social contract between me and my community. That contract links the present (when I receive the note) to the future (when I spend it, i.e. when I exchange it for real goods or services).

The implicit contract involves a debt (the community owes me) and a corresponding credit (I am owed by the community). Because token money, like all debt, links to the future, it involves our expectations of the future, which fluctuate within the uncertainty of whether the future will actually deliver. Before I spend the note, it is merely a token of potential wealth. If the future does not turn out as we expect, my potential wealth may not be realised. This is also true of other forms of token money, such as entries in books and bits in computers. It is also true of other forms of debt, and in this context there is no difference between money and debt: both involve contracts, implicit or explicit, for delayed payments. Therefore both money and debt must be included in modelling of the dynamics of an economy, meaning its development in time.

Yet according to Keen [5, 6], the role of money in macroeconomics has been seriously neglected. Indeed much economic theory ignores both money and debt and treats exchange (the fundamental event of economics) as barter. Notable exceptions have been Keynes' qualitative discussion of a revolving fund of finance [7], and the circuit theories of money initiated by Graziani [8]. Keen has been, according to his claim, the first to show quantitatively how Keynes' revolving fund of finance works, and the first to show, building on circuit theory, quantitatively that a manufacturer can borrow money and still make a profit [9].

Simple dynamical models of economies

The models by Keen [5], and extensions of them by Davies [10] illustrate the intrinsically dynamic nature of economies, and the role of money in those dynamics. They also illustrate the value of relatively simple models, and contrast with the opaque complexity and irrelevance of neoclassical equilibrium models.

Keen [5] starts with a simple economy that develops by its own internal workings into a steady state. This steady state demonstrates how Keynes' "revolving fund of finance" can work, and also serves as a reference state from which to explore other things. Keen goes on to demonstrate how a credit squeeze causes a drop in the bank deposits of business and employees and a rise in unemployment. He extends this model to demonstrate that a government stimulus directed to households is much more effective in quickly restoring employment and circulating money than is a stimulus directed to boosting bank reserves. These are potentially important findings from rather simple models.

Davies [10] extends Keen's model to include property, as well as goods and services, so an asset price bubble might be simulated. The following examples come from this work. The methods are explained in detail in the references.

Keen's economy comprises banks, firms and employees ("workers"). Firms borrow money from banks and use the funds to manufacture goods. Those goods are sold to employees and bank personnel. Employees work for the firms in return for wages, and bank personnel work for the banks, deriving income from the interest charged on loans. Starting with the firms having no money, this little economy quickly approaches a steady state.

Davies' version includes housing property and employee mortgages and it comes to an analogous steady state, which is illustrated in Figure 1.

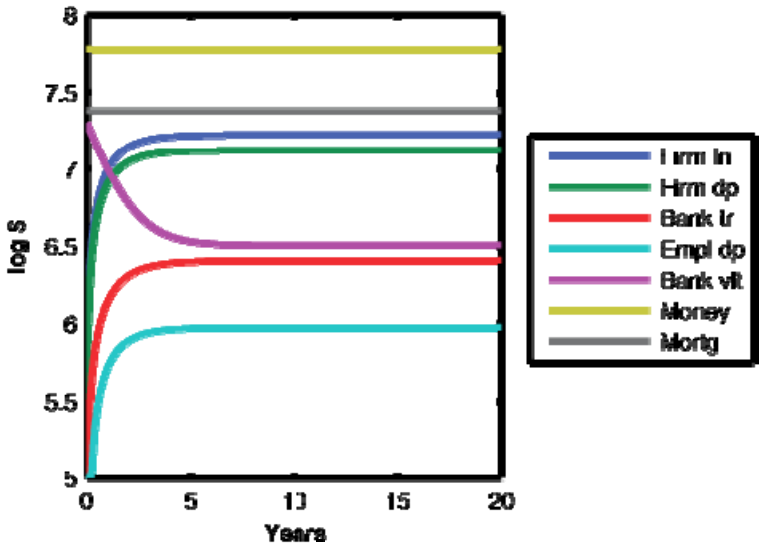

Figure 1. Approach to steady state in a simple economy. Quantities shown are accounting balances: Firm loans, Firm deposits, Bank transaction account, Employee deposits, Bank "vault" account, total money supply and total employee mortgages. From Davies [10].

In this example the population is steady and the total amount of money is constant. The money starts off in the bank's reserve account. To avoid common confusions, Keen suggests it is useful to think of paper money, and to regard the reserve money as being kept in the bank's vault. The model is started with some of this money already in the possession of employees, through their mortgages (otherwise it takes generations for the mortgages to come to steady state). However the firms start with no money, and both the Firm Loan and Firm Deposit accounts rise from zero. As firms take loans the bank vault is further depleted, and as firms conduct their business money flows to employees' deposit accounts. The bank's transaction account also rises from zero as interest charges are added. After a few years a constant amount of money circulates through the various accounts.

This example illustrates fundamentally non-neoclassical behaviour. During the initial transient phase, lasting 3-5 years, quantities change rapidly - they are dynamic. The subsequent steady state is not the same as a neoclassical model equilibrium, because the model is not constrained *a priori* to reach or approach a steady state, it does so through its internal interactions. During the initial transient the economy is far from a steady state, and a neoclassical model is not capable of representing this phase. Furthermore the model can deviate far from equilibrium under the action of internal forces, as two more examples will illustrate.

In a variation on the steady model, the price of property is assumed to rise exponentially, simulating a speculative bubble. If the money supply is also taken to rise exponentially, and some of the bank's profit is re-invested in its reserve fund, then an economy with perpetual inflation results, as shown in Figure 2 (note the logarithmic vertical

scale, in which exponentials become linear). This "growth" behaviour is readily induced in the model. It is true that the growing property prices and money supply are imposed from the outside, but this type of model accommodates these influences just as readily as it accommodates the steady state of Figure 1.

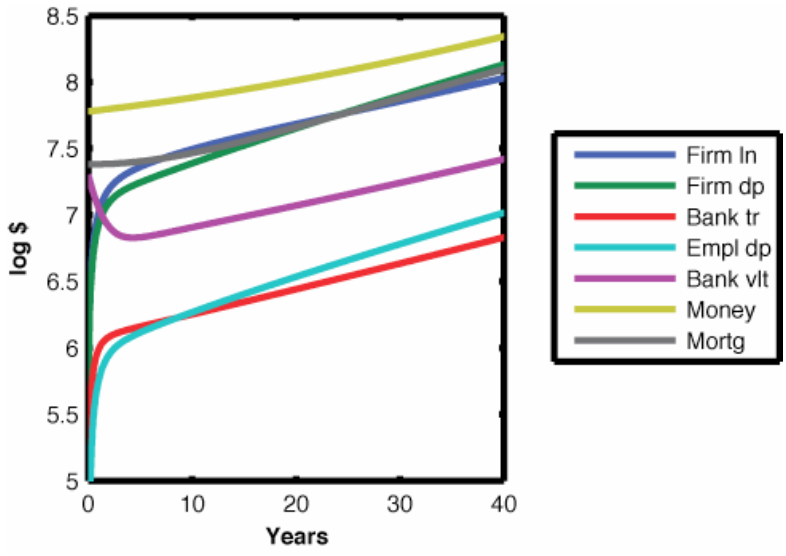

Figure 2. An economy with perpetual inflation, driven by inflating property prices, with the money supply increased to match.

It is easy to experiment with this model. One can, for example, keep the money supply constant as property prices increase. In that case, not surprisingly, the bank vault is soon depleted, but the response of the other variables is also instructive: firm and employee deposits and the bank transaction account continue to increase, but the firm loans peak and decline. A recession would soon ensue.

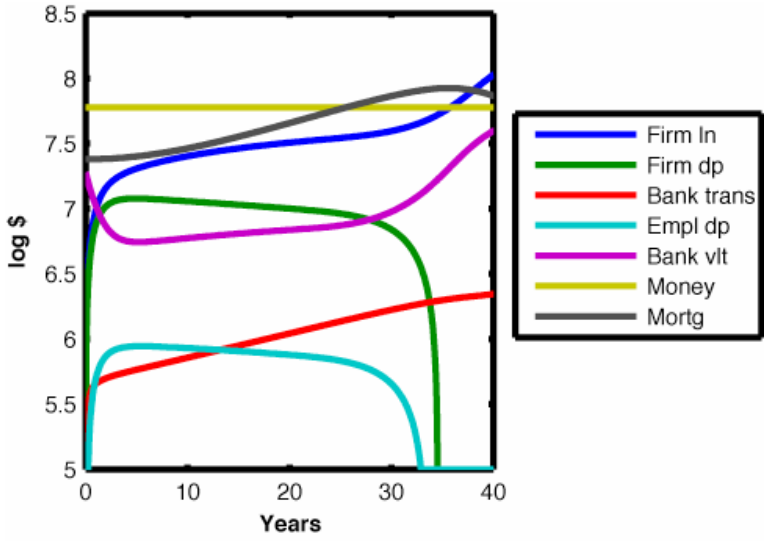

Figure 3. Primary variables for the case of a property crash.

Another experiment was to couple the property price to employee indebtedness. Although the total of employee deposits was increasing in the model just mentioned, some deposits went into overdraft (not shown here: more detail is in the reference). Therefore the rate of increase of the property price was reduced in proportion to the overdrafts. The result was that property prices peaked and crashed, taking the rest of the economy with them. The primary variables are shown in Figure 3.

Prices and wages are compared in Figure 4 for the three cases. Prices are nominal prices for goods, whereas property prices are prescribed as already described. Wages and unemployment (below) are calculated from a Phillips curve. The exponential increase in land prices in the inflationary case (Figure 4b) can be contrasted with the peak and decline in the crash case (Figure 4c). Wages and goods prices both decline in the latter two cases, though in proportion so that real spending power is roughly maintained. However many employees are heavily in deficit.

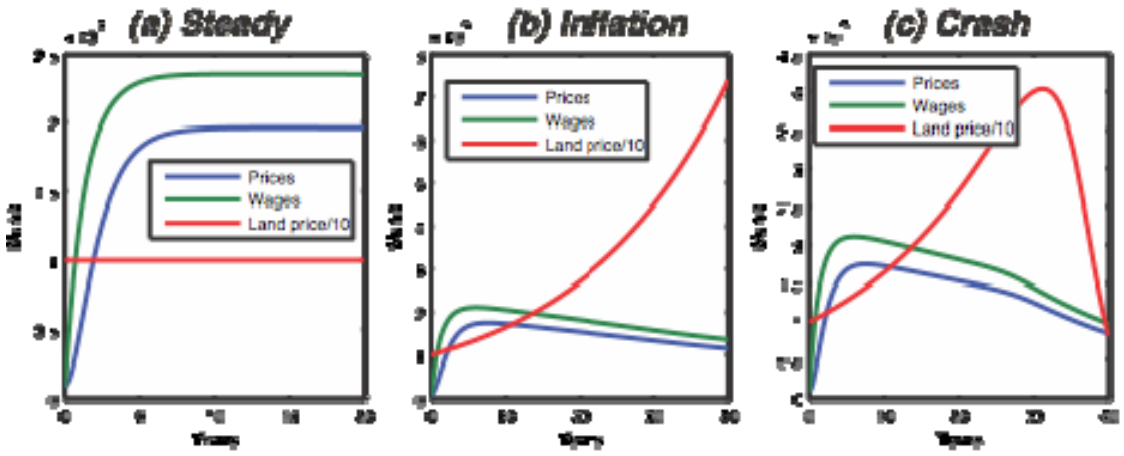

Figure 4. Nominal prices for goods, wages and land prices for the three cases considered.

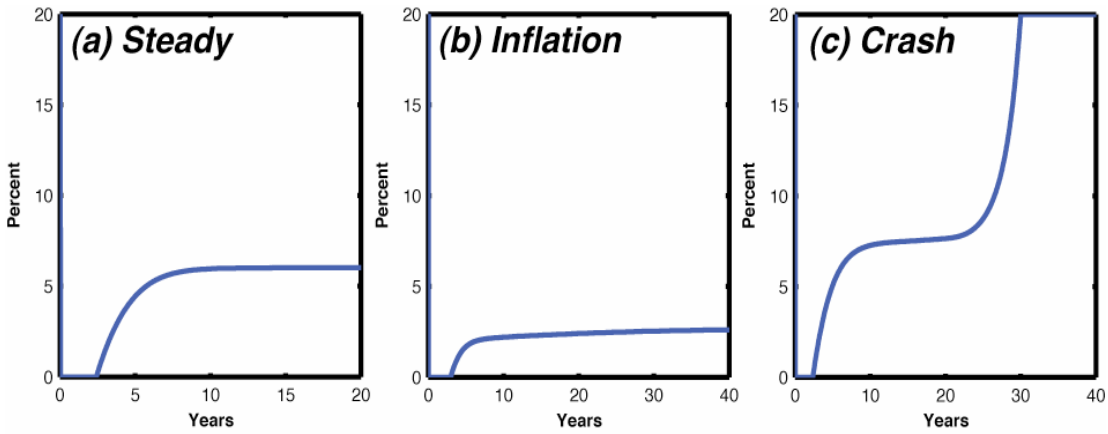

Figure 5. Unemployment for the three cases considered.

Unemployment is dramatically different in the three cases (Figure 5). It is near 6% in the steady case, only about 2.5% in the inflationary case, but high early and then

skyrocketing in the crash case. It should be borne in mind that the unemployment rate is calculated from an empirical Phillips curve that merely characterises the way economies have behaved over the past few decades. Further details of these models can be seen in the reference [10].

The point being made here does not so much concern the details of the models, nor their potential veracity, but rather the relative simplicity of the models and their ability to yield instructive detail on the interactions among the variables characterising the model economy. They are also readily amenable to experimenting with various assumptions, as these examples illustrate.

In an example of instructive detail, Figure 3 shows that during the crash the bank vault reserves increase as firm deposits and employee deposits crash. In other words money is withdrawn from circulation, and this will slow the productive economy. Keen also found that bank reserves increase during his simulated credit crunch. The important policy implication of this is that it does little good to boost bank reserves, as was done in the United States. It does more good to boost consumer spending, as was done in Australia.

The mathematics

The mathematics behind these models comprises a coupled set of ordinary, first-order differential equations. An example is the equation for the balance, E_D, in Employees' deposit accounts.

$$\frac{dE_D}{dt} = \phi_D F_D + r_D E_D - \varepsilon_D E_D$$

where t is time F_D is the balance in Firms' deposit accounts, and the other factors are rate constants representing the rate of pay received from Firms, the rate of interest received from the bank, and the rate of consumption expenditure.

Such a coupled set of equations may not easily yield analytical solutions, but it is readily integrated numerically. Commercial packages such as Matlab, MathCad or Mathematica will do this routinely on a desktop computer. Analytical solutions can be valuable if they can be obtained without undue simplification, because they reveal the internal interactions of variables explicitly. However these equations are still simple enough (even though the set of them is quite large in Davies' models) that the behaviour resulting from numerical integration can be understood fairly readily with careful examination. Therefore these models can lead to useful insights.

Contrast with a neoclassical approach

Keen [6] has drawn attention to a draft paper by prominent economists Gauti B. Eggertsson (NY Fed) and Paul Krugman (Princeton, NY Times columnist, Nobel Laureate) that attempts to apply equilibrium modelling to the Global Financial Crisis [11]. Their paper illustrates fundamental problems with the neoclassical approach. Keen gives a detailed critique, and only a few main points will be made here.

Most basically, equilibrium models cannot follow the system through a bubble and crash like that illustrated in Figures 3, 4(c) and 5(c). They have to make do with before-and-after models. However the "before" condition was not at equilibrium (otherwise it would not have crashed) so they cannot properly represent it. Neither is there any assurance that the "after" condition is at any equilibrium. Indeed, as there has been no fundamental reform, the global financial system is probably moving into another boom and bust sequence, which is intrinsically out of equilibrium.

Next, the models do not include money, or debt of any form, astounding as this seems to an outsider to the field. The authors reveal a fundamental misconception by stating "Ignoring the foreign component, or looking at the world as a whole, the overall level of debt makes no difference to aggregate net worth - one person's liability is another person's asset." In the real world, when banks issue money by creating it out of nothing and "loaning" it, the "borrowers" can spend it, even though there is the formality of a book-keeping entry treating the borrower's debt as a bank asset. People can also fail to pay back the "loan", thus creating a problem for the bank. This is central to the dynamic of a boom and bust. Keen notes that the authors also reveal their ignorance of Minsky and Schumpeter.

Lacking money, the authors contrive obligations between "impatient" agents and "patient" agents, where what is borrowed is not money, but "risk-free bonds denominated in the consumption good" (whatever that might mean). They assume there is a ceiling on the amount that impatient agents can borrow and they contrive a crisis by lowering that limit for the second of their two equilibrium models. Such contrivances are not necessarily a bad thing, if the model is carefully posed to reasonably represent an observed aspect of the world. They might still be instructive in principle, if carefully interpreted, but in this case the models are so unrealistic that little useful is likely to be learned.

The neoclassical situation can be contrasted with the simple non-equilibrium models presented above. Analogous contrivances have been used in the cases illustrated in Figures 2 and 3. In Figure 2, the price of property is assumed to rise exponentially with time. In Figure 3 the price is assumed to respond negatively to the level of overdraft of employees. However these models were conceived as steps towards a more satisfactory kind of model. Although they are already instructive in some respects, they have the potential to do much better. The land price and the money supply can be made mutually dependent, which creates the potential for an internally-driven instability, and the model will then follow the dynamics that result, however far from any notional equilibrium it may stray. Neoclassical models can never do that.

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Five methodological fallacies in applied econometrics

D.A. Hollanders (Technical University Delft, Netherlands)

Abstract
This paper discusses five methodological problems in applied econometrics. These are the problem of measurement, data mining, publication bias, the Duhem-Quine critique, and the non-repeatable nature of historical events. These problems form a third source of error next to two other more common sources of error in econometrics, sampling error and specification error. The paper argues that these problems aggravate the already difficult task of testing, but can often be dealt with. In some circumstances however testing itself is inappropriate, and econometrics is better understood as a means for description than for testing.

JEL classification: B40, C18, C50. Key words: applied econometrics, methodology, philosophy of science.

1. Introduction

Econometrics is a collection of probability statements. That is, estimated regression-coefficients come with a disclaimer that they may be wrong. The disclaimer takes the form of the probability that the estimated coefficient would have popped up if the true value of the coefficient equals zero. If this probability is below 5%, the coefficient is said to be significant. In a world of finite data the probability a true hypothesis is rejected – the type I error-never equals zero and it has to be accepted as a fact of life, even if the model is correctly specified.

A second concern, besides this Type I error, relates to the if-statement that the model is correctly specified. In its basic from, the ordinary least squares-model assumes regressors exogenous, error terms homoskedastic and uncorrelated, and sometimes normally distributed. Violations of these kind of model-assumptions form a second source of error, called specification error. Testing model-assumptions and thereby enabling correct inference is the core business of econometrics. A large part of econometrics consists then, in the words of Hendry [1980] of 'test, test, test'.

To deal with misspecification error and being aware of sampling error distinguishes good econometrics from bad econometrics. Nonetheless exclusively focusing on these two sources of error suggests there are no other possible sources of error. There are. The paper concerns itself with five such sources of error in econometrics; these fall outside the two categories mentioned, and together constitute what may be called methodological errors. These are (1) measurement error, (2) data mining, (3) Duhem-Quine critique, (4) publication bias, (5) historical events being sui generis.

These methodological concerns are not new and no claim to novelty is made. All the same, they are treated, if mentioned at all, non-systematically in many econometric textbooks, and are dealt with, if treated at all, ad hoc in applied work. It may therefore be useful to group and categorize them. The five concerns all circle around the question
if and how it is possible to test, or if one likes, they form some epistemological disclaimers that comes with testing.

2.1. Measurement problem and the problem of conceptualizing

The saying has it that without data, you're just another person with an opinion. Without data, at least you're a person without an econometric model, as data are the sine qua non for any estimation procedure. With the data the first problems however immediately arise.

A first problem with data is error in their measurement. Individual-level data as age, occupation, gender and voting behavior may often be assumed to be measured accurately, but this is generally not the case for macro-variables as inflation, GDP, social capital, inequality and employment. Perhaps counter intuitively, measurement error in the dependent variable is a relatively minor problem, only causing the estimators to be less efficient by increasing the variance of the error term. For the independent variables, things are different. An ill-measured regressor generally introduces endogeneity, thereby causing the estimator to be biased and inconsistent, see for example Davidson and McKinnon [2004]. It is then remarkable that much effort is made (and rightfully so) to control for reversed causality, cofounders and self-selection, and that measurement error of independent variables typically is not treated with similar concern. Sometimes ill-measured instrumental variables replace an endogenous variable to control for endogeneity, inviting via the backdoor what has been tried to get rid of via the front door.

A second and related problem is that though it is often clear something is measured, it is not always equally clear what is measured exactly. Contrary to political science, not much attention is paid in economics to operationalization and conceptualization of variables. Some examples illustrate the point.

Inequality is a frequently used concept in public debates and academic disputes. It also appears in many a regression. An often used operationalization is the Gini coefficient. The Gini lies between zero (if everyone has the same income) and 1 (if one person earns all nation's income), and the higher it is, the more unequal a country is. For example, it is reported to be 0.3 for rich countries and 0.5 for Latin-American countries. The Gini is one operationalization of income inequality. There are others; for example the percentage of total wages that is earned by the 10% richest people (or some other percentage than 10%). Another possibility is to look at the part of national income that goes to the production factor labor. Yet another possibility is the mean wage divided by the median wage (the higher this value, the higher inequality). Besides the choice of the exact operationalization, there are some other bridges to cross. For one thing, income and wages were used indiscriminately in the above, while not quite being the same thing. It remains also to determine whether to look at individual or household income, whether to use pre-tax or after-tax income, and whether to include non-monetary aspects of inequality. And it makes more sense to look at life-time income of individuals than at income at a certain moment in time, If, for example, everyone earns 1 in the first period of life and 3 in the second period in life, there is no inequality in life-time income, however the Gini at each point in time would be larger than that of a (poorer) country where half of the population earns 1 all the time, and the other half 2. Last but not least, there is the problem which data to apply the exact operationalization to. One may use either tax-records or questionnaires. All in all, there is an embarrassment of riches when it comes to measuring the concept of inequality. And then, measurement error has not been mentioned yet.

One has to make a judgment call, based on the practical consideration of data-availability and the theoretical question the data have to answer. Of course, if all different

operationalizations had the same qualitative result, things would not be that problematic. This is not the case however. Atkinson and Brandolini [2003] measured the same concept, the Gini, for different reliable data-sets for the Netherlands. The result was that the Gini-coefficient went up in one case, went down in another, and followed a U-shaped form in yet another. Consequently any position can be backed by a convenient choice of a data–set which in itself is reliable.

Inequality does not stand alone. GDP (Gross domestic product) is based on both historical figures and estimations and is frequently revised downward or upward afterwards. Sometimes guesswork takes the upper-hand, as the estimates of China's GDP by the Worldbank show; till recently these figures were extrapolated from a study of prices in America and China, dating back to the 1980s. Recent new price figures suggest that China's GDP may have been overestimated by 40%. This estimation applies to GDP measured at purchasing power parity, which takes into account that the yuan-equivalent a dollar has more purchasing power in China than in the US. However, something could as well be said for measuring GDP at market exchange rates, as these are the rates at which countries trade with one another. Besides measurement error and educated guess work, it is questionable what GDP is an operationalization of. If it viewed as a yardstick for economic welfare, it is first of all better to look at GDP per capita than total GDP, which is however reported in news-headlines. If this correction is applied than Japan witnessed higher economic growth than the US in 2003-2007 instead of the other way round. Correcting for population growth is only the beginning. GDP leaves out important economic factors as leisure, inequality, and the environment. Correcting for inequality makes France the richest nation (wealthier than the US), whereas correcting for leisure puts the Netherlands in first place. The US is only the winner when looking at GDP per head. If one doesn't win a single race, one may also increase the GDP by including some sectors previously not counted. Greece increased its GDP by a quarter by including inter alia smuggling, white-washing and prostitution.

Inflation can likewise be measured in different ways, for example excluding volatile prices such as food and fuel (core inflation), including them (the headline inflation) or focusing on either consumer or producer price inflation. These choices matter, or as the Economist reads 'That was the mistake made in the 1970s, when officials deluded themselves that inflation was under control by excluding ever more prices from the indices.' Nowadays, central banks focus consistently on one measure. Then it still matters which measure is looked at, or as again the Economist reads, 'the Fed focuses on "core" inflation (which excludes food and fuel) whereas the ECB targets overall inflation, America's central bank runs a looser policy in response to higher oil prices, thus pushing the dollar down.' (A different question is whether consumer good prices are that relevant when increased money supply mainly inflates asset- and house prices; only to inflate consumer price goods later with a vengeance.)

The motto of the Chicago school is that when you cannot measure, your knowledge is meager and unsatisfactory. This is an agreeable statement. However, the cases in which we cannot measure are more numerous than the cases we can. And then, like the case of inequality, the words of the political scientist Gary King [1986] hold that 'replacing the unmeasurable by the unmeaningful is not progress'.

2.2. Data mining

How does one know a theoretical plausible hypothesis holds? Test it. Does one know whether the outcome of the test is correct? One does not, but one can specify the probability with which one doesn't. How to know the tests themselves are appropriate? That is the question of the next three paragraphs, dealing with data mining, publication bias and the Duhem-Quine critique.

Sherlock Holmes stated that 'It is a capital mistake to theorize before one has data. Insensibly one begins to twist facts to suit theories, instead of theories to suit facts.' True this may be in the circumstance of crime investigation, the principle does not apply to testing. In a crime investigation one wants to know what actually happened: who did what, when and how. Testing is somewhat different.

With testing, not only what happened is interesting, but what could have happened, and what would have happened were the circumstances to repeat itself. The particular events under study are considered draws from a larger population. It is the distribution of this population one is primarily interested in, and not so much the particular realizations of that distribution. So not the particular sequence of head and tails in coin flipping is of interest, but whether that says something about a coin being biased or not. Not (only) whether inflation and unemployment went together in the sixties is interesting, but what that tells about the true trade-off between these two economic variables. In short, one wants to test.

The tested hypothesis has to come from somewhere and to base it, like Holmes, on data is valid procedure (even more, it is good thing, or as Kennedy [2002] states 'Some economists seem to feel that data-driven theory is, somehow, unscientific. Of course, just the opposite is true.'). The theory should however not be tested on the same data they were derived from. To use significance as a selection criterion in a regression equation constitutes a violation of this principle. Sometimes for good reasons, sometimes for reasons that are not obviously convincing.

Consider for example time series econometrics. The Box-Jenkins framework explicitly models a time series as a function of its own lagged values. In doing so, inclusion of lags is based on the empirical consideration whether they are significant. Now, if for example five lags are indiscriminately tested with 5% significance one after another –which is not unusual- then the probability one lag will turn out be significant is larger than this 5%. Assuming independence between the five tests, the probability is not 5% but 22.6%. (Of course, for lags that are a multiple of a lower lag –for example 2 and 4-the tests are not independent.) While 5% is the significance level communicated, included lags are typically not really significant at the 5% level.

True, in time series there may be a good reason to capitalize on autocorrelation. It may not be clear a priori which lags matter, while it is clear that some definitely do. Theoretical ignorance then makes lag-selection an empirical question, and time series models are sometimes referred to as models of ignorance because of it. So, the Box-Jenkins framework models the auto-correlation structure of a series as good as possible first, postponing inference to the next stage. In this next stage other variables or their lagged values may be related to the time series under study. While this justifies why time series uses data mining, it leaves unaddressed the issue of the true level of significance.

In cross-section regression there is generally no such justification for data mining. Theoretically relevant regressors are easier to line up than in time series where it is clear lagged values matter but not which lag

All the same, this is sometimes recommended in a general-to-specific approach where the most general model is estimated and insignificant variables are subsequently discarded. As superfluous variables increase the variance of estimators, omitting irrelevant variables this way may increase efficiency. Problematic is that variables were included in the first place because they were thought to be (potentially) relevant. If then for example twenty variables, believed to be potentially relevant a priori, are included, then one or more will bound to be insignificant (depending on the power, which cannot be trusted to be high). Omitting relevant variables, whether they are insignificant or not, generally biases all other estimates as well due to the well-known omitted variable bias. The data are thus used both to specify the model and test the model; this is the problem of estimation. Without further notice this double use of the data is bound to be misleading if not incorrect. The tautological nature of this procedure is apparent; as significance is the selection criterion it is not very surprising selected variables are significant.

The table illustrates the point by quantifying it. Running several experiments (like testing a variable) with significance level 5% one experiment will be significant only by chance. The table gives the probability at least one test is significant as a function of the total number of experiments. With five experiments already the overall type I error is close to the earlier mentioned number of 22,6%, and with 100 it is close to one.

A practical solution is to adjust the significance level. One procedure that precisely does that is the Bon-Feroni correction, which divides the overall significance level by the number of experiments (for example, testing two independent experiments at significance level 0,025 leads to an overall significance level of 5%).

Number of independent experiments	P[at least 1 trial significant] without correction	P[at least 1 trial significant] with Bon-Feroni correction
1	0,05	0,05
2	0,10	0,049
5	0,23	0,049
10	0,31	0,049
20	0,64	0,049
100	0,994	0,049

A second solution is to double-check whether the relation holds for different sub-sets and perform out-of-sample tests. This addresses the problem, as long as these subsequent tests themselves do not become the selection criterion.

Besides running regressions with different variables, which is avoidable, it is hard to completely avoid specifying different model-specifications with the same data. More often than not, remedying heteroskedasticity, using logs of a variable instead of the variable itself or determining whether a random or fixed effect is appropriate are integral parts of the regression analysis itself, and are not decided a priori. Of course, this is exactly the point of econometrics: 'test, test, test' and with non-experimental data it is virtually unavoidable as running another experiment is impossible. It is however not clear how to interpret results, since properties of estimators are derived under the assumption the model is estimated only once. At least, it is then advisable to practice what Tinbergen called kitchen-sink econometrics, being explicit about all steps in the process. Next to that, adjusting the significance level comes a way to addressing the concern of data mining and fitting more than one model.

Friedman [1991] stated 'I have been extremely skeptical of relying on projections from a multiple regression, however well it performs on the body of data from which it is derived; and the more complex the regression, the more skeptical I am. (..) Regression analysis is a good tool for deriving hypotheses. But any hypothesis must be tested with data or non-quantitative evidence other than that used in deriving the regression or available when the regression was derived.'

Indeed econometrics is a good device for testing a theory that was derived from considerations unrelated to those data. Taken literary, this means that one model-specification and one only may be estimated or that the significance level be adjusted.

2.3. Duhem-Quine critique

Thus far it was tacitly assumed that it is in principle possible to test one hypothesis independently. According to the Duhem-Quine critique not so and the following makes clear what the problem is. Beck [2006] states: 'Suppose we regress Congressional vote for the incumbent on campaign spending by the incumbent. Suppose we find almost no relationship. We might conclude that money does not matter and that everyone who thought that money did matter was wrong. This would be consistent with this regression. (..) But no student of elections would stop here. Theory would tell us that challenger spending matters, and perhaps increased incumbent spending is related to increased challenger spending. Or, perhaps incumbents in trouble spend more to offset their troubles. The electoral analyst would then incorporate these theoretical ideas (...) into more appropriate regressions, which would then yield more believable results.' There is much to agree with here, in particular being critical about estimation-results.

All the same, the quoted text also raises questions. What would a student of elections do if there was still no relationship between vote for the incumbent and campaign spending by the incumbent in the extended and more appropriate model? Would the outcome of no relation be convincing, or would the student not stop then either, and if not, when, if ever, will (s)he? On another note, would the student have stopped if the relation was significant in the first model, which was however not appropriate? In other words, was the inappropriateness of the model or the insignificance of the relation the criterion to continue regressing? And if the first was the case, why not run the appropriate model from the start?

These questions refer to a more general question: if a hypothesis is rejected, is the hypothesis itself given up or is some auxiliary hypothesis rejected? Any hypothesis, like the one here, is tested under the (implicit) assumption the rest of the model is correctly specified. An (in)significant result may either lead to giving up this assumption, or to the rejection (tentative acceptation) of the tested hypothesis. In the example, it is not the hypothesis of no relation that is (tentatively) accepted, but the model in which it was tested is rejected.

This exemplifies the Duhem-Quine critique that it is not possible to test a single hypothesis; only a body of interrelated hypotheses and auxiliary-hypotheses can. This has consequences. As the whole model is tested, it is a matter of choice which one of the hypotheses making up the model is rejected (or tentatively accepted). This choice cannot be made on formal grounds. It is a matter of common sense one could say, and to a degree and in the example of Beck that is definitely the case. But it is not really the point. If for some hypothesis common sense is considered a better arbiter than a test, then there is no need to test in the first place. It also begs the question for which hypotheses common sense is a better judge than tests. May be that too can be decided by common sense, but the problem with common sense is that it is not that common, and even if so, it is not necessarily sensible. Common sense could be wrong. That is why testing is performed in the first place, to put common sense to the test.

The same holds for for example wage equations. Suppose education has a negative return, which goes against everything, from earlier econometric findings to virtually every theory, from common sense to personal experience (for some at least). Would someone rush to publish that (s)he found the revolutionary finding of a negative return? (And if so, would it be published?)

He/she probably would, but only after having made sure that every rival interpretation could be discarded. Possible rival interpretations include that (i) a control variable was omitted (ii) the specification was wrong, it should have been non-linear, (iii) the data were incorrect, (iv) heteroskedasticity was overlooked. May be education turns out to not have a negative impact on wages after all.

Or maybe it does. In that case, the result is all the more convincing. Actually, that is exactly the point. If negative returns on education are not accepted right away, positive returns shouldn't either. Otherwise some hypotheses are more equal than others. May be positive returns should be assessed even more critical. The meaning of testing is to try and falsify the received wisdom, not adhering to it.

One way to partly deal with this problem is robustness checks. It is more convincing if a hypothesis is rejected in several models that are reasonable than rejecting a hypothesis in one model as if that is the only reasonable one.

2.4. Publication bias

Private vices, economists learn, often lead to public benefits; in testing however private virtues do not necessarily add up to public benefits. That is, if only significant results are published, then results published are not significant. This also holds for tests that are performed entirely correct, and crucially hinges on whether insignificant results are published.

To take an illustrative example, every now and then, a monkey hits the newspapers for outperforming the benchmark by picking his portfolio via throwing darts at different stocks on a dart board. Considering how many highly educated and well paid people try to outperform it, a remarkable success indeed.

Though remarkable, it is not necessarily convincing. One would like to know how many monkeys are throwing darts around the world. If for example 1000 apes are doing so, and only one did the job, then the hypothesis that one could better (and cheaper) hire a monkey as portfolio manager cannot be said to be significant. One can never be sure as long as one does not know how many monkeys darted (or other species for that matter). Crucial thing here is that monkeys not outperforming the market generally do not make it into the newspaper. Considering no monkey has been employed as market-analyst, I would stick to the hypothesis it was just one of the outliers.

Not only monkeys try to outperform the markets. With some more success, academics do too. Following the Capital-Asset-Pricing-Model as the analyzing framework, asset-returns should be determined by a single factor, the (market)risk. In principal other factors should not add anything. Somehow some seem to do. A long list of effects has been put forward, inter alia, the size effect (big stocks have lower return), the momentum effect (going short in stocks that went down), and the value premium (greater return for value stocks than growth stocks). The search for effects on asset prices other than risk has been likened to handing out data-fishing licenses. One of several objections against these kind of (in itself interesting) results is indeed data-snooping-or publication bias. (Other concerns are measurement error, survivorship bias by only considering stocks of firms that did not go broke along the way, and inadequate measure of the market portfolio.) What counts is how many researchers were fitting how many effects (id est, how many darts were thrown by the researchers). Perhaps stock-returns of stocks beginning with the letter A are significantly high, but then with 26 letters (and assuming independence) one letter will be significant with a probability of 0.74. The relation should be tested on new data.

The same holds for yet another example, wage regressions. Left-handedness has been find to significantly matter for the height of wages. May be it does, but one wonders if hair color, height, weight, and eye color were all tested too by someone else.

When such tests are performed by the same researcher, this is equivalent to data mining, and the Bon-Feroni correction should have been applied. When different researchers perform different regressions with the same independent variable, this cannot be done. In that case, what holds for darting monkeys, also holds for regressing econometricians. If only significant results are published, the published results are not significant. The solution is that journals accept null-findings and insignificant results become easier to get published. In fact, after estimating a good model, one can calculate the power of the tests, id est the probability of an insignificant result. This is (approximately) the frequency with which insignificant results should be reported. If not, either something unlikely has occurred or the null hypothesis the model was correct should be rejected.

2.5. Events

Outcomes of voting polls come with standard errors and confidence intervals. Elections themselves don't. Polls are estimates based on samples, and standard errors tell

how confident one can be that the estimates would be similar were another sample drawn from the same population. On Election Day one does not need a confidence interval, as the result is known.

This points to the more general question whether the sample used in a regression is indeed a sample drawn from a larger population, or that the "sample" in fact contains the whole population. So, whether the data are equivalent to a voting poll or to Election Day; in the first case, standard errors make sense, in the latter they might not.

In some applications, such as wage equations, there is indeed a larger sample (all people working). In other applications that is less clear. Suppose one runs a panel data-regression with fixed effects for democratic countries in the 20th century, controlling for inter alia the decade (for example regressing growth and population size on size of Social Security). What one is saying then is this: France in 1910 is like England in 1990, except for it being France and not England, and except for it being 1910 and not 1990. The position is then that, after controlling for relevant variables including time and country, these two different countries in two different historical episodes can be considered draws from a larger distribution. It is rather difficult to see what that distribution is.

Three interpretations are however on offer. First, that the countries are draws from a super-or meta-population. The error-term in the regression could have turned out different. This is taking the error term too literally. The error term is in the model because we cannot explain everything in reality, not because it is really there in reality. The idea of a meta-population comes down to the belief that we live in a Panglossian world or that God plays dice. Even if one believes so, it is difficult so see this as anything else than indeed a belief.

A second interpretation is that every year another realization is drawn, which constitutes the distribution. But England in 1950 is difficult to compare to England in 1850, 1700 (or 1500), also after controlling for 'time-effects'. Likewise it is difficult to imagine that England nowadays will be comparable, in the sense of stable regression-coefficients that is, to England in 2200. This would be equivalent to proposing that all elections in the last 100 years are draws from a larger population, and that results from elections in the twenties are generalizable to the next election. In that case one would want to know the standard errors on Election Day. Few people however do.

A third interpretation is that the sample of all democratic countries is a draw from the population of all countries, democratic or not. That is, other countries might also become democratic, and the regression tells what the regressions-coefficients are if they decide so. It is again difficult to see how a democratic country in Western-Europe is sufficiently similar to – let's say-an African country turning democratic. And if this counter-factual is reasonable, then reversing the logic would lead to the position that one could infer what would happen to social security in a Western Europe turning despotic, by looking at African countries. At the very least, few people use the standard error in American elections to predict Dutch voting outcomes.

When regressing one takes the position that the units of analysis are similar, only differing in their values for the regression variables. And by presenting significance levels one is apparently taking the position that there is some underlying population. Even if the first assumption is acceptable –that some countries in some period are similar-the second assumption is far more problematic. The alternative is to view the countries in this period as a

historical episode, and consequently the regression as a historical description. Asked what he feared most, Harold MacMillan famously replied, 'events, my boy, events.' Econometricians should be equally worried by them.

The unique character of historic episodes makes life in one way easier for a researcher. Statistical significance does not play an important role then; the coefficients are what they are, as one has the whole population. Regression is then a historical description of a certain episode. And if history indeed does not repeat itself, forecasting is not relevant anyway. Regression analysis does have merit, as regression can analyze historically and locally valid relations in a systematic way no other research may hope to do. In the words of Hoover: 'Econometrics is not about measuring covering laws. It is about observing unobvious regularities' (as quoted in Kittel [2004]). These unobvious regularities are however as interesting as they are historical.

2.6. Some other concerns

In the above some methodological concerns were sketched. Before turning to the conclusion, here are two other minor concerns listed that not made it on the short list.

A first one is that statistical significance is not the same as economic importance. A variable may be significant, yet have a minor impact on the dependent variable, these are the cases the coefficient is small. It is therefore important to assess what the effect of a change of the independent variable has on the dependent variable. This is more pressing with large samples. Having many data points is of course nothing but a good thing, but it is good to bear in mind that any coefficient not literary equal to zero will flash significant if the sample size increases. And in social sciences it is hard to come up with a variable that will have absolutely nothing to do whatsoever with the dependent variable (eye color might have something to do with your wage). Nothing but a good thing, but the effect may be tiny. Small effects may be relevant (for example if wage discrimination of women is significant) or may be less relevant (for example if education raises wages by a very small amount).

A second concern is sketched by Leamer [1983]. He shows that different specifications lead to substantial different outcomes. His example is the question whether the death penalty lowers the murder rate by deterrence. The independent variable is the murder rate. Different researchers may think of different control variables, dependent on their theoretical view on what determines crime in the first place. Leamer gives five possible theoretical priors. For example a 'right winger' will view as crucial other deterrence variables like the probability of conviction and of execution (given being convicted). This contrasts with someone with the 'bleeding heart' prior, who will see economic conditions as unemployment and inequality as the prime cause of crime. Each researcher will control for the variables (s)he sees as crucial, treating all other variables as doubtful. Leamer subsequently shows that depending on whether doubtful variables are included, the 'right winger' may find that the drop in the murder rate per execution lies between 0.86 and 22.56. This is in itself already a large range, but the 'bleeding heart' may find the effect to lie between a drop of 25.6 and an increase in the murder rate of 12.37. Leamer states the feeling 'that any inference from these data about the deterrent effect of capital punishment is too fragile to be believed'. This indicates that a priori theories, on which the model is and should be based, matters for the final outcomes. Different theories lead to different outcomes and outcomes may just end up confirming the theories on which they were based in the first place.

3. Conclusion

The above has raised some points related to testing. These methodological concerns are to be distinguished from the usual problem of econometrics such as heteroskedasticity, auto-correlation, non-stationarity, and endogeneity.

The first point, measurement error and error of measurement, indicates that even before testing begins, the problems already started. Especially measurement error of independent variables can have severe consequences, as it introduces endogeneity. A related problem is that entities as inflation, inequality and GDP can be operationalized in different ways, leading to truly different outcomes. It is remarkable that very precise estimates are based on data that are not very precise.

Three other concerns -publication bias, Duhem-Quine method and data mining-lie at the core of testing itself. These are difficult to avoid completely, but can reasonably be dealt with. When multiple tests are performed significance levels should be adjusted accordingly. Robustness checks should be performed and researchers should be explicit about the ways they have tried to falsify their result and which steps have been taken in the estimation procedure. Finally, it would be good that null-findings are just as easy to publish as significant results.

It may be useful to realize that these problems are also present in natural sciences. There too measures may come with error, insignificant results may be hard to publish, a single hypothesis cannot be tested, and there too models are derived from the data. There is one difference, and that is a big difference: the possibility of running another experiment. In economics this is difficult to do and econometrics is the art of making the most of non-experimental data or as Orcutt has it ‘Doing econometrics is like trying to learn the laws of electricity by playing the radio’.

All the same, if these laws are really claimed to be general -in the sense that there is a stable relation and a wider population-then it should in principal be possible to play another radio, that is to perform another test on data that the researcher was not and could not have been aware of when estimating the model. Testing the model on these new data is the real test, as the words of Friedman also suggests.

Critics of experimental economics doubt its relevance for its lack of external validity. A valid point, but if the external validity of econometrics is much better, it should be possible to conduct another test. There are circumstances in which such a test is not only difficult to imagine but simply impossible to perform. It is not possible to run the 20th century over again to see whether macro-economic relations in democratic countries still hold. The fifth concern articulates this. It is for example not obvious that there is a population of democratic countries in the 20th century out of which countries were drawn. Then the vocabulary of testing is just not appropriate. As history does not repeat itself, it is also not relevant either, as forecasting is not important anyway. Regression analysis of for example OECD-countries should then be understood as a descriptive account first and foremost in which testing is impossible or irrelevant, or both. Coefficients cannot be said to be significant or not, they are what they are.

There remains a valuable role to play for econometric models; they are able to describe historical events in a systematic way no qualitative researcher can hope to do. And it can, by doing so, suggest historical relationships that are not visible by other means.

Hicks stated that 'as economics pushes on beyond "statics", it becomes less like science, and more like history'. Similarly, as econometrics pushes beyond repeatable events, it becomes more like history, though hopefully not less like science. In those cases econometrics is a collection of historical statements.

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Author contact: d.a.hollanders@uvt.nl

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