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The Mathematical Economics of Compound Rates of Interest: A Four-Thousand Year Overview Part II

April 24, 2001

By [Michael](#)

2. Why Economies Develop Debt Crises: The Mathematics of Compound Interest

The past century's economic schoolbooks have described a universe running down from entropy. Production is assumed to be plagued by diminishing returns, so that each additional unit of input produces less and less output. Even if technology were recognized to raise the productivity of labor, capital and land over time, neoclassical models hold that each additional unit of consumption or wealth yields diminishing psychological utility.[1] Not only will economies grow less rapidly, they will feel poorer.

Large parts of the population in many countries are indeed becoming poorer and forced into debt, but the pessimistic assumptions cited above make no reference to debt. Their seeming independence from finance – and from social policies to deal with debt problems and wealth distribution – is supposed to make economics scientific. And if the subject is to be a science, of course, it must adopt the scientific hallmark, mathematics. Unfortunately, the only way for economic models to produce a mathematically solvable equilibrium is to use physical production functions that slow down and psychological wealth-seeking utility functions that dissipate rather than become addictive. Economic technocrats thus are taught to use mathematics in a wrongheaded way at the outset, while ignoring the exponential mathematics of debt and the asset-price inflation it feeds.

This blind spot of “learned ignorance” has created economic devastation from Russia and Japan to third world debtor countries. Today's academic curriculum teaches models that fail to recognize how the economy's debt overhead mounts up to produce financial shocks. Also ignored is the degree to which wage-earners and industrial investors find a rising share of their incomes diverted to pay debt service. The way to get rich today is not by earning wages and profits, but to benefit passively from the inflation of real estate and other asset prices as interest is credited and other new savings are recycled into mortgage and stock market loans. But even if economic theory recognized these dynamics, the national income and product accounts (NIPA) do not include capital gains, so there is no clear basis for giving a quantitative sense of proportion to the financial, insurance and real estate (FIRE) sector vis-à-vis the rest of the economy.

The neglect of debt is curious, for the subject was placed at the center of economic and indeed, religious policy for most of civilization's past four thousand years. The mercantile debts and rural usury of Bronze Age Babylonia and classical Greece and Rome saw the accrual of interest double and redouble the sums due, leading to expropriation of indebted families and forcing them into bondage. From feudal Europe's papal bankers to the emergence of large-scale Dutch, English and French finance capital, the expansion path of public as well as private debts has soared off the charts toward infinity. Money is saved and reinvested to grow without end, regardless of the economy's ability to pay. Yet the mathematics describing the growth of interest-bearing debt on an economy-wide basis are missing from today's macroeconomic policy models.

What the Babylonians recognized that modern economists don't

Mathematics played a major role in training the scribes of Sumer and Babylonia. Most of them were employed in palace and temple bookkeeping, so their schoolbook exercises included manpower allocation problems such as calculations of how many men were needed to produce a given amount of bricks or dig canals of a given size, the expected growth of herds and the doubling times of investments lent out at interest.[2] Surprising as it may seem to modern readers, this mathematical training four thousand years ago was more relevant for dealing with society's debt overhead than is that given to economics graduates today, for it dealt with exponential functions (as well as astronomical computations and even quadratic equations).

When U.S. bank lending rates peaked at 20 percent in 1980, they reached what had been the normal commercial interest rate from Sumer c. 2500 BC through the Neo-Babylonian epoch in the first millennium. In fact, when Alexander the Great conquered the Near East in 331 BC, the rate had remained remarkably stable at the equivalent of 20 percent for more than two thousand years. It had not been set with any particular reference to profit levels or the ability to pay, but was a matter of mathematical convenience, reflecting the Mesopotamian way of computing fractions by division into 60ths. A bushel of barley was divided into 60 “quarts,” and a mina-weight was composed of 60 shekels. Paying interest at the rate of 1/60th each month added up to 12/60ths per year, or 20 percent in modern decimal notation. A mina lent out at this rate would produce 60 shekels in five years, doubling the original principal.

A model Babylonian scribal exercise from around 2000 BC appears in the Berlin cuneiform text (VAT 8528). It asks the student to calculate how long it will take for a mina of silver to double at the normal rate of one shekel per mina per month. The answer is five years at simple interest. And in fact, the common practice was to lend long-distance traders money for this five-year period. Assyrian trade contracts c. 1900 BC, for instance, typically called for investors to advance 2 minas of gold, getting back 4 in five years. Elsewhere in Mesopotamia commercial contracts normally were denominated in silver, but the interest rate was the same.

This idea that doubling times were determined by the rate of interest was well enough understood to be given a popular imagery. "If wealth is placed where it bears interest, it comes back to you redoubled,"[3] an Egyptian proverb observes. Another compares making a loan to having a baby, viewing the reproduction of numbers in sexual terms. The word for "interest" in every ancient language meant a newborn, either a goat-kind (mash) in Sumerian and the Akkadian language used by the Babylonians, or a young calf – tokos in Greek or foenus in Latin. The "kid" or "calf" was born of silver or gold, not by borrowed cattle as some economists once believed, missing the metaphor at work. What was born was the "baby" fraction of the principal, 1/60th. And only when these accruals of interest had grown to be as large as their parent, after the fifth year, were they deemed "adult" enough begin having new interest "babies" on their own, for everyone knows that only adults can reproduce themselves. Thus, compounding began only after the principal had reproduced itself by the time 60 months had passed. Investors who wanted to keep their loans growing had to draw up new loan contracts.

How long could the process go on at these rates? A relevant scribal problem (VAT 8525) asks how long it will take for one mina to become 64, that is, 26. The solution involves calculating powers of 2 ($2^2 = 4$, $2^3 = 8$ and so forth).[4] A mina multiplies fourfold in 10 years, eightfold in 15 years, sixteenfold in 20 years, and 64 times in 30 years, that is, six times the basic five-year doubling period, expressed in modern notation as 26.

Traders and merchants were able to pay such rates out of their business gains, but serious problems occurred in the agricultural sphere, especially when crops failed or military hostilities interrupted the harvest. Matters were aggravated by the fact that interest rates were higher and more extortionate in the rural sector. The most typical rate was 33 1/3 percent, evidently reflecting the normal sharecropping rate of a third of the crop. Rates of 50 or even 100 percent might be charged, often for only short periods of time. Creditors (mainly palace collectors or other officials) demanded whatever they could get when they found cultivators in distress conditions. Sharecroppers or other individuals who were unable to break even or pay their stipulated rents or fees to the palace were forced to borrow out of need found that once they ran into debt, it was difficult to extricate themselves. The problem was that rural loans were made to pay taxes or get by hard times, not to acquire property or finance investment. Thus, instead of financing the acquisition of property, rural usury led to its forfeiture.

At the interest rate of 33 1/3 percent, Babylonian agricultural debts doubled in three years. Probably reflecting this fact, §117 of Hammurapi's laws (c. 1750 BC) stipulates that after three years of service, by which time the creditor had received interest equal to the original debt, it should be deemed to have been paid and the bondservant liberated to rejoin the debtor's family. The implication is that doubling the debt principal represented a moral and indeed, practical limit, largely because it was recognized how quickly debts grew to exceed the rural economy's ability to pay. Indeed, at no time in history has output grown at sustained rates approaching the typical 33 1/3 percent rate of interest charged for agricultural loans, or even the commercial 20 percent rate. When the loan proceeds were used for consumption or to pay tax arrears, interest charges ate into the needy cultivator's modest resources, obliging him to pay sums growing exponentially beyond his ability to produce. Under these conditions, creditors were enabled to draw into their own hands the debtor's family members as bondservants, followed by the land and other assets. This threatened to polarize society self-destructively by expropriating the citizen-army that traditionally supported itself on the land.

The charging of interest is found in classical Greece some time around 750 BC, probably being introduced by Syrian ("Phoenician") traders. (Hudson 1992 provides a scenario for how this occurred.) Following Egyptian mathematical practice, Greek interest rates were decimalized at 10 percent, half the Mesopotamian rate. This made the doubling time for loans ten years. But despite this fact, along with sharecropping rates and related crop payments being set at a lower proportion of the yield than in Mesopotamia's richer lands, this did not save cultivators from running into such serious problems that rural debt revolts occurred. Sparta's "Lycurgan" reforms went so far as to ban the use of precious metals as money, and made the land inalienable and hence safe from forfeiture for debt arrears. By the 7th century BC the oligarchies in Corinth and other Greek cities were overthrown and driven into exile by popular leaders ("tyrants") who cancelled the debts of their rural supporters and redistributed the lands of the exiled families.

One of the last cities to experience a debtors' revolt was Athens, where Solon laid the foundations for economic democracy by banning debt bondage in 594 BC. But subsequent Greek regimes drew the line, often obliging civic administrators to pledge not to cancel the population's debts. By the third century BC even Sparta's formerly egalitarian economy was polarizing between landowners and families who had lost their property through debt foreclosure. Toward the end of the century Sparta's kings Agis and Cleomenes tried to save matters by cancelling the population's debts, but they were exiled and Cleomenes was murdered. Sparta's final reformer, Nabis, was overthrown by local oligarchies with the aid of Rome.

The Romans and other Italians seem to have adopted the practice of charging debt around 750 BC from Greek and Near Eastern traders, but used the duodecimal system of fractions based on dozens, probably reflecting the division of the year into twelve months. The pound was divided into twelve troy ounces, and the legal rate of interest was set at 1/12th (8 1/3 percent). This was the lowest major regional rate in antiquity, but it also proved often to be beyond the ability of cultivators to pay, especially in times of war when they were called away from their land to fight. (For a while the rate was cut in half, but in due course reverted to 1/12th.)

The decline in interest rates as civilization's center moved westward from the Near East to Greece and then to Italy resulted from technical mathematical causes, not from declining productivity, profit rates or monetary deflation. And despite this decline (and hence the length of time it took for a debt principal to double), the debt burden became increasingly serious as debt cancellations became a thing of the past. Livy, Diodorus and Plutarch described how debt

pressures were aggravated as the economy polarized and the wealthiest landed families shifting taxes onto the less prosperous classes, impoverishing Roman society. The money economy was destroyed, bringing on the Dark Ages and a reversion to local subsistence production.

In his *Politics* (I.10 at 1256, written c. 330 BC) Aristotle pointed out how inappropriate was the metaphor of debts reproducing themselves, for silver was sterile. “The taking of interest is contrary to nature because money by nature cannot produce anything and is intended only to serve the purpose of exchange,” that is, as a means of payment and common measure of value. Its proper function was simply to be a catalyst, not to intrude into exchange relations, yet interest-bearing debt had a financial expansion path that diverged from that of the underlying tangible economy. This is why rural usurers were so hated.

The contrast between money’s sterility and the reproductive power of animals explains the frequent depiction of usurers as old homosexuals, incapable of reproducing themselves. When Livy (VIII.28) wrote his history of Rome he probably knew only the bare fact that in 326 BC the Papirian law had abolished the right of creditors to keep their debtors literally in bonds. In the popular Stoic fashion of his day, he drew on an established literary archetype to compose a dramatic scenario for the events leading up to Rome’s debt revolt. He portrayed the Roman crowd rioting to protest a lustful usurer, Lucius Papirius, abusing a boy left in his charge as a debt pledge, “regarding the boy’s youthful bloom as added interest on his loan.” When the boy rejected the creditor’s advances, Lucius

ordered him to be stripped and beaten. Mangled by the blows, the boy rushed into the street and complained loudly of the usurer’s lust and brutality. A vast crowd gathered, inflamed with pity for his youth and outrage for the wrong, and considering too the conditions under which they and their children were living, and they ran into the Forum and from there in a compact body to the senate house. Forced by this sudden outbreak, the consuls convened a meeting of the senate, and as the members entered the senate house the crowd exhibited the lacerated back of the youth and flung themselves at the feet of the senators. The strong bond of credit was on that day overthrown through the mad excesses of one individual. The consuls were instructed by the senate to lay before the people a proposal ‘that no man be kept in shackled or in the stocks, except such as, having been guilty of some crime, were waiting to pay the penalty; and that the goods but not the person of the debtor should be the security for money lent.’

Usury was personified as sterility, the antithesis of fecundity and participation in the normal social reproductive process. Rather than creating families, creditors broke them up by seizing their members as bondservants and foreclosing on their subsistence lands, thus depriving them of their means of support. Some usurers consumed splendidly to gain the approval of others, as in the narrative of Sodom and Gomorrah, but more often they acted miserly and did not consume much, sacrificing their own worldly enjoyment to an addictive, increasingly compulsive property acquisition for its own sake.

The soaring curve of wealth addiction became the natural counterpart to the exponential growth of debt. As individuals obtained more money and property, they desired yet more, becoming insatiable. The way to acquire property most quickly was through usury, causing social polarization. “Woe to you who add house to house and join field to field till no space is left and you live alone in the land,” declaimed Isaiah. Greek dramatists would portray the limitless greed for money as a disease of the psyche. In Aristophanes’ last play, *Ploutos* (388 BC), the character Karion remarks that a person may become over-satiated with food – bread, sweets, cakes, figs and barley – but no one ever has enough wealth. His friend Chremelos agrees:

Give a man a sum of thirteen talents,

and all the more he hungers for sixteen.

Give him sixteen, and he must needs have forty,

or life’s not worth living, so he says. (lines 189–93)

As the French classicist Jean-Pierre Vernant (1982:82) paraphrases this thought: “Ultimately, wealth has no object but itself. Created to satisfy the needs of life, as a mere means of subsistence, it becomes its own end, a universal, insatiable, boundless craving that nothing will ever be able to assuage. At the root of wealth one therefore discovers a corrupted disposition, a perverse will, a pleonexia – the desire to have more than others, more than one’s share, to have everything. In Greek eyes, ploutos (wealth) was bound up with a kind of disaster,” headed by hubristic behavior, whose defining characteristic was not just the egoism of wealth but the injury its holders did to their victims, above all through usury.

The exponential doubling and redoubling of debt

For thousands of years religion paid more attention to the problems inherent in the exponential growth of debt than do modern economists. Martin Luther depicted the growing mass of usurious claims on the poor and the rest of society as the “great huge monster . . . who lays waste all . . . Cacus,” who “would eat up the world in a few years” as usurers scheme “to amass wealth and get rich, to be lazy and idle and live in luxury on the labor of others.” Once Cacus got hold of a man and imbued him with the insatiable desire for money-wealth, he turned him into a “usurer and money-glutton” who “would have the whole world perish of hunger and thirst, misery and want, so far as in him lies, so that he may have all to himself, and every one may receive from him as from a God, and be his serf for ever. . . . For Cacus means the villain that is a pious usurer, and steals, robs, eats everything.”[5]

Napier’s 1614 book on logarithms juxtaposed exponential or “geometrical” series of numbers to their simple arithmetic expansion. A poetic application of this mathematical idea appears at the outset of Shakespeare’s *A Winter’s Tale*, which actually was published a few years earlier. The metaphor of “a cipher . . . standing in a rich place” is used to indicate the logarithmic exponential by which a debt multiplied as it mounted up unpaid at compound interest.[6]

This passage has caused speculation on how and when Shakespeare might have known Napier or his circle, but the most striking cultural point is how dramatists and novelists often have paid more attention to debt than do modern economists.

The novels of Dickens, Balzac and their contemporaries, as well as earlier British drama, are filled with debt imagery, reflecting the major role it played in nearly everyone's life.

In antiquity no governments had gone bankrupt, as public debts did not arise until medieval Europe. The process started with Italian bankers lending money to enable rulers to pay Peter's Pence and related tribute to the Roman papacy. In short order the continent's territorial wars pushed realms deeply into debt, headed by the almost constant fighting between England and France. As the previous chapter has noted, it was largely to avoid further war borrowing that Britain granted liberty to its colonies, just as it finally would dismantle its colonial system after 1945, being too broke to continue the game.

It was in reference to Britain's war debts that one of Adam Smith's contemporaries, the Anglican minister and actuarial mathematician Richard Price, graphically explained the seeming magic of how debts multiplied exponentially. His 1772 *Appeal to the Public on the Subject of the National Debt* described how "Money bearing compound interest increases at first slowly. But, the rate of increase being continually accelerated, it becomes in some time so rapid, as to mock all the powers of the imagination. One penny, put out at our Saviour's birth at 5% compound interest, would, before this time, have increased to a greater sum than would be obtained in a 150 millions of Earths, all solid gold. But if put out to simple interest, it would, in the same time, have amounted to no more than 7 shillings 4½d." In his *Observations on Reversionary Payments*, first published in 1769 and running through six editions by 1803, Price elaborated how the rate of multiplication would be even higher at 6 percent: "A shilling put out at 6% compound interest at our Saviour's birth would . . . have increased to a greater sum than the whole solar system could hold, supposing it a sphere equal in diameter to the diameter of Saturn's orbit."

Price suggested rather naively that Britain's government should try to make use of this exponential principle to pay off the public debt by creating a sinking fund that itself would grow at compound interest. The idea had been proposed a half century earlier by Nathaniel Gould, a director of the Bank of England. Parliament would set aside a million pounds sterling to invest at interest in a sinking fund, where it would build up the principal by reinvesting the dividends annually. In a surprisingly short period of time, Price promised, the fund would grow large enough to pay off the entire debt. The government thus would extricate itself from debt by establishing financial claims on the rest of the economy! "A state need never, therefore, be under any difficulties, for, with the smallest savings, it may, in as little time as its interest can require, pay off the largest debts."

What Price had discovered was how the exponential growth of money invested at interest multiplied the original principal by plowing back the dividends into new saving. Here was the explanation for how savings snowballed in the hands of bankers, bondholders and other savers who kept on reinvesting their dividends. It is the same principle the Babylonian scribes had been taught four thousand years earlier, when the compound interest phenomenon was just really getting underway on a large scale.

What Price failed to appreciate was that never in history has any economy been able to turn a penny or any other sum into a surplus large enough to pay creditors a solid sphere of gold reaching out to Saturn's orbit. Economists estimate that during the two thousand years since the birth of Christ the European economy has grown at a compound annual rate of 0.2 percent, far less than the level at which interest rates have stood. No doubt many people saved pennies back in Roman times, and indeed, hundreds of talents of silver and gold were lent out at high rates of interest. Yet nobody had accumulated a vast volume of gold nearly as large as the earth itself, or even as large as a city block. The entire volume of gold in the world today is enough to fit into a single large fortress – an estimated — million tons, worth about \$— billion at the price of \$280 an ounce. (fn) The inference is that the interest that savers intend to obtain will not and cannot materialize in practice. Financial claims on income and head wealth run ahead of the economy's non-financial or "physical" ability to produce (and hence, to pay), culminating in crises that wipe out savings along with the bad debts. The accrual of savings (that is, other parties' debts) thus are not inherently linked to the economy's ability to carry these debts.

Recognizing that no society's productive powers could long support interest-bearing debt growing at compound rates, Marx poked fun at Price's calculations in his *Grundrisse* notebooks (1973:842f.) that were incorporated into *Capital* (III:xxiv). "The good Price was simply dazzled by the enormous quantities resulting from geometrical progression of numbers. . . . he regards capital as a self-acting thing, without any regard to the conditions of reproduction of labour, as a mere self-increasing number," subject to the growth formula

Surplus = Capital (1 + interest rate)ⁿ

No wonder Adam Smith found that no nation in history had paid off its public debt, and that Britain's tax revenues had become "a fund for paying, not the capital, but the interest only, of the money which had been borrowed . . ." As for the idea of a sinking fund, governments simply turned around and reborrowed an equivalent sum for whatever was set aside to pay off the debt, or indeed whatever was needed to finance yet new wars. Such a fund "is a subsidiary fund always at hand to be mortgaged in aid of any other doubtful fund, upon which money is proposed to be raised in any exigency of the state." To ambitious monarchs or parliamentary leaders, the fund would be an irresistible temptation.

In 1798, a generation after Price put forth his argument for a sinking fund, the Rev. Thomas Robert Malthus drew the contrast between geometric and arithmetic rates of growth in the way that most economic students recognize today. Picking up his fellow minister's imagery, Malthus asserted that populations tended to grow "geometrically" unless checked by natural forces such as famine, disease or war, while the means of subsistence – the populations of animals and plants consumed by humans – could grow only "arithmetically," that is, at simple interest. It followed that social programs to provide more money for the poor would be self-defeating, because they would have more children ("multiply their numbers"), pressing against the limits of subsistence and forcing their living standards back down to minimum survival levels. [7]

The original financial context that made readers familiar with Malthus's contrast is all but forgotten today. Few economists remember that the mathematical idea was first applied to the rates at which savings and debts double and

redouble at compound as contrasted to simple interest. What is ironic is that although Malthus's idea that fertility rates would increase in response to rising income levels has not materialized, the financial principle emphasized by Price remains apt. What do indeed rise with income levels are savings. These grow geometrically as interest charges on the economy's financial claims – its debt overhead in the form of, bonds, mortgages and other bank loans – are recycled into yet new lending until the overall volume of debt claims exceeds society's ability to pay out of its income-generating powers.

Private individuals did not fare better than governments in attempting to make use of the compound interest principle by bequeathing savings to accumulate over a protracted span of time. In 1800 a Mr. Thelluson set up a trust that was to accumulate its income for a hundred years. At the expiration of that time the trust was to be divided among his descendants. His estate of £600,000 was estimated to yield £4500 per year at 7½ percent interest, producing a final value of £19,000,000, some thirty times the original legacy.

As matters turned out, Thelluson's will was contested in litigation that lasted 62 years, from his death in 1797 to 1859. By the time the lawyers were paid, "the property was found to be so much encroached on by legal expenses that the actual sum inherited was not much beyond the amount originally bequeathed by the testator." [8] Meanwhile, under William Pitt the government calculated that at four per cent compound interest the trust would own the entire public debt by the time a century had elapsed. Legislation known as Thelluson's Act accordingly was passed, limiting such trusts to twenty-one years' duration.

Socialist analyses of the dynamics of compound interest, and its consequences

By failing to place proper emphasis on the degree to which new savings find their counterpart in new debts, today's academic models have promoted a false sense of security on the part of savers who believe – indeed, insist – that the loans which back their savings not be written off. Since the early 1990s the reluctance to write off the real estate debts, stock market debts, third world debts and other bad debts in which bank deposits, insurance policies and money-market funds have been invested has led to public bailouts to U.S. S&L depositors in the late 1980s, along with IMF bailouts from governments (that is, their taxpayers) to institutional investors. The reluctance to write off bad debts – and the "bad savings" that have lost their backing – is largely responsible not only for keeping debtor countries and debtor sectors on the hook, but also debt-ridden (one might equally well say "savings-ridden") economies insolvent. The most notorious example is Japan, which has remained mired in a deep recession since the early 1990s.

In Volume III of *Capital* (ch. xxx) and Vol. III of *Theories of Surplus Value* (both of which were published posthumously from notes made in the early 1850s) Marx described high finance as being based on "imaginary" or "fictitious" capital. Money lent out at interest was a "void form of capital" [9] consisting of financial claims on the means of production in the form of bonds, mortgages, bank loans and commercial paper. This view understandably emerged mainly from the ranks of economic reformers. Indeed, it has been left almost entirely to non-mainstream writers to explain how economies are sacrificed to their creditors.

In 1840 the French socialist Proudhon voiced what had become widely recognized among his St. Simonian contemporaries when he proposed as a basic axiom that the financial "power of Accumulation is infinite, and is exercised only over finite quantities": "If men, living in equality, should grant to one of their number the exclusive right of property; and this sole proprietor should lend one hundred francs to the human race at compound interest, payable to his descendants twenty-four generations hence, – at the end of 600 years this sum of one hundred francs, at five per cent., would amount to 107,854,010,777,600 francs; two thousand six hundred and ninety-six times the capital of France (supposing her capital to be 40,000,000,000, or more than twenty times the value of the terrestrial globe!" [10] If this financial power were not checked by radical new policies to abolish financial fortunes and replace debt with equity investment, hopes to increase human welfare through higher industrial productivity would be stifled.

Marx described the debt burden as corrosive to the extent that interest charges ate into profits, deterring investment in plant and equipment to employ labor to produce goods and services for sale. Marx summarized this process by the formula $M-C-M'$, signifying the investment of money (M) to produce commodities (C) that would sell for yet more money (M'). By contrast, the growth of interest-bearing capital – classical usury – consisted of the disembodied $M-M'$, making money simply from money itself in an essentially sterile operation.

Although sterile, however, financial capital asserted its domination over tangible capital, above all in the foreclosures that followed in the wake of such crashes. A transfer of ownership ensued from debtors to creditors was inevitable as the self-expanding growth of financial claims surpassed the ability of the economy's productive powers – and earning power – to keep pace. This inherent asymmetry is what made financial claims "fictitious," as their demands for payment ultimately could not be met. Attempts to carry the economy's debt overhead deflated the market for the commodities being produced, causing gluts that led to crises in which everyone scrambled for money and the banks themselves were caught short and failed.

Yet having analyzed finance capital's tendency to grow geometrically at compound interest, Marx dropped the subject, anticipating that finance capital would be subordinated thoroughly to the dynamics of industrial capital. Despite his compendium of historical citations recognizing the exponential growth of money-capital, he did not incorporate this idea into his long-term system. Rather, he judged this phenomenon – usury – to be survival from antiquity that the dynamics of industrial capitalism would render obsolete. "In the course of its evolution, industrial capital must therefore subjugate these forms and transform them into derived or special functions of itself," he wrote with an optimistic Victorian ring. The destiny of industrial capitalism was to mobilize finance capital to fund its own economic expansion. "Where capitalist production has developed all its manifold forms and has become the dominant mode of production," Marx concluded (1971:468), "interest-bearing capital is dominated by industrial capital, and commercial capital becomes merely a form of industrial capital, derived from the circulation process." The financial problem would take care of itself as industrial capitalism mobilized savings more productively than ever before had been the case. For this to be true, the economy's means of payment would have to keep up with the exponential growth of interest-bearing claims.

This actually seemed to be the case as European and North American public debts seemed to be on their way to being paid off during the relatively war-free century 1815-1914. As lending was being mobilized to fund heavy transport, industry, construction and mining, the economy's debt burden actually seemed likely to be self-amortizing by being linked to industrial capital formation. As the *Technocracy Study Course* (New York: 1934:136f.) published by Technocracy, Inc. – one of the typically cultish movements that emphasized the importance of compound interest – put matters (italics in original):

The physical expansion of industry was, in a period from the Civil War to the World War, a straight compound interest rate of growth at about 7 per cent per annum. During that period, the debt structure was also extending at a similar rate of increment. Since the World War . . . the rate of physical expansion has been declining, and physical production has been progressively leveling off. Thus, for the period prior to the World War there was a close correspondence between the rate of growth of the debt structure, and of the physical industrial structure. Since the World War, while the physical structure has been leveling off in its growth, the debt structure, not being subject to the laws of physics and chemistry, has continued to expand until now the total long- and short-term debts are only slightly less than the entire wealth, or monetary value of all the physical equipment. As time progresses this discrepancy between the rate of growth of the physical equipment and that of debt must become greater, instead of less. The implications of this will be interesting to consider.

The Technocracy movement of the 1930s based its view of economics on “the Compound Interest Property of Debt,” according to which “debt is expected to generate more debt, or to increase at a certain increment of itself per annum,” around 5 percent over the long term. But though the Technocrats drew attention to this dynamic, the matter was dropped there without a positive policy conclusion.

While Marx directed his invective against industrialists squeezing surplus value out of wage labor, Henry George's *Progress and Poverty* (1879) accused landowners of taking the fruits of progress in the form of rents and rising land prices. His solution was to fully tax the land's rent (along with the kindred monopoly returns taken by the railroads and emerging trusts). Marx's own analysis had emphasized how labor had been driven off the land into the cities and reduced to a state of dependency on the owners of capital for its livelihood, but he accused George of ignoring the problems caused by industrialization. What socialists and rent taxers shared common was the recognition that despite the vast growth in productive powers resulting from power-driven production and other technological breakthroughs, the lot of workers hardly had risen. The statistics compiled by Thorold Rogers in *Six Centuries of Work and Wages* (1885:539ff.) indicated that English labor had lived as well on the eve of the discovery of America in the mid-15th century as in the late 19th-century factory towns. The surplus rather was accruing to the owners of wealth.

Flürscheim, Bennett and others attempt to put compound interest at the center of economic analysis

A number of financial writers in the 1890s found the cause of poverty to lie ultimately not in profit and rent but in interest-bearing debt. Thanks mainly to Keynes, the best remembered is the Swiss-German Silvio Gesell. He was influenced by the German-American iron-maker Michael Flürscheim, who had been George's major European collaborator. It is significant, however, that Flürscheim's *Clue to the Economic Labyrinth* was published by Swan Sonnenschein, Marx's British publisher. The tracts on debt reform by J. W. Bennett (1895) and John Brown (1898) were printed by the U.S. publishers of Marx, Charles H. Kerr & Co.

These financial reformers agreed with land reformers that the economy's surplus was being siphoned off in the form of rentier income, but pointed out that land rents ended up being taken by creditors in the form of interest, as were industrial and monopoly profits. Indeed, mortgage charges were bankrupting U.S. farmers as the interest burden was made more costly by the monetary deflation that rolled back prices for crops to the point where gold prices had stood before the Civil War, making it harder to pay outstanding debts.

Bennett's *Breed of Barren Metal* (1895:87) described a hereditary rentier caste threatening to draw all the world's wealth into its hands as the inventive powers of industrial enterprise were outrun by the inexorable mathematics of compound interest, “the foundation stone on which our industrial system is built. . . . It is the principle which asserts that a dollar will grow into two dollars in a number of years, and keep on multiplying until it represents all of the wealth on earth.” The problem was that “under the laws of interest and rent the capitalists of the country . . . each year receive an amount of wealth so large that they are able to save from it a sum greater than the yearly net increase of the wealth of the nation” (p. 151).

In contrast to Keynes, Bennett (p. 49) emphasized that the problem with saving was not merely that money saved was not spent on current goods and services – that is, hoarded in the usual understanding of the term – but that they were lent out at interest, creating “an inverted pyramid, the misplaced base of which becomes more unwieldy day by day. The interest-bearing wealth increases in a ratio which is ever growing more and more rapid.” Economies became unstable as liabilities rose at an accelerating tempo while fewer assets were left unattached by debt.

Spelling out what Bennett's analysis meant, John Brown (1898:81f.) explained: “At ten per cent the principal is doubled every seven years, so that in less than a century the interest is 16,384 times the principal, and after that the principal increases at such a stupendous rate that the figures soon become unmanageable. At five percent the principal doubles every fourteen years, just half as rapidly as at ten per cent. Interest accumulates in a geometric ratio, while savings increase arithmetically. Thus if \$10 is saved up, say every seven years, in 140 years the principal will amount to \$200. If, however, ten dollars is put into a bank at ten per cent interest every seven years, at the end of 140 years the principal will have become over twenty millions of dollars!” Here, he concluded, “is the subtle principle which makes wealth parasitic in the body of industry – the potent influence which takes from the weak and gives to the strong; which makes the rich richer and the poor poorer; which builds palaces for the idle and hovels for the diligent.”

These dynamics explained the periodic trade depressions and financial crises as economies “whose financial systems are founded on rent and interest-taking” experienced a scallop-shaped upswing followed by sharp crash as creditors called in their loans when they saw how risky business conditions were growing as a result of the growth of debt. The process produced “a trade depression every ten years or oftener and a panic every twenty years,” Bennett explained (1895:93), as

“there are not available assets to meet [creditor] demands and at the same time keep business moving.”

The mathematics of compound interest also explained “the extremely rapid accumulation of wealth in the hands of a comparatively few non-producers,” as well as “the abject poverty of a large percentage of the producing masses” (p. 80). As Bennett elaborated (p. 102): “The financial group becomes rich more rapidly than the nation at large; and national increase in wealth may not mean prosperity of the producing masses.” The accrual of interest-bearing debt was responsible for “the failure of improved machinery to better the conditions of the producing masses in a degree at all commensurate with the increased producing power which it has given to the laborer.” Non-producers received “much the largest salaries,” for “one’s income is often in inverse ratio to the service which he does his fellow men” (p. 111). This perception countered Frederick Bastiat’s banal claim that everyone was paid according to the economic service performed.

The accrual of financial fortunes – or more to the point, their failure to find their counterpart in new tangible capital investment – threatened to undermine the nation’s economy “and lead to its decay and final destruction,” as had occurred in Rome and other ancient civilizations that had succumbed to usury. “There is not enough wealth produced to meet all of these obligations. Either the current expenses of production cannot be paid or the fixed charges of rent and interest cannot be met. If current expenses are not paid, manufacturing plants deteriorate, fixed capital is encroached upon, wages are reduced and laborers thrown out of employment. Current obligations are not met. The business man finally becomes bankrupt, or the wage-workers become bankrupts and outcasts depending on charity for support. If interest is not paid, then the wealth hypothecated for the loan is appropriated by the lender, and the borrower, failing to meet his obligations, becomes a bankrupt” (p. 85).

If these writers are forgotten today, it is because urban poverty, the oppressive conditions of factory and slum life, and anti-trust policies were the most readily reformable problems. Little popular momentum to restructure the financial system could arise until a more acceptable alternative could be found than banning interest (Bennett and Brown) or depreciating money’s value (Gesell and the subsequent Social Credit movement). Rather than seeing finance in a symbiotic relationship to tangible activity, Bennett and Brown wanted economies to operate without it altogether. “If interest-taking is right,” claimed Bennett (p. 47), then

compound interest-taking is right. The principle of compound interest is, that a dollar, or the wealth represented by it, without any exertion on the owner’s part will grow into two dollars in a given number of years, four dollars in twice that period, eight dollars in three times the original period, and that it will keep on increasing in a geometrical ratio until that one dollar, with its interest, would, in time, represent all of the wealth on the earth. The rate makes no difference as to the principle of the thing. . . . And what makes matters worse, it is not one dollar that is assumed to have the power of indefinitely increasing, but several billions of dollars.

A syndicate of less than one hundred American capitalists, if allowed to collect interest on their capital at a low rate and re-invest for 150 years or less, would at the end of that time own the earth and all real and personal property thereon. This is a simple mathematical proposition, capable of exact demonstration, and any one who doubts the truth of this statement may set all doubts at rest by computing compound interest on one and one-half billions of dollars for one hundred and fifty years, at five per cent per annum.

It seemed that in the long run economies would have to succumb, but how could they get by without credit? These financial critics went beyond orthodox economists by pointing to the problems created by debts mounting up at interest and showing that interest-bearing debt grew by its own mathematical laws rather than economic laws. But they were unable to propose a way in which the two expansion paths – physical production and interest-bearing claims – might co-exist despite their inherent disequilibrium in the short run. Hence, their reforms were not pragmatic. The idea of a credit-free (or at least, interest-free) system simply was too radical for most people to contemplate. It was easier to think of general strikes and even outright revolution to seize the means of production and expropriate the proprietors – or at least to tax them – than to set about designing a financial system that, in theory, could avoid credit crises even in the short run.

One of the most popular expositions of compound interest was developed by Flürscheim, who criticized George for refusing to address the issue. “It is true that the employer is the sponge which sucks up the profit, the greater value (Mehrwerth, as Marx calls it) of labor’s product,” he wrote (*A Clue to the Economic Labyrinth* [1902]:116), “but only to yield it to the rent and interest lords, as well as to the middlemen, who together press it out of him as quick as he gets it, barely leaving him on the average the hard earnings of his own work, and, what is worse, taking the power from him of increasing production to its full potentiality.” Contrasting finance capital to physical capital, he called on labor and industry together to attack “the real enemy,” the financial rentiers who ended up with most industrial profit as well as the rent collected by landlords.

Pointing out that claims for financial tribute constituted the bulk of the world’s capital (p. 347), Flürscheim explained that, “When an orator or writer has to reply to a socialist’s attack upon capital as the oppressor of labor, he points to what orthodox economy calls capital, and speaks of our wonderful progress due to our improved means of production and distribution, whereas his antagonist thinks of Government bonds, of land monopoly, of mining rights, of all kinds of tribute claims selling at Exchange for certain amounts, and not at all falling under the orthodox definition of capital, though representing that capital which people principally have in view when they use the term.”

Flürscheim elaborated that “All exertions, all improvements in the methods and tools of labor, the strictest economy, the severest self-denial, are powerless to compete with the rapidity of self-increase possessed by capital placed at compound interest, and they cannot keep up with its demands.” To illustrate the dynamic at work, he composed an allegory (pp. 327ff.). Many ages after man was driven from Paradise and told “to earn his bread by the sweat of his brow, mercy began to prevail. A loving angel was sent down by the Great Master, charged with the task of lightening the burden. The angel’s name was Spirit of Invention. He began his work by teaching man to make useful tools” and tame animals, and in time to mobilize water power, air and wind power, fire and steam power to drive machinery.

“It seemed that at last the golden era had come of which men had dreamed for ages past,” but “that envious spirit, that

fallen angel, Satan,” was jealous that his own empire would soon be over for ever. Among the follies of man, one little imp, called Interest, managed to attract his attention. “‘What is the matter with you, Interest?’ he asked the saucy imp. ‘You don’t seem to be so dejected as your comrades are?’”

“‘Why should I be dejected, master?’ replied the spirit, ‘Am I not one of your favorite soldiers? Haven’t I always been victorious under your august guidance?’”

But Satan answered sadly, “Alas, You are no match for the Spirit of Invention.” The Interest imp, however, volunteered to demonstrate his prowess in a dual, helped by his son, Compound Interest.

At this point, Flürscheim introduced an image that Napier had suggested at the outset of his second book on logarithms in 1617, the *Robdologia*, likening the principle of geometric increase to that of a chess-board on which each square doubled the number assigned to the preceding one. An old Persian proverb told of a Shah who wished to reward the inventor of chess, a subject, and asked what he would like. To the Shah’s surprise, the man asked “as his only reward that the Shah would give him a single grain of corn, which was to be put on the first square of the chess-board, and to be doubled on each successive square; which, to the surprise of the king, produced an amount larger than the treasures of his whole kingdom could buy. It is this kind of chess-game which capital is continually playing with labor.” The remarkable growth of compound interest soon swallowed “products, capital, the earth and even the workers.”

This was in essence the ploy that Flürscheim’s Compound Interest demon used. “Look at this chess-board,” he told the angel against whom Satan had pitted him. “It seems just like any other chess-board, with sixty-four squares,” but it “had the peculiar quality of extending the dimensions of the squares, so as always to be large enough” to hold whatever was placed on them. Instead of asking for grains of wheat to be placed on them, the Interest Imp asked for soldiers. “Now, listen well to what I propose,” he said to the angel, pointing to the latter’s huge army.

I enter the first square with my son, and you match one of your warriors against us. We enter the second square doubled in number; you send two more warriors – and so on every succeeding square. . . . When we arrive at the last square, and you have a single soldier left after occupying the same, we shall declare ourselves vanquished, and Satan with all his troops will leave this world for ever. If I win, you and your army are to be at the commands of my master. Are you agreed?

The angel agreed, expecting his horde of soldiers to easily exceed the number that the Interest Imp and his son, Compound Interest, seemed likely to accrue.

In the beginning the angel laughed, for, though twenty squares were passed, no noticeable diminution of his forces was perceptible. Demon Interest said nothing, but attended to business, quietly doubling his army on every succeeding square. At the thirtieth square the angel ceased to laugh, and soon saw he was lost.

‘I despised you, little fellow,’ he signed despairingly, ‘and I am punished for my vanity. I see there is no use fighting against you. Demon Interest is more powerful than the Spirit of Invention. I am your slave. Command your servant!’

‘I am the only servant of my great master,’ dryly replied the demon. ‘Here I see him coming. He will give you his orders.’

And Satan gave his orders. He commanded that the angel was to continue in his work with all his troops, which were to be increased with all possible exertion, so that humanity – which did not know the nature of the antagonist it had to fight against – would always keep in fresh hope of final success when the new troops were forthcoming. But as fast as they appeared, Demon Interest was to send forth a larger army to capture the new forces, to enslave them, and – instead of their benefiting man – make them increase the slave-chains which weigh him down.

Flürscheim concluded (p. 333) by asking, “What is compound interest? Is it anything else than the fresh investment of earnings of capital?” He added that “Napoleon Bonaparte, when shown an interest table, said, after some reflection: ‘The deadly facts herein lead me to wonder that this monster Interest has not devoured the whole human race.’ It would have done so long ago if bankruptcy and revolution had not been counter-poisons.”

But that is just the point, of course. The fact that mathematics of debts mounting up at compound interest tend to overwhelm the economy’s ability to pay means that something must give. For awhile the growing debt burden may be met by a sell-off or forfeiture of property from debtors to creditors. This problem, which should be the starting point of financial analysis, calls for public policy to resolve matters. “Market” resolutions violate society’s norms of equity, as they did in the epochs of Hammurapi and Isaiah.

Conclusion

On the microeconomic level, every economy needs short-term credit to bridge the gap between income and outgo. Merchants need it to trade, and producers need it to carry inventories and undertake work in progress. Governments need to borrow in wartime or other national emergencies, and consumers borrow in the face of adversity, or simply in the expectation that they can repay the debt out of rising incomes in years to come. The rate of interest acts as a mediator between these borrowers and their creditors.

Financial optimists anticipate that debt service may be defrayed out of the borrower’s rising earning power or profits, but a growing proportion of loans must be paid out of other sources of revenue than projects in which the loan proceeds are invested. Government debt stems from unproductive war spending or, more recently, from cutting taxes on the wealthy and on the finance, insurance and real estate sectors. Just as problematic are business and personal debts. Their aim should be that the interest rate is less than the profit rate or the rate at which consumers can earn the money to repay the debt with its stipulated interest. But even if this condition is met, the debt can be carried only at the cost of building interest charges into the economy’s cost structure. At the macroeconomic level, the inherent tendency is for the volume of debt to exceed the economy’s means to pay without a massive and drastic change in resource ownership.

Financial systems will be malstructured if they steer the economy's savings more into bonds and loans – that is, into interest-bearing claims on the economy's income and, ultimately, property – than into equities or direct investment. To formulate a better policy it is necessary to distinguish between productive and unproductive debt. This distinction was implicit already in Bronze Age Mesopotamia, whose rulers cancelled agrarian barley debts but left commercial silver debts intact. In medieval Europe, the Thomist idea of "interest" was an equity-type interest in mercantile activities, as opposed to straight usury (an idea also found in Islam).

What makes today's debt problem so intractable is the degree to which debt and savings are linked. In earlier ages most people saved by accumulating gold and silver coinage or bullion, but most savings today (and money itself) take the form of assets that represent the liabilities of other parties, enterprises or public agencies. Such debts represent the savings of everyday people, bank depositors, pensioners and governments, making it politically harder to let debts be wiped out by a financial crash or debt moratorium. Even if debts are wiped out by bankruptcy, savers are bailed out by the government, increasing public debt proportionally.

The coming millennium may see the "Thelluson principle" operate on an economy-wide scale as each sector seeks to use the principle of compound interest for its own gain. It has become normal for insurance companies, for instance, to stall payment of customer claims, and for businesses in general to pay their bills later so as to leave their money earning interest. For the economy as a whole, new saving is taking the form largely of creditors accruing interest and plowing it back into new loans rather than tangible capital formation. This increases the debt overhead without building up the economy's capacity to carry debt.

Edward O. Wilson's *Consilience* (New York: 1998:313) points out how impossible it is for the world's financial savings to grow at compound interest ad infinitum. He cites "the arithmetical riddle of the lily pond. A lily pod is placed in a pond. Each day thereafter the pod and then all its descendants double. On the thirtieth day the pond is covered completely by lily pods, which can grow no more." He then asks, "On which day was the pond half full and half empty? The twenty-ninth day."

By the time people feel obliged to argue over whether the financial glass is half empty or half full, we are on the brink of the Last Days. Growth in savings is simultaneously growth the economy's debt overhead. As debts grow, less saving is recycled into tangible direct investment; more takes the form simply of paying off debt. The growth in credit (that is, debt) may be used to inflate the stock market and real estate bubble, but in the end it must shrink the economy precisely because it is "faux wealth," "fictitious capital" that draws savings away from new direct investment in tangible capital formation.

It trivializes the problem to say that a debt-ridden economy "owes the money to itself." For a century, American farmers and industries in the western states owed debts to bankers and bondholders in the east. Today, the poor throughout the world, and increasingly business and government bodies as well, owe a rising proportion of their income to wealthy institutional creditors (including pension funds nominally owned by workers, for whom these retirement savings are not available to pay off their own current debts). At some point the trends of debt must rise so high as to exceed the economy's ability to pay, namely, the entire available economic surplus. There is no inherently mathematical solution at this crisis point. The response must be political, as it always has been.

Attempts to "restore equilibrium" by reducing wages and profits in indebted economies are counter-productive, in addition to being socially intolerable. Austerity aggravates the debt problem. Higher interest rates or taxes to pay creditors reduce the revenue available to invest in new productive capacity to enable the economy to "earn its way out of debt." The market for output shrinks, making new direct investment less remunerative, leading yet more savings are invested in bonds and loans. Employment declines, wage levels stagnate and many families borrow money to make ends meet. Tax revenues fall, forcing governments to borrow to pay unemployment insurance and undertake counter-cyclical spending to make up part of the private sector's slack. But matters are aggravated as rents fall and real estate prices decline. Property owners default on their mortgages, threatening the ability of the banking system's loan portfolios to cover its deposit liabilities. The government is called upon to bail out savers (if not the banks themselves) by raising taxes or going deeper into debt by issuing more bonds, whose interest charges must be paid out of future tax levies.

Some governments try to inflate their way out of debt by creating new money and credit, but such credit takes the form of yet more debt! Inflation pushes up interest rates, prompting businesses to borrow for shorter periods of time, hoping to refinance their loans when interest rates recede. This exacerbates the debt burden as more debt falls due each year. As loan maturities shorten, some companies and individuals default. Capital leaves the country as domestic and foreign investors jump ship. The exchange rate falls, making debts denominated in other currencies more expensive to service.

In the end, debt cancellations are made inevitable. What is interesting to the economic historian is the degree to which the need for this resolution was perceived more readily over four thousand years ago in Sumer and Babylonia than is the case today. Part of the problem is that nearly all classes are now "savers" in one way or another, even indebted workers via their pension funds and Social Security. To wipe out debts is to annul the savings that are their counterpart.

Whereas past financial crises wiped out savings along with the economy's bad debts, matters have changed in today's era of federal deposit insurance. Governments have increased taxes or borrowed to bail out savers (as the FSLIC did in the late 1980s, and as Japan has done since the late 1990s), in the belief that the value of savings can be guaranteed in perpetuity, even when they are reinvested each year to mount up at compound interest. Such public guarantees ultimately must yield to a realization that, in the end, the game must be given up as the debt overhead tends to exceed the means to pay.

If debts rise beyond the economy's ability to pay, then the savings that form their counterpart cannot be made good. Not only must governments default, as Adam Smith noted, but private-sector debtors also must default.

Heading the list is the economy's most highly indebted sector, real estate. Property owners usually default at the point where the stipulated interest and amortization comes to exceed the rental cash flow. Commerce and industry likewise

become insolvent at the point where their earnings and cash flow (and available reserve funds) threaten to be absorbed totally by debt service. Consumers become are confronted with bankruptcy at the point where debt service fully absorbs their take-home income (that is, wages net of tax deductions, social security and pension fund withholding and debt service) remaining over and above their basic subsistence needs.

States and municipalities become insolvent at the point where they are unable to raise taxes or borrow yet more money. To increase property taxes would induce abandonment. Indeed, as the debt burden grows and something has to give, it is not savings and their counterpart debts. Pressure mounts to cut real estate taxes so as to save the federal government from having to bail out banks that have invested their checking and savings deposits in mortgage loans collateralized by real estate that has fallen in price. The tax burden is shifted onto labor in the form of income and sales taxes, including value-added taxes. The economy shrinks all the more in a debt deflation, the modern version of incipient financial insolvency.

The result is something much like ecological pollution. We might think of it as debt pollution, and its overheats the financial environment while stifling “normal” growth.

What then are the alternatives? Attempts have risen throughout the ages to ban the charging of interest outright. This is what the laws of Exodus (the Covenant Code) urged, as well as Islamic law and the Christian Church’s laws against usury. Yet Canon law permitted mercantile lending and ended up endorsing the “mountains of piety” to lower interest rates on loans to the poor as it became apparent that credit is a necessary fact of life, and that it inevitably must bear a charge. To deny this is ill-tempered utopianism.

Once this is acknowledged, questions arise regarding how and on what terms is it proper to charge interest. The most simple and basic reform is to direct credit into the most productive lines where it can be paid off out of an enhanced capacity to produce and earn money. This St. Simonian ideal was followed up most effectively in Bismarckian Germany and other Central European countries in the late 19th century, and more recently in Japan. The creation of an industrial credit system involved much closer links between banking, heavy industry and government than had been forged under Dutch and British banking. (These steps are described in the next chapter.) But today’s deregulatory philosophy is moving in just the opposite direction.

In an attempt to collect interest – along with land rent – for the community as a whole, numerous writers have urged government banks. Bennett (1895:172), for instance, pleaded for this St. Simonian socialist ideal: “A real national banking system must be under the direct control of the government. All past experience has demonstrated that where individuals were given irresponsible power, they used it to advance their own ends, regardless of others.” Interest still would be paid, to be sure, but it would be paid to the government or its financial agencies. More often, however, governments have created depository institutions such as Postal Savings systems and savings banks. But today, these are being privatized in every economy.

When France nationalized its banks a few decades ago, it found that the problems were largely administrative, involving corruption and crony dealing of much the same sort found in Russia and other socialist economies, as well as Latin America. The most successful banking has occurred in “mixed” economies that provide the requisite sets of mutual checks and balances. But such balances are now being pulled out in today’s deregulatory “free banking” environment.

One must acknowledge in any event that permitting interest opens the gates for savers to compound their money by making new loans with the interest they receive. Over time it is inevitable that their financial claims will mount up beyond the economy’s ability to pay. There can be no long-term equilibrium between the financial rentier sector and the rest of the economy. That always has been recognized.

What has not been agreed upon is what should be done when debt problems become economy-wide. Ancient rulers were not reluctant to cancel the most problematic, rural debts. Modern governments do nothing so straightforward, but as Adam Smith noted, they often “pretend” to pay their debt in the time-honored fashion of inflating their way out. Gesell’s variant of this approach would reduce the value of money steadily at a rate offsetting the rate of interest. However, his proposal dealt only with money itself. In his plan, prices themselves would not rise, but the bank notes or other monetary means of payment would have their face value reduced. Both the inflationary and “shrinking money” approaches would wipe out the value of savings as well as that of debt. But matters are just the reverse under today’s IMF-Washington Consensus. Economies are subjected to deflationary austerity programs that make the debt burden heavier rather than lighter.

Tax codes throughout the world now encourage loans at interest rather than equity investment. Permitting interest to be credited as a tax-exempt cost of doing business makes it less expensive for companies to issue bonds than stock. The result is that bondholders and other creditors get the business revenue that otherwise would be paid to the government tax collector if it were distributed out as dividends on equity. Yet equity investment minimizes the debt burden. Today’s tax system this promotes and even accelerates the channeling of saving into interest-bearing debt, compounding over time.

In the early centuries of public debt – that is, in medieval Europe – governments simply defaulted or repudiated their debts. This ruined the early Italian bankers; today it threatens the solvency of global banks and institutional investors. The political problem lies in the fact that to cancel debts involves canceling savings, as one party’s debt is the backing for another party’s saving. Today’s international diplomacy pressures governments not to declare bankruptcy, but to sell off their national patrimony and sacrifice their domestic economies to pay their creditors. Never before in history have private interests been placed so highly above those of government.

All classical economists, including Marx, focused on profits as the economy’s motive force, but this has not turned out to be the case in recent decades. Seek profits involves risk, ties up capital, and requires entrepreneurial effort. It is easier, less risky and even minimizes taxes to lend out one’s savings to others to manage, collecting interest for the service of providing this wealth. What is remarkable is that unearned revenue is now being encouraged in preference to earned profit, above all in the form of asset-price inflation.

Until quite recently, nobody dreamed that it might be possible to carry an exponentially rising debt burden by using loans to fuel a matching asset-price inflation. Speculative borrowing may be made remunerative (if not economically productive) buys control of real estate, common stocks, hard assets and other property (M-A-M', with "A" standing for real estate, enterprises or financial claims on these assets). Such a strategy has been able to work for about a generation only because rent (including monopoly profits) were large enough to pay interest charges, while indebted governments have raised the money to pay their creditors by selling off the public domain, that is, the national patrimony historically used to provide society's basic services at a price considered equitable and designed to promote long-term economic development. But this is not a process that enhances the power to produce goods and services. It is essentially sterile in terms of the classical definition of productive investment.

Worst of all, it encourages debt compounding that only can culminate in the problems cited above.

[1] I have treated the topic of this chapter in my articles on "The Mathematical Economics of Compound Interest: A 4,000 Year Overview," *Journal of Economic Studies* 27 (2000):344-363, and "The Use and Abuse of Mathematical Economics," *ibid.*:292-315.

[2] Karen Rhea Nemet-Nejat, *Cuneiform Mathematical Texts as a Reflection of Everyday Life in Mesopotamia* (New Haven 1993 = AOS Series Vol. 75) provides a bibliography.

[3] Miriam Lichtheim, *Ancient Egyptian Literature*, II:135.

[4] Hildagard Lewy, "Marginal Notes on a Recent Volume of Babylonian Mathematical Texts," *Journal of the American Oriental Society* 67 (1947):308 and Nemet-Nejat, *op. cit.*: 59f.

[5] The passage occurs in Luther's 1540 Wittenberg pamphlet, *An die Pfarrherren wider den Wucher zu predigen* ["That the priests should preach against interest"]. Curiously, although Marx footnoted this passage in *Capital* (Vol. I, London 1887:604, and Vol. III, ch. xxiv:463f.), it is missing from Volume 45 of Luther's works (Fortress Press, 1962) dealing ostensibly with his economic writings published. That so important a denunciation of interest would be omitted attests to the cognitive dissonance with which denunciations of interest strike modern secular and religious minds alike. Yet from the Bronze Age onward, such denunciations have been in the forefront of all religions in societies where interest has been charged to needy debtors.

[6] Expressing gratitude for the nine months of hospitality he has received, the character Polyxenes uses the florid metaphor of a burdensome debt that can never be repaid. The idea is that to take the time to thank his host properly would consume yet more time, using up yet more hospitality for which yet more thanks would be due in a never-ending series. (In this passage the words "without a burden" mean without debt.)

Nine changes of the watery star [the moon] hath been

The shepherd's note since we have left our throne

Without a burden: time as long again

Would be fill'd up, my brother, with our thanks;

And yet we should for perpetuity,

Go hence in debt: and therefore like a cipher,

yet standing in rich place, I multiply

With one we-thank-you many thousands more that go before it.

[7] The reality is that instead of increasing as incomes rise, fertility rates taper off. And over time, breakthroughs in agricultural and mining technology have increased productivity in these sectors more rapidly than has occurred in manufacturing, so that food and other consumption goods have grown faster rather than more slowly than population.

[8] Palgrave's *Dictionary of Political Economy*, citing the *Annual Register* (1797) and Chambers's *Encyclopaedia* (vols. 8 and 10). Geoffrey Gardiner (*Towards True Monetarism*, London 1993:135) observes that in the late 1970s, "the burgeoning oil revenues of the producers were further gilded by the addition of high interest earnings. At their highest British interest rates had the effect of doubling the cash deposits of the oil-producers in only five years, or 16.3 times in twenty years! . . . The wisdom of an earlier age, which had led to the passing of 'Thelluson's Act' to discourage the establishment of funds which compounded interest indefinitely, had been forgotten."

[9] *Capital III* (Chicago 1909):461.

[10] P. J. Proudhon, *What is Property*, First Memoir, Eighth Proposition (New York, n.d.:215).

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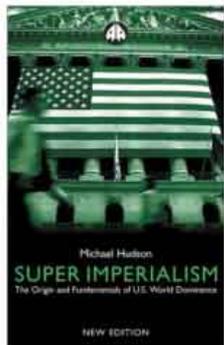
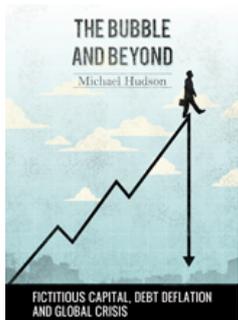
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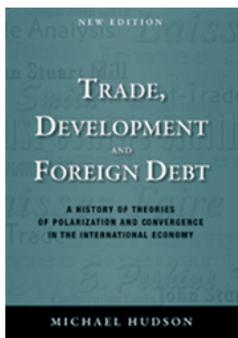
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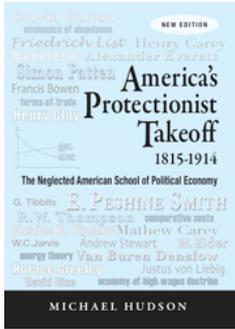
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