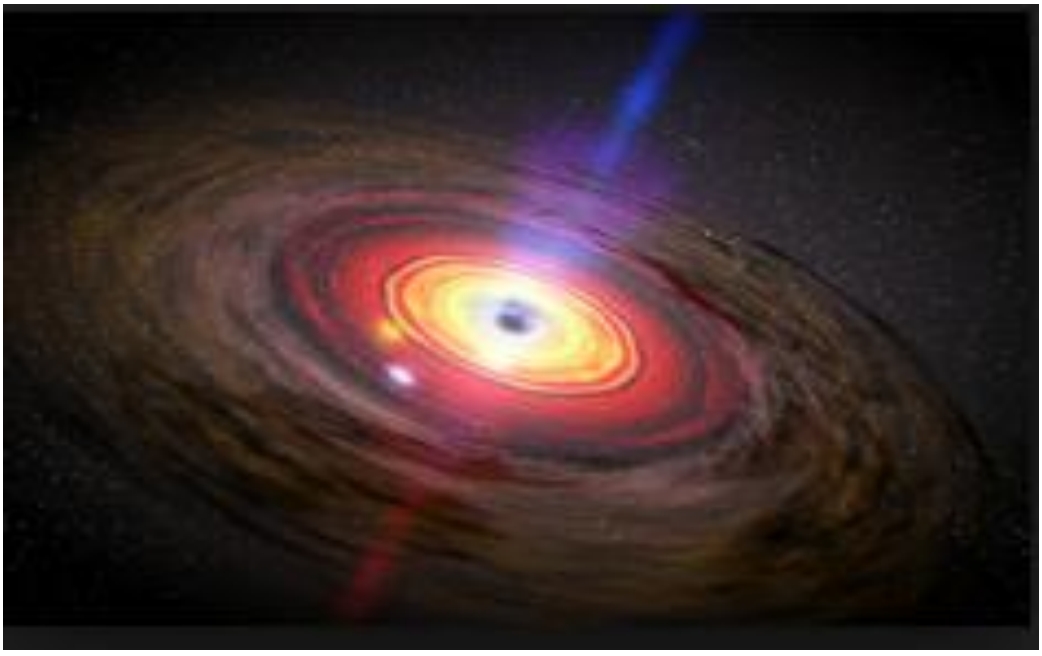
Black Hole Economics:

Why The Rich are Getting Richer and *You* are Getting Poorer



It wasn't supposed to be like this, you know. Back in 1979, that glib snake oil salesman, Arthur Laffer, promised that with tax cuts for the corporations and the rich, everyone would benefit as the increase in economic growth that would result would *trickle down* to everyone's benefit. 39 years later, the rich have certainly benefited but somehow the rest of us have largely become poorer as wealth has become massively concentrated in the hands of the top 1%. Today, so entrenched has the Laffer Curve "theory" become that finally one of those 1 percenters has reached the top office in the USA, on a platform of – yes – cutting taxes for the rich! And, heaven help us, many Americans – and, apparently, most of the Republican members of Congress – still believe the story. The last two exercises in tax cutting (and the resultant debt growth) has now led the US to the point where GDP growth has largely slowed to a crawl and the total indebtedness of the US economy has reached unprecedented highs. So what went wrong with 'trickle-down' economics that has brought us to the current state of affairs? And now that Congress has written 'chapter three' in the tax reduction tale, the **Corporate Welfare Act** of 2017 (a.k.a. "tax reform"), the question is **where are we going from here?**

Let's start with the "**what went wrong**" question. Politicians love cutting taxes. For Ronald Reagan way back in 1980, that was easy and very popular. But if your income gets cut back, then your expenditures had better be cut back as well – or you will have to borrow to cover your household 'deficit'. Reagan's 'household' (so to speak) was the US government, but cutting government spending would not have been popular – and he felt, unnecessary – when all the growth that Laffer promised would be coming soon. Tax collections would increase, and the

government would then cover off any immediate spending deficits with the growth that would result from tax cutting.

Only that part never happened. US government deficits began to grow relentlessly and the total indebtedness of not only the federal government of the US but also the US states have soared more or less since then, with but one all too brief respite.

And so it was that the debt load on the US economy actually grew and grew, and the US economy grew increasingly more sluggish as deficits mounted. Following the election of 1992, new president, Bill Clinton, was so alarmed that he instituted a regime of raising taxes, slashing expenditures, and paying down the US government debt. His policies – which were the complete antithesis to the tax reducing 'Laffer strategy' – worked like a charm. As the previously growing debt burden was lifted from America's back, the economy soared, the stock market soared, consumer confidence soared, and the US dollar rose to new highs. To this day, thanks to the memory of his spectacular economic success, Bill Clinton remains one of the most popular and respected (ex) politicians in America. Parenthetically, by the year 2000, people in the investment industry actually began to be concerned that low risk US government bonds would vanish!

They need not have worried. Hanging chads killed Al Gore's chance to be elected president following in Clinton's footsteps, and George W. Bush Jr. was elected on a platform of slashing taxes in order to out-Reagan Reagan. By 2008 not only had that explosion of government debt triggered a massive real estate boom and bust, but it also led the US (and as it turned out, much of the Western economic world) to, and actually briefly into, the economic **Black Hole**.

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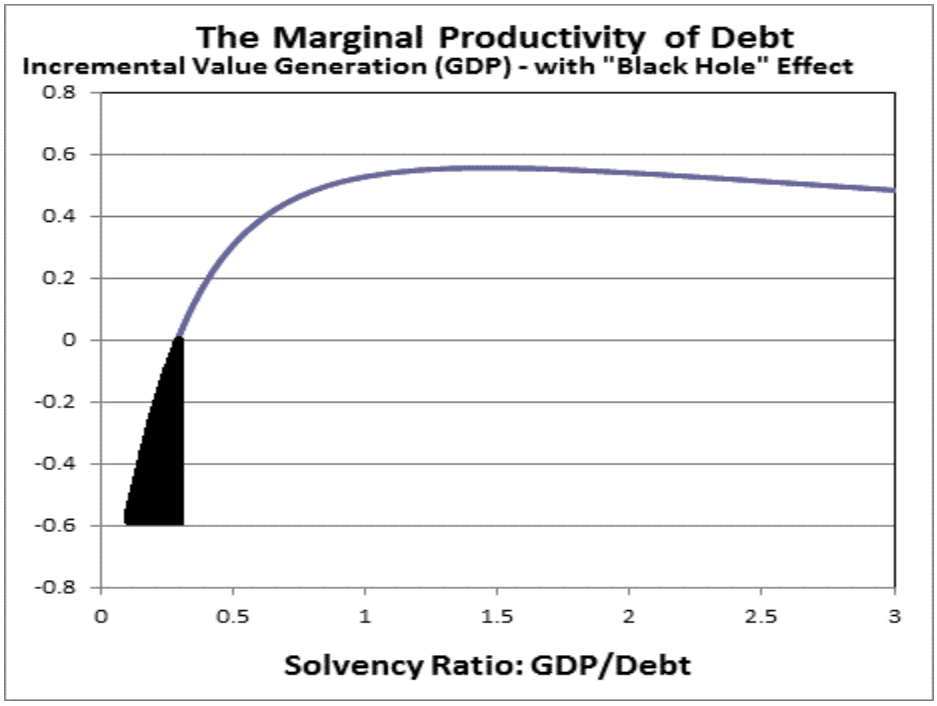
At the same time as Laffer was propounding his "theory" of taxation and economic growth, the founder of Strategic Analysis Corporation, Dr. Verne Atrill, made some remarkable calculations based on a set of mathematical theorems that he had spent his life developing. He discovered that there is a ***precise*** point at which an economic entity (corporation, household, or entire country) stops expanding and begins to contract instead. This is a mathematical singularity, and, for the economy as a whole, can be measured by using the **ratio of GDP/ Total Debt**, This point is akin to the **event horizon** of a celestial '**black hole**' and it acts in a similar manner. A celestial black hole draws energy (light and matter) into its vortex, and an economic black hole draws economic energy – GDP – into its 'vortex' due to the dead weight of massive debt. Below that point, if central banks continue to use so-called Quantitative Easing ***in all its forms***, debt will continue to expand (and historically has done so with increasingly speed), but more and more GDP will be sucked in, eventually causing a collapse of the economy along with the value of the currency. Today, parts of the Euro Zone notably Greece and Spain, have already slid into that vortex, and Japan and the US are dancing on the rim!

For those who are curious, the complete mathematics are freely available online by visiting my blogsite, **The Occasional Contrarian**. In the appendix to this article, I show the full mathematical development of the **theorem of solvency *from first principles***, including the associated table of values, and the graphic relationship which results (shown below). This

relationship is termed the **Marginal Productivity of Debt Curve** , or **MPD Curve**. In the chart, a **GDP/Debt ratio of .289**[1] **($3.50** of debt per **$1.00** of GDP) is the *financial equivalent of* the "**event horizon**" of a celestial black hole. Like the celestial sort, economic 'black holes' keep increasing as the mass of debt increases, but in doing so, sucks in more and more GDP to support that debt (that is, stultifies and then starts to reverse the growth of GDP). Below that ratio value, the **growth of real GDP** turns negative while total indebtedness keeps expanding at a and faster and faster rate. Essentially, it becomes activity for the sake of activity, but that only serves to crush GDP itself and increase the dead weight of debt on an economy. For those who like hard numbers, the **current** total debt of the US stands at $68.6 trillion and current GDP is $19.7 trillion, a ratio of debt/GDP, or **almost precisely 3.5:1**.



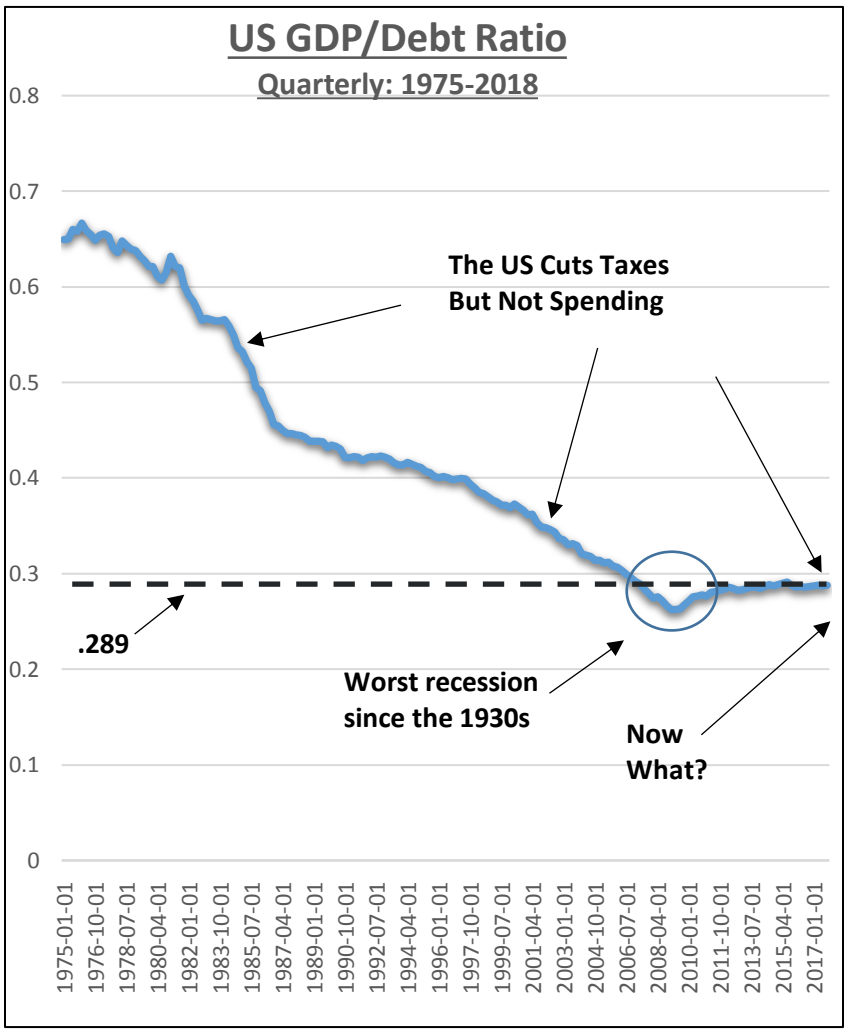
In the 20th Century, a considerable number of paper money-issuing governments and their central banks, faced with the problem of trying to stimulate growth at that .289 (and lower) level, have done so by trying to issue more and more paper (debt, both short and long term) to attempt to counter the failure of the real economy to catch fire. According to a study by the **Cato Institute**, in the 20th century, 55 governments had executed this 'strategy', all with devastatingly similar consequences for their economies and currencies. Thus far in the 21st Century, we have watched **Greece, Spain, Venezuela and Argentina** fail (among others). Initially, stock market values in those countries usually soar, so that the "stimulus" policies seem to "work"! However, looking at it another way, as the debt ***aneurism*** expands and the money has to go somewhere, it heads into the "safety" of the ownership of hard assets. However, ***if history is a reliable guide***, this eventually leads into a shrinkage of the GDP, then to price hyper-inflation. The US is currently dancing on the edge of its own "event horizon", and may only be still standing because

[1].289 is the numerical value of Wein's Constant in physics. It is one of 11 constants from the realm of physics that show up in the book **How ALL Economies Work**, by my late guru, friend, and partner, Dr. V.H. Atrill.

it is the global key currency. While GDP growth has not proven to be **self-sustaining** without continuing stimulus, it is, however, '**self-delusioning**'.

At and then below a GDP/Debt ratio of .289, the growth of GDP (due to the weight of added debt) falls to and then below zero. We term this a ***scientific bankruptcy*** because ***the effects*** of bankruptcy hold. Debt compounds while value (GDP activity) recedes. Parenthetically, such a point must exist, because otherwise, Zimbabwe (for one) would be one of the richest countries in Africa, and Greece and Spain would be sitting atop all of Europe.

I'll Build a Stairway to…



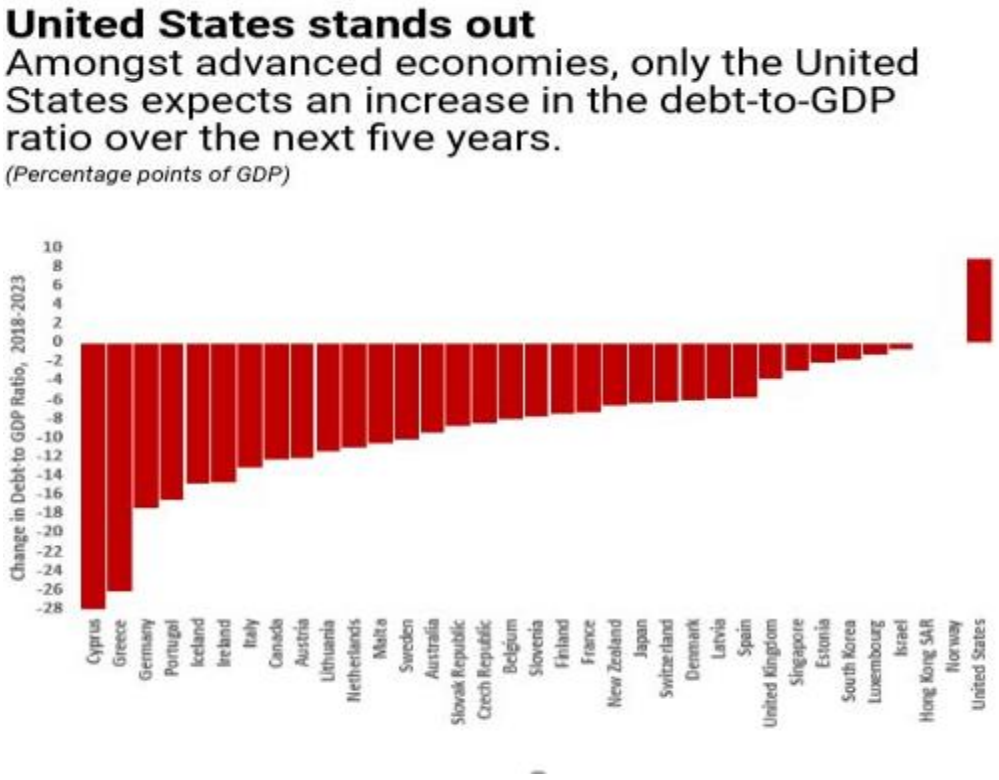
Looking at the chart of US national solvency, we find a tale of careless accounting, hubris, and political sloth if not outright venality. Reagan cut taxes but not spending, and by the time his successor, Bush Sr. had left office, the US solvency condition had slipped into **chronic deficit**. Clinton cleaned up the **Federal** balance sheet by raising taxes and cutting expenditures, but Bush Jr. quickly went back to tax cutting – again without matching spending reductions. This took the US down to the Black Hole horizon condition (.289), which is where, over the last 41 quarters

and counting (as of May 2018), the US has been ever since then. Trump and the Republicans (some reluctantly!) have now cut taxes a third time, again with no spending cuts. Unfortunately, the next step down promises to be a lulu.

You will observe that once the US crossed that second-order insolvency ("Black Hole") condition in **2007-8**, the US economy went into an ugly plunge, most horribly in the banking, housing, and auto sectors. Fortunately, the US Fed reacted and adjusted very quickly and pulled the economy back up and out, and a larger collapse was aborted. The impact on the Fed's balance sheet, however, has been massive, and – while I suspect it is not repeatable – has placed a very heavy onus on it.

The IMF Wades In

Even the IMF had managed to get into the picture. The IMF forecasts that the US is the only economy to expect an increase in the Debt/GDP Ratio, or to put it the other way, the US is the only economy which should expect a decline in the GDP/Debt Ratio, which would – unfortunately mean that the .289 line in the sand will be breached.



Implications of Economic 'Black Holes'

As the Stability Ratio of the US approaches .289 and growth falls very close to zero – and since 2008-9, US growth has been extremely sub-par –several things happen as a consequence.

1. First and foremost, since growth grinds almost to a halt, there are **few price pressures** due to a lack of shortages – of almost everything. And without the pressure of rising demand on goods and services, we don't experience price inflation. And without that demand pressure, wages and prices will either be steady or even decline. Everyone has been waiting for the "usual" increase in inflation that comes late in a business cycle – particularly late in an expansion that has been going on for almost 10 years – but thus far, there is no evidence of anything of the sort, GDP growth being so very slow.

2. Without growth, there is **very little demand for money**. Businesses notably had been paying down their debt, not increasing it as usually has happened following recoveries from past cyclical contractions. In recent years, Corporate America is paying out through share buybacks as much as or more than it is earning, which explains why loan growth hasn't caught fire in this cycle, even with near zero interest rates. From Economics 101, if there is almost a zero or even negative demand ***for*** money, why would anyone expect anything but a low or even negative return ***on*** money?

3. While our central bankers may not be happy about the economic growth trajectory, at least they can say that all that 'pump priming' that they have indulged in to keep the economy moving has not led to the kind of inflation that the economists of olden days warned us about. Interest rates have remained low and encouraging. '**Monetarism'** and the **'Philips Curve'** seem to be out the window ("thanks to 'wise' central bank guidance")! The bottom line for central bankers is that long term quantitative easing is nothing to be feared.

4. The failure of wages, prices, and interest rates to react to massive monetary stimulus has lulled our central bankers into a sense that the real risks to the economy lie in deflation with falling prices, when in fact, we are indeed already facing rampant inflation, **the problem being one of measurement**.

5. The critical item that Government and economists do not choose to identify or measure is the ***cost of a dollar of GDP***. For most of the 20th century, it used to take ('cost') the US about $1.45-.50 of additional debt to generate $1.00 of additional GDP (the peak of the Atrill Curve). Since 1984-5, the marginal "cost" of an ***additional*** $1.00 of GDP has steadily escalated to **$3.50**. Yet central banks and main stream economists are completely mute on this issue. They certainly do not refer to this as "inflation"! However, referring to the 55 examples of insolvent countries since 1900, all pursued massive monetary easing of some sort, and all of them ended with an inflationary collapse of ***both*** their economies and associated currencies.

For those are interested in the current US numbers, the .289 ratio has held virtually ***dead steady*** for the past 27 quarters, with a brief dip prior to that in the recession/depression of 2008-9!

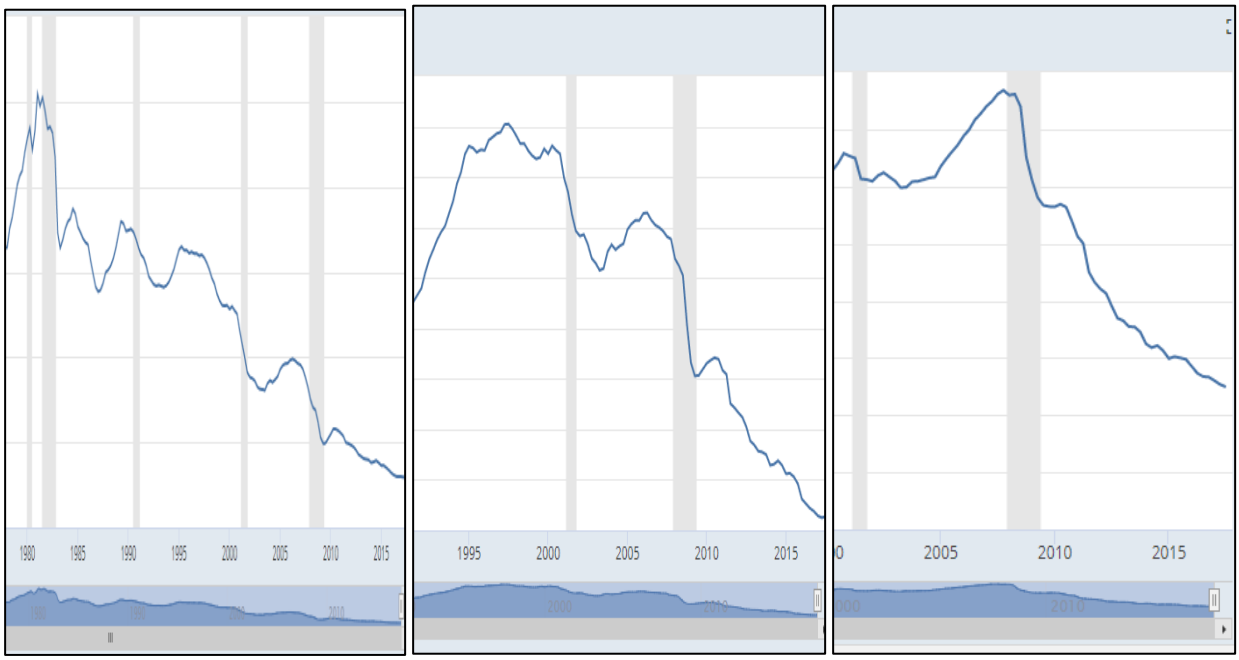
Of course, there has been some real economic growth in the US economy, for which the US can thank net immigration of ¾ of 1% per year (and the quantitative easing programme). Since the US economy first achieved the GDP/Debt ratio of 0.289 in the third quarter of 2007, the US economy has expanded at an average rate of 1.4%, despite all efforts to grow at a faster rate, far short of the "usual" 3%+ annual rate in earlier decades.

Some Consequences that flow from the Atrill Curve

- **Money On Strike: Velocity Declines Endemically**

Velocity of Money – US (Source: **FRED**)

MZM **M2** **M1**



One of the truly striking features of the US, Japan, and Europe is that the **velocity of money** is not only declining but has been in a steady decline for a long time, in one case going back three decades ("money zero maturity", or MZM in the US). This is a central characteristic of all increasingly insolvent economies that we have examined – Europe, Japan and the US. Money does less and less "work', in essence 'trying' to counteract the increasing financial inefficiencies brought on by excess debt.

Note that the velocity of MZM – the loosest definition of 'money' – peaked out in 1980 at the peak of the balance sheet strength of the US, M2 peaked out at the end of Clinton's presidency when Bush began to weaken the balance sheet (again), and finally M1, so-called high-powered money – only peaked when the solvency of the US finally fell to .289, the start of the ***scientific bankruptcy*** condition of the US.

- **When Money Goes On Strike, The Printing Presses Go To Work**

The challenge to monetary authorities is that of trying to overcome what is effectively falling money availability caused by falling velocity. Historically, they have done this by issuing more and more money through programmes equivalent to very aggressive 'quantitative easing'. Unfortunately, the **MPD Curve** shows all too clearly that this makes the problem worse.

In all those 55 countries referred to above, I suspect that research will find that there is a tipping point when price and wage inflation suddenly start to accelerate, as currency values and GDP implodes. Price and wage inflation then reverses their moribund course and velocity re-accelerates massively as well (as Weimar Germany, for one, shows. By the way, Germany has left an excellent documentation of that period for anyone to see, and we recommend the records of the Bundesbank to all students of national insolvencies.). At that point, holders of those currencies in question try to exchange their money for things – anything – which can hold their value as the purchasing power of those currencies collapses. Seen in this light, we should all hope that the current quest by central banks to stimulate an uptick in inflation (as measured by wages and prices) fails, as they are likely to waken a sleeping tiger. Germany, alone among advanced Western economies, has already been there but can't seem to convince the unfortunate Greeks (and the rest of us) that far worse things may lie ahead!

In very modern times, when both Greece and Spain fell to that .289 condition, and then pushed (hard) to stimulate further, their respective economies virtually immediately collapsed to the tune of about -25%. At that point, lenders stop allowing their governments to borrow anything more, and both governments have been brought (more or less) kicking and whining to heel. While lenders do recognize what is essentially a bankrupt, there is nothing in current economic theory that shows that any limit has been surpassed. Worse, to confront the problem head-on is to threaten the solvency of many European banks which hold Greek and Spanish debt. And, naturally, those bankrupt governments are unwilling to stop borrowing, as borrowing is so much easier and more popular than instituting the austerity needed to reverse their sad condition.

One may well ask, if a decline through the .289 breakpoint has triggered hyper-inflation in those 55 countries in the Cato study, why has modern Spain and Greece avoided a similar hyper-inflationary fate? The answer is very simple. Being monetarily constrained by being in the Euro-zone, neither country controls the money printing-press the way that the other 55 failures did. So their economies collapsed as the MPD Curve predicted, but exploding prices could not occur. Modern day Venezuela is, of course, a similar story and is suffering both outcomes.

- **The Disappearance of Public Companies**

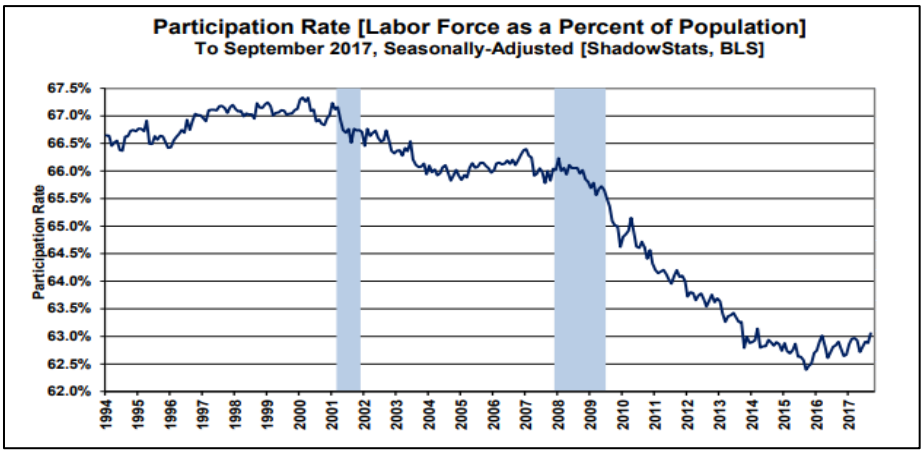
Roughly one third of all US public companies have disappeared since 2008, in a sort of fit of corporate cannibalism. When a company cannot expand in the usual way because of a lack of demand growth, but enjoys a high valuation and has shareholder pressures to achieve greater growth, then growth by acquisition makes sense. But growth by acquisition is inevitably followed by reducing expenses in the combined firm through achieving efficiencies and eliminating what may now be overlapping jobs, that is, increasing unemployment.

As a sidebar to this, predatory hedge funds have actively sought out companies with strong balance sheets and therefore 'spare' investment resources, with the intent of forcing them to divest (pay out) their 'surplus' investment resources to shareholders. This may have prevented some companies from making unfortunate acquisitions but it puts pressure on corporations to divest themselves of the surplus liquidity which otherwise might have been used for expansion

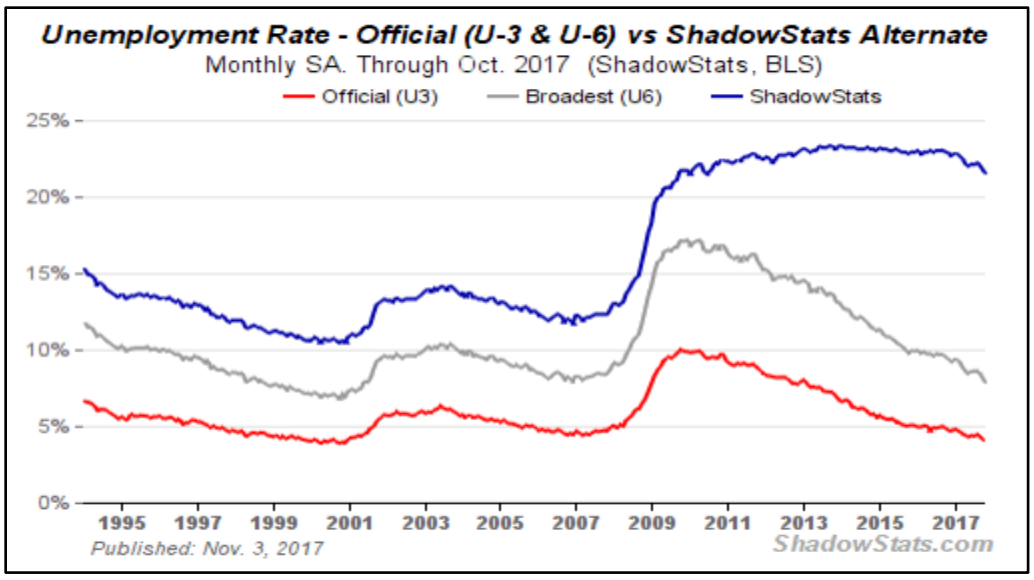
purposes when and if opportunity knocks. It has become a sort of mantra in the US that returning money to shareholders is a 'good thing' and the stock market often rewards companies that do this with high – and sometimes extreme – market valuations. But a high market valuation without a concomitant business expansion doesn't do anything for the economy, even though it does enrich shareholders ("the 1%"), albeit, I suspect, temporarily.

- **The Disappearance of Jobs**

The 'Participation Rate' of the US – the ratio of persons who are working against those who are eligible to work – has fallen steadily for some years now. To gloss over this reality, with in a clear attempt to throw sand in the eyes of its citizens, the so-called Unemployment Rate has been steadily falling (thereby coming under the heading of 'good policy'), not by increasing the number of persons working but by redefining "unemployment" to mean those who have only been looking for work within the past year, and eliminating from being counted as 'unemployed' everyone else.



John Williams, in his excellent service, **Shadow Government Statistics**, shows the **participation rate** as well as his own determination of the **US Unemployment Rate**, which suggests that the actual US unemployment rate is close to **22%** when measured on the scale last used in the early 1960s. That may be on the high side, but it is close to matching the potential for the increase in GDP that we have calculated would occur assuming that the US returned to a degree of optimum solvency. That big jump in Williams' alternate unemployment rate occurred, as one would expect, once the US hit its 'Black Hole' event horizon at .289 – and it has not changed materially ever since (the blue line on the chart).



- **Infrastructure Spending Dies a-Borning**

In 2016, the election of Donald Trump came with a platform of a strong increase in spending on new and very much needed infrastructure. However, with no ability to expand the public balance sheet (government debt) and no incentives for private monies to fund such projects due to the lack of visible demand growth, it is no surprise that infrastructure spending has pretty much died on the vine, at least so far. The **Corporate Welfare Act** of 2017 should pretty much seal the coffin shut on any such initiatives as there will simply be no public money available ***at all*** going forward. Worse, the Trump requirement that the states match the federal spending, when conjoined with the effect on state tax collections due to the Trump tax 'initiative', should close off any state and local spending here as well.

- **Austerity Does Work**

In **1992**, Bill Clinton took the reins of office the US and set out to clean up the insolvent US government balance sheet by **raising taxes** and **cutting costs.** When he left office in 2000, the US was on top of the world, its currency was at an all-time high, consumer confidence was at an all-time high, the stock market was booming, and the economy was on fire. Small wonder that he is still revered today. Revisiting the MPD Curve, it is, or should be, apparent that the impact of an increasingly ***solvent*** government, from an insolvency state, spills ***directly and immediately*** over into the real economy. From 1992 to 2000, the ***decline*** in federal government leverage pushed the US economy ***up*** the MPD Curve.

The Pathology of Insolvency

Armed with the suggestions below, I expect that economic historians like Kenneth Rogoff will find that there are some general characteristics of overall economies which are

heading into (a mathematical or 'scientific') bankruptcy. These seem to mark the lull before the storm, and have probably been present in all those 55 countries where the currency ended up collapsing under the eventual pressure of national bankruptcy and hyper-inflation:

1. Velocity of money falls endemically
2. Private sector borrowing (and corporate investing) dries up
3. Interest rates fall towards zero initially as there is no demand for money, thereby hurting the middle-class in the economy (in particular) by – effectively – looting their savings
4. Although the real economy slows, hurting the economically weak man in the street, the financial economy (the stock and bond markets) soars, helping the wealthy to become even more wealthy
5. Inflation, *as measured by prices*, initially falls due the lack of demand growth
6. The government balance sheet gets steadily worse
7. Internal political harmony turns to intense dissonance ('its not my greed, its yours')
8. Central banks are, in effect, left holding the bag in the absence of any political will or agreement to find policy solutions for weakening economies
9. In the absence of a mathematics to the contrary, to central banks, every 'weak economy' problem can best be resolved by printing more money in one form or another

Our expectation (based on the Weimar reported experience) is that when a country crosses the .289 threshold and their currency ***really begins to fall*** and internal prices (i.e.: inflation) really start to rise, their central banks do not react by slowing their money printing, because to curtail that monetary growth would be to "kill any possible expansion just as it got underway". These same fears stopped Greenspan from acting responsibly (***as he openly admitted in his book***) and were probably always there among those 55 countries noted above, as they were in the US. The actual linkage would be fascinating to discover – but for students of the subject, now we know where (and why) to look.

Outcomes and Issues

- ### The Lifeboat Economy

When overall growth ends or slows drastically, there are two possible outcomes, either share what is there or grab everything that one can. I call this a **Lifeboat Economy** because growth can no longer skate our overall ***desire for more*** onside. In the US, the expansion of government **entitlement rights** has grown from a modest percentage of total government revenues to more than 100% of annual tax revenues as the more powerful groups seek to protect what they now have against others looking to enhance their own interests. Cooperation between political parties has fallen ***below*** zero because to share what we already have is to take away from what we now have. The US political scene has bifurcated into two parts, those who are at least trying to expand the sharing process, although they have nothing to share that doesn't

belong to someone else in the absence of real growth, and the Republican Party which is determined to keep even more of what they have at the expense of the rest of the populace (i.e., through cutting taxes). Internationally, Greece is a caricature of the lifeboat phenomenon. Having eaten themselves out of house and home, they came demanding that others support them. Germany (alone) ***is*** on the right track about fixing, not pandering to, their debt problem.

In the US, a major global issue has arisen, and that is the effort by President Trump to use pre-emptive trade wars as a means of 'balancing' the negative global trade books back in favour of the US. Not since Smoot-Hawley has the US attempted such an unfortunate measure to overcome this issue (and then spent the next 80 years undoing that damage!). While as of the time of writing, there is no firm evidence as to the direction that this latest endeavour will ultimately take, the move to grab more for the US at the risk of escalating a global trade war is further support for the lifeboat nature of the current economic situation.

- ***Reducing*** **Debt Will Lead to Strong Growth**

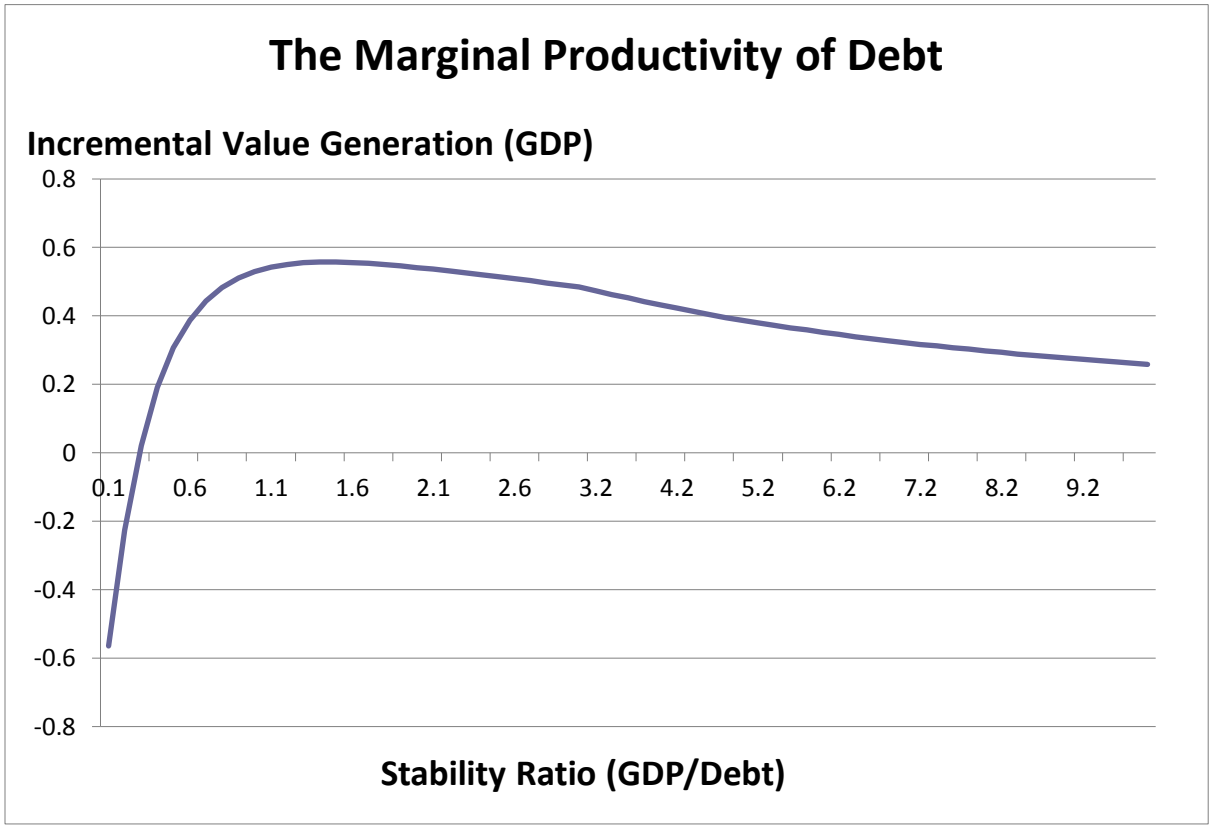
If, at the peak of the Atrill Solvency Curve, it takes $1.50 of debt to generate $1.00 of GDP in a normal, healthy, and solvent economy, then there is **an astonishing amount of excessive debt outstanding** today in Europe, Japan, and the US, all of which is **weighing *down*** on their economic potential. Harvard economist **Ken Rogoff** identified the value $3.50 of debt per $1.00 of GDP (.289) as ***quite possibly*** having considerable economic significance for countries. Without the Atrill solvency mathematics to back his findings up, Rogoff could not defend his findings and therefore he was and is, essentially, simply ignored. The assertion of ***possible*** importance without a rigorous mathematical proof could not stand up to his critics with their neo-Keynesian, pro-debt-issuance axes to grind.

The **resolution of the current debt problem** is (axiomatically) simple. How would a bankruptcy lawyer or accountant deal with bankruptcy? He would direct the bankrupt to **sell assets** and **pay down debt**, write off any and all debt which the bankrupt is unable to pay down, and then **live within one's means** (no credit cards!). Arthur Laffer once asserted that no country ever improved its growth outlook by raising taxes (and paying down debt), yet from the MPD curve, that outcome for the US would bring a ***large increase*** in GDP as a result of the government debt burden being lifted. However, governments do not like, nor want to abide by, what is essentially the **banking discipline** and Greece is proving to be, perhaps, merely the first example of a 21st Century insolvent government to outright reject Germany's 'sell assets' suggestion and solution!

As Bill Clinton's presidency clearly showed, if that excessive debt load can be lifted, then two things occur. The GDPs of those bankrupts will lift to a considerable degree. Elsewhere, using the numerical data from the MPD curve, one can readily calculate that the GDP of the US could be in the order of ***40+% higher*** than it is today without that excess debt. Indeed, we have calculated that the **average US household income could *rise* by something in the order of $15-20,000** if the US were solvent.

- **<u>The "Chinese Miracle" Explained…and a Myth Exploded</u>**

Can we use the Atrill MPD Curve to explain the "Chinese Growth Miracle" (and for that matter, the 'Japanese Miracle' after WWII)? By referring to the complete curve below, you can see that on the **right hand** side of the peak of the curve that there is an area in which additional debt ***<u>adds</u>*** significantly to the generation of value (GDP).



Using the MPD Curve, we can readily understand that the emergence of **China** as a global economic power has not been due to some superior insight into the economic growth process as they like to claim, but simply due to the growing use of debt after about 1970. The advantage of debt is that you can get lots of money for expansion with the wave of the hand and growth will follow almost magically! The disadvantage comes when an economy roars up and over the peak and heads down the slippery slope towards the Black Hole condition. Suddenly, debt has a cost and the economy will slow dramatically at the .289 point.

China has not discovered a 'new way' of managing the economy. It just followed the exact same roadmap left behind by post-war Japan, "the Japanese miracle" which followed a similar solvency trajectory. However, when more than 20 years ago, Japan crossed the .289 boundary condition, their growth came to an abrupt halt as that country reached the **event horizon** of its own 'Black Hole'. It should be noted that the **<u>Debt/GDP Ratio</u>** of China (as reported) has risen from a very low level to ***more than 3 times*** (a GDP/Debt /ratio of .33). With China falling so rapidly towards their own Black Hole condition, my guess is that China will

soon experience the same lesson that Japan has to this day still not learned, and it should not be long before the Chinese Miracle grinds to a halt.

It is no surprise that global GDP growth has been so slow with US, Japan and much of Europe in a very weak solvency condition (***as defined***) along with a few other major countries including Argentina and Venezuela. Give **China** another two or four years, and global growth should be a thing of the history books. We will then all have fallen under the spell of modern central bank solutions for slow-growth economies.

- **Does an Economic and Currency Collapse Necessarily Occur?**

Japan is a story about the failure of Quantitative Easing. It has been over 20 years since Japan became a **second-order insolvent** with a GDP/Debt ratio of .289. Curiously, however, Japan has hung right there and hasn't got any worse (or any better). However, Government Debt as a percentage of GDP rose from 100% in 1995 to more than 200% today. GDP has essentially flat-lined. In the meantime, household and corporate debt fell to keep the overall national solvency ratio constant. Ben Bernanke is widely considered to be the cause of the current militant QE in Japan by chiding Prime Minister Abe that the problem with Japanese stimulus was that it was ***not enough***. Well, Japan tried harder. The results? Japanese GDP growth remains extremely tepid, and their central bank is increasingly ending up owning a growing percentage of the country's debt ***and*** equity market wealth. So far, however, Japan has remained right at the .289 level.

For what it is worth, the US has been emulating Japan with very slow GDP growth, rising government debt but flat or falling private sector borrowing, notably in the productive corporate sector, and a central bank that has (had??) been steadily acquiring financial assets. The past years have been very interesting as corporate America has basically used virtually all of its reported net earnings for dividends and share buy-backs. With essentially no investment in future growth, the US GDP outlook would have to be characterized as questionable. Even with the most recent corporate tax cut, the game has not changed for the better, as what is appears to have done is to accelerate mergers and acquisitions, now running at a record pace, rather than capital spending.

- **Let's Retire the Miller/Modigliani *Hypothesis***

Anyone with an ounce of common sense "knows" instinctively that debt does count in the valuation process that the market carries out. However, having proved that debt does ***not seem*** to particularly matter in the valuation process (using the debt/equity ratio), Messrs. Miller and Modigliani did inspire at least one 'client', **government**, to cheerfully ignore the impact of too much debt…on everything.

Leverage does count. Using the Atrill Solvency Ratio as defined above (and in the appendix attached), below .5 on the MPD curve, GDP growth really slows and at .289, real economic growth starts to go into reverse. *One of our board members did his Ph.D. thesis on*

forecasting currency and interest rate movements *using the Atrill Solvency mathematics, with excellent success*. In our common stock valuation work, it is a maxim that **price follows solvency** (leverage). In short, it is time to expunge the M/M 'Theorem' from the books of both government and academia.

Where Do We Go From Here?

I can see three possible outcomes for the US stemming from the current situation:

1. In the next recession, increase debt and a push the US below the .289 ratio. The Corporate Welfare Act and the incipient trade wars would seem to more or less guarantee this outcome.
2. Decrease the debt and follow the Clinton solution, but this is very unlikely under President Trump
3. Do nothing much either way, and continue to follow the Japanese path.

One thing that flows from the MPD Curve is that **the process does not heal itself**. As Japan and now the US have shown, the .289 breakpoint is remarkably stable – a sort of stasis point of balance. From real time observation of Greece and Zimbabwe (for two), it takes a concerted effort to push the economy below the .289 level as there is a powerful pushback from the players in the economy, and certainly from the banking system, as shown by the falling velocity measure. But improving the Solvency Ratio is also very difficult because the austerity that is initially entailed from cutting spending is politically difficult to swallow – as Greece has clearly shown.

An economic historian with time on his/her hands should be able to examine other economies that have gone through this phase to find parallels – as there must be. The private sector also systematically responds by reducing its own indebtedness to balance the expanding balance sheet of government. I have to conclude (from a limited sample) that the entire system does not go into the Black Hole willingly and without a strong effort by the private sector participants to resist that move. Stasis is therefore a very real and continuing possibility going forward – in which case, the rich ***will*** continue to get richer as share buybacks and M&A activity increasingly concentrate ownership of productive assets in fewer and fewer hands!

Because the US GDP/Debt ratio has remained virtually steadfast at 0.289 since the third quarter of 2007, no increase in the basic economic growth rate can occur no matter how many economists and pundits attempt to forecast a return to the faster historical rates of growth. Every year since the recession following the 2008 market collapse, a growth rate of 3%+ for the coming year has been the standard forecast. And every year, the final number comes in around that 1.4-2.0% rate. Heading into 2018, economists were again looking for ***accelerating*** global growth of 3%+, and this against a background of ***slower*** economic readings from a number of international sources, including Japan, China and Canada. I would not be holding my breath in the expectation of anything like the forecast number!

What About The Corporate Welfare Act?

The **Corporate Welfare Act** of 2017 (a.k.a "tax reform") is the crowning glory of 30 out of the last 38 years in the history of US fiscal mismanagement. Referring to the newly-passed "tax reform" bill (and based on the experience of previous US tax cutting exercises), the main outcome will be **a rise in government indebtedness**, with a ***very tiny*** proportion (maybe 6-8% at the most) of the corporate "savings" flowing into actual expansion. The stock market has done well and may continue to do so! However, this late in the business cycle and with this level of slow growth and a potential trade war underway, I cannot see that US corporations are going to be undertaking much *new* capital spending expansion, while the impact on the weakening US government balance sheet should become increasingly clear and fairly severe.

The timing of this round of tax cutting for corporations and the wealthy is very unfortunate. When Reagan undertook his tax cutting exercise, the solvency condition of the US placed it well up towards the peak of the Atrill Curve. In other words, the US was in great shape, and could withstand the stunning load of debt that Reagan and Bush thrust on to it. By 1992, the solvency ratio had declined to .5, leading Bill Clinton to clean up the deficit mess that they left behind. When George Bush Jr. sponsored **The Homeland Investment Act**, or what we would classify as Round 2 of tax cutting in 2004, he was following on the hard work and success that Clinton left behind in getting the US out of its chronic deficit by strengthening the US balance sheet. In other words, the US was in an improving fiscal condition in 2000. By the election of 2008, however, the Solvency Ratio of the US had actually fallen below .289, or what we term the 'brink of scientific bankruptcy', and the US suffered its worst recession in decades before the Fed managed to pull the US (barely) back onside. Obama did nothing at all to repair the damage that Bush Jr. left behind him. And so President Trump is ***starting*** his tax cutting exercise with the US in the ***worst fiscal condition*** that it has ever been in, save the near depression in 2008-9. The US balance sheet plunged dismally during the tax-cutting tenures of Reagan/Bush and Bush /Obama but **there is simply no room for another such decline in the US solvency measure, without crossing the Black Hole event horizon. As a result, we are entering a totally new era with potentially very unfortunate consequences on the horizon**.

Critics and economists everywhere, not to mention President Trump, are free to ignore the mathematics, the analysis, and the conclusions herein. A sort of ***grand experiment*** is afoot, and therefore this is an 'interesting time' in the economic life of the US. Mr. Trump himself has seen his own enterprises go bankrupt three times before and so this could he his fourth one – although on a much grander scale than his previous failures. The question at this moment is, does Trump and the political and economic community wish to play Russian Roulette with the welfare of 322.4 million Americans? (That's the US population of 325.7 Americans less the One Percent.)

Sorry to say, it is not 'paradise' that this stairway leads to.

One can, of course, adopt a completely clinical attitude towards this event and simply wait and see. Indeed, given the unwillingness of the president and the Republican-controlled Congress to mitigate – or even understand – the potential outcome of such an event, that is probably all that any person of any political/economic persuasion can do. However, it couldn't hurt if readers passed on this information to others.

I certainly do not detect ***any*** political willingness in the US, Europe or Japan to embrace a modern Clinton-style solution to the debt problem. Right now, most central banks are at least paying lip service to the concept of ending Quantitative Easing and moving towards some level of Quantitative Tightening, as – believe it or not – all central banks are acutely aware of the Weimar experience. However, it would be my guess that as the current "expansion" phase of the US and global economy slows and heads into something that looks like a recession, especially if this is accompanied by prolonged stock market weakness, the political pressure on central banks to reverse course and stimulate again will be tremendous. Unfortunately, with no tools left to them and certainly no political support for a Clinton-style solution, then for the central banks, monetary (debt) expansion is likely to be the solution of choice with all that that entails for the GDP/Debt Ratio for the US.

What would be a real concern would be a significant recession coupled with a stock market meltdown – or perhaps we should put that the other way around given the extreme valuation of the US stock market – a significant bear market in common stocks which triggers a strong slowdown in the economy as it did in 2001-2 and 2008-9. A decline in the US GDP accompanied by a large increase in stimulus (debt issuance) could push the US through the .289 mark with unknown and unforeseen consequences. The offset to public debt increases could, of course, be the rapid paydown of private sector debt in this circumstance, with the ending balance being more or less still at that point of stasis, as Japan experienced for two decades. What we cannot know as yet, is, is whether there is a point of central bank frustration coupled with the lack of response of the private sector which pushes one or more central banks to pile on stimulus much more urgently, á la Germany in the 1920s and Zimbabwe (among others) in later years?

A strong leader of the US Federal Reserve Board could emerge with good political support from Congress, with a mandate to actually resolve the US debt problem (and, of course, by definition, the rest of the insolvent world which will take their cue from the Americans). We are cynical enough to doubt that this will occur, but cautious enough not to bet the farm that it won't. However, Jerome Powell, the new Fed chairman, has been labelled the GOP version of Janet Yellen (the outgoing chair person), and so I would expect nothing imaginative or innovative during his tenure.

Despite the general consensus that interest rates will rise, we would not look for much of an increase in overall interest rates, save for the Fed-controlled short end, ***unless*** one of two things happen. First, if the US debt/GDP ratio does plunge much below .289, then interest rates

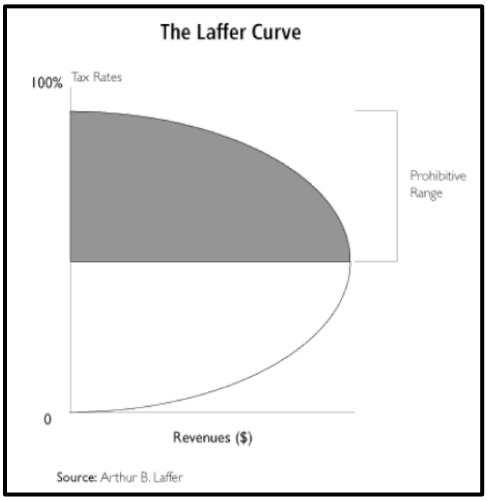
are very likely to soar. Second, if, on the other hand, structural change occurs which resolves the current malaise and the debt/GDP ratio returns to the average of most of the 20th century of roughly 0.70, interest rates will return (that is rise) to normalcy as well. But until there really is a true debt resolution movement underway, then things cannot change much from the conditions which we have outlined above. Demand for money will continue to be very weak, the US economy will continue to sputter along, and the rich will continue to get richer as the centrifugal forces of debt expansion continue, driving the poor and middle classes further into debt or at least genteel poverty. As depressing as this may seem, it is actually not a bad outcome, given the alternative of a plunge into the Atrill **Black Hole**.

What Should be Your Principal Take-aways?

First, I want to leave any readers who have managed to hang on to the bitter end with a very clear message. The **Marginal Productivity of Debt Curve** visually and clearly shows that if the US (and Japan and Europe) were closer to the peak of the curve, the additional GDP which would result would be enormous – I calculate from the table of values, somewhere in the order of +18-20% greater than today. We should observe that while this calculation follows from our math, Bill Clinton has already 'proved' that the math is essentially correct when it suggests a strong and favourable outcome. The **MPD Curve** does not portend merely a modest improvement, but a game-altering change in the growth outlook resulting in a powerful improvement in the US economy and its annual growth rate – at least until their respective economies get to their usual peak level, if not for some time afterwards.

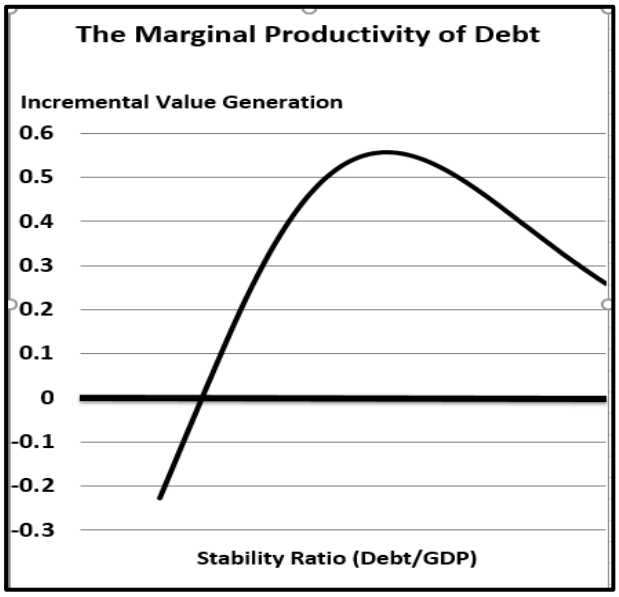
Second, I came across this unfortunate and seriously misguided ***bon mot*** recently: "A monetarily sovereign government has the unlimited ability to create its sovereign currency". After reading this article, I trust that the reader understands that for the US, it is not longer the case that it has an unlimited ability to create currency (debt) any longer. It is extremely close to its own limits of debt issuance before there is a profound and negative impact on its economy.

The Symbology of Change



The Laffer Curve, shown ***as originally propounded by Laffer himself***, suggests a trade-off between tax rates and tax revenues with a "prohibitive range" thrown in. Intuitively, the curve "makes sense" in that something like what is shown here *seems* to be the likely out-come of any taxation policy. The problem is that the proffered outcome is entirely intuitive, has not a shred of any statistical evidence behind it, certainly has no mathematics to back it up, nor an equation for its construction. However, for those, including Ronald Reagan, who were looking for an easy-to-digest **symbol** to back up and market their assertion that cutting taxes came under the heading of a "good thing", the Laffer Curve was superb.

Unfortunately, as we have all discovered in the years since he first put this notion forward, the Laffer Curve and the real world have little to do with each other. Application of the curve to American tax policies since 1980, with one brief interlude, have been proven lead to disaster – and if the current tax cuts are allowed to continue, may well lead to a second massive setback to the US economy. Using this symbol as a guide to an overall evaluation of its success, we would suggest that the **D-** as shown, is very probably **the appropriate letter grade** for both Laffer and his curve.



Turning to the **Atrill Marginal Productivity of Debt Curve**, here I have shown this curve in a slightly different way. Rather than using an *arithmetic* scale along the X Axis, I have used a *logarithmic* scale instead. In doing so, I actually more closely reference the mathematics which Atrill used. The curve shown here not only has excellent mathematical and theoretical underpinnings, but better, can be used as a forecasting tool for economists and those who set tax and spending policies for government. As for the symbolic and emotional content of the Laffer Curve, the Atrill Curve clearly points the way to a ***massive recovery and growth*** in the US economy, leading to genuine full employment rather than the current manipulated version of full employment (arrived at by eliminating every soul who has been unable to find a job 'in the past year'). What we get with this version of the Atrill Curve is a fairly close representation of an **'A'**.

As Bill Clinton has already pointed the way to, raising taxes and cutting spending, ***when the economy is in the terrible solvency condition that it is***, is an economic and political formula for huge economic and electoral success once the evidence starts to flow that the Atrill Curve 'works' – as it will. The courage to flout the Laffer Curve nonsense, however, will be significant, as the Laffer Curve has become almost a sacred tenet in American political life.

Afterthoughts

The **Divine Right of Kings** has long ago been supplanted by the **Divine Right of Government**. It is this problem in the past 100 years or so, and up until now, that allows and has allowed money-printing governments to spend and borrow, and run economically amok, to the massive detriment of employment, resource allocation and utilization, and the general well-being of their citizens. This "divine right" needs to be supplanted by a ***constitutional*** requirement for

the government of every country to be solvent *as measured*, and be as close to peak efficiency as possible, reporting to their citizens on a regular and timely basis.

Finally, I do not think for a moment that the solvency problems that we are faced with today are the result of political malfeasance, ill will, greed, or even stupidity. In general, politicians and financial leaders act in what they consider to be the best interests of the greatest number of people. Their intentions are good. Unfortunately, as Michael Bloomberg has observed, **you cannot manage what you don't measure**, to which I must add, **you cannot manage if you don't know *what* to measure**. My (late) colleague, Dr. Atrill has shown us what to measure and why: it is now up to us to do something about it.

C. Ross Healy, MBA, CFA

- Chairman, Strategic Analysis Corporation
- Associate Portfolio Manager, MacNicol and Associates Asset Management

In the appendix that follows, I have set out the mathematics behind Dr. Atrill's **Theorem of Solvency** ***from first principles***. Note that this is not based on statistical analysis. The casual reader may not require this depth of analysis, but if I am to assert – as I do – that at .289, the GDP of an economy will start to actually shrink, then there had better be solid and conclusive ***mathematical*** evidence for that conclusion.

Appendix:

The Economics of Solvency

I shall start by visiting Dr. Atrill's "Stability Ratio", a simple but key leverage ratio derived from balance sheet accounts that is an excellent predictor of balance sheet stress. By this, I measure how sensitive a company's ***in***ternal financial system is to ***ex***ternal financial stresses. I will show why this ratio is better than other, 'standard' leverage ratios, and I will do so by determining the limit at which leverage ceases to generate economic activity and becomes a drag instead.

When the traditional accountant looks at a balance sheet to see what is available to take care of the total debt, he likes to take into account all of those things which can be liquidated to meet the debts, and the easiest things to seize are the property, plant and equipment. But we are measuring something different: we are providing a measure for what the accountant terms the 'Ongoing Concern Principle'. A company that must sell off all or part of its plant, equipment and inventories to meet its debts will violate that principle because, whatever happens after that, the potential to generate business will have shrunk. In other words, ***tomorrow will not look like today***. The Stability Ratio is designed to measure the solvency of an entity and its ability to continue on in business (do equivalent economic work) for the foreseeable future.

The Stability Ratio is the ratio of 'dynamic receivables' (that which is in or coming into the company which is readily available to meet its obligations), which we symbolize as 'R', to dynamic payables (its debts), which we symbolize as 'P'. Looking at a typical balance sheet, R is the total assets of the company (or whatever) minus the Net Plant, Equipment and Inventories, plus the Accumulated Depreciation. 'P' is the total debt of the organization, short and long term. Accumulated depreciation is a non-cash deduction from the plant and equipment which permits a recovery of taxes which otherwise would be a payable (a debt). Hence, it is added back into the R in the ratio.

The Stability Ratio is the net result of all of the routine transactions that go on in the life of a company/entity, and are periodically sampled and summed up in the balance sheet. We find that for most entities, the Stability Ratio tends not to change a great deal from quarter to quarter or even from year to year. It is the result of the money Entry and Exit events that occur, and their relative stability suggests that organizations tend towards a modality in their operations that remains fairly constant. How the Entry and Exit events are tied together and related is the key to understanding how all economies actually work.

Defining The Exchange Conditions

(Entry and Exit Events)

I must begin by observing that every economic Entity has a process ***within it*** that ties together its **Entry** and **Exit** Events. The easiest way to think of this is the case of a company which seeks to turn service inputs (labor, raw materials etc.) into a product. At the same time as this is happening there is another process within the company that is related to the first process, *but is entirely distinct from it*. It is the process of turning its receivables into payments. These two processes within the company run opposite to each other as shown in Figure 1.

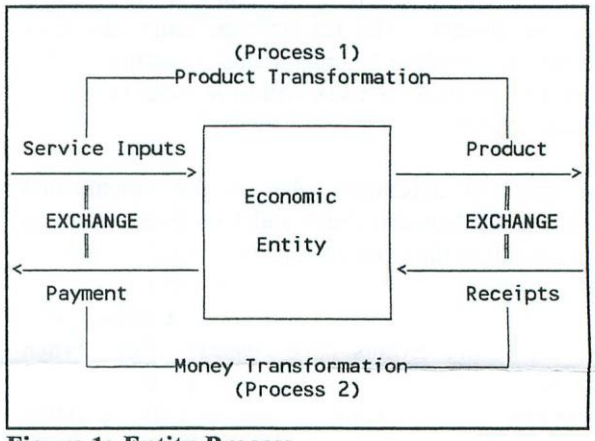


Figure 1: Entity Process

In Figure 1, Process 1 shows service inputs being turned into product. As just stated, we are not concerned with the technical details of *how* this is done. However, we realize that Product cannot appear or Exit from the Entity if there are no service inputs (labour, materials and so on). Likewise, Payment cannot occur without Receipt Events. The tie between Entry and Exit Events is therefore a fundamental economic reality that all entities must respect in order to remain functional.

The complete process for an established entity can be described as turning inputs into product (Product Transformation - Fig. 1), exchanging ('selling') this product for a receipt, and processing those receipts into payment (Money Transformation - Process 2 in Fig. 1). The process then begins anew as that money is then exchanged for new inputs, in an endless cycle.

From the point of view of the Entity Process, Exit and Entry Events therefore happen at both "ends" of the Entity through the process of Exchange. At one end of the Entity, we have payments (Exit Events) exchanged for Service Inputs (Entry Events). At the other end we have product (Exit Events) exchanged for Receipts (Entry Events).

The goal of the theory of Accounting Dynamics is to determine how much financial stress can be put upon the relationship between Entry and Exit Events and to measure this stress in an objective manner. Through this, we bring an engineering approach to the management of balance sheets.

The first step is to determine *how* this process can be represented. One's first reaction may be to construct a technical relationship such as a 'production function' that turns input into output or receipts into payment. These types of technical

relations however, are specific to each Entity and degenerate into trying to "estimate", if possible, the proper form of the function. Rather than pursuing this route, we search for a **general** relationship that applies to **all** companies and is based upon what we observe as a **fundamental characteristic** of Entity Activity.

In order to determine the fundamental relationship between Entry and Exit Events, we can ask the question, *"If the Entry Events of an Entity were cut off right today* [that is, if no more materials came to the plant and all the labour ceased to work], *what would happen to its Exit Events* [the product going out the shipping doors and the sales receipts which flow from that]*?"*. Would all Exit Events stop abruptly because Entry Events have ceased? Well, certainly not immediately! When Entities experience a "cash crunch" they try to conserve cash, typically by reducing or extending their payables, paying only those bills that must be paid and putting off the rest. In other words, what we observe is that the Exit Events, sales and the receipts there from, start to diminish. Similarly, if Exit Events (sales and receipts) were to cease, Entry Events would start to diminish, as inventories cannot accumulate indefinitely.[i]

In order to formalize this relationship between Entry and Exit Events we begin by abbreviating:

a = Exit Events

b = Entry Events.

The next step is to represent mathematically how these two Events diminish in relation to each other. To do this we use the following logarithmic expressions:

$\boldsymbol{log_a b}$ = diminishing level of Entry Events due to arrested Exit Events

$\boldsymbol{log_b a}$ = diminishing level of Exit Events due to arrested Entry Events

Let us consider the first logarithmic expression. The effect of reducing Entry Events is ***equivalent to*** an Exit Event. For example, the payment of bills has the **same effect** on bank balances as postponing the collection of money from receivables. We represent this relation mathematically in terms of the logarithmic expression $log_a b$, which means that the decrease of Entry Events *b* is related to the arresting of Exit Events *a* by a power law. Recall the definition of the logarithm: If $log_a b = x$, then $b = a^x$ (*x* is the diminished level of Entry Events due to ceased Exit Events). In words, Entry Events are diminished in proportion to diminished Exit Events raised to a power.

Likewise, the collection of receivables (i.e. Entry Events *b*) has the same effect on the bank balance as the postponement of payments, which is represented by our second logarithmic expression, the diminished level of Exit Events, $log_b a$. Mathematically, as above, if $log_b a = y$, then $a = b^y$ (*y* is the diminished level of Exit Events due to ceased Entry Events).

The question we now have to answer is what determines the powers *x* and *y* which represent the diminished levels of Entry or Exit Events due to arrested Exit or Entry Events, respectively.

Let us examine the first expression, $log_a b = x$, or, as stated above, equivalently from the definition of the logarithm, $b = a^x$. Entry Events *b* are diminished proportionally if Exit Events *a* cease. This reduction of Entry Events in turn (cf. Figure 1) leads to a further reduction or arresting of Exit Events and so forth. If a company stops paying its bills (Exit Events), its suppliers will reduce their shipment of raw materials (Entry Events). This in turn leads to the reduction of production (Exit Events), which results in a reduction of sales (Entry Events). We therefore postulate that Exit Events *a* are related to $log_a b$, which is the reduction of Entry Events *b* due to ceased Exit Events. In turn *b* is related to $log_b a$. More precisely[ii],

a is proportional to $log_a b$
b is proportional to $log_b a$

This means that there exists a "feedback loop" between Entry and Exit Events. Our task is now to determine the precise relation of the feedback, or mathematically speaking, the proportionality

factor.

We cannot simply equate b to $\log_b a$ and a to $\log_a b$, since this would imply that all companies' Entry and Exit Activities are related in precisely the same way. What ***is*** implied, however, is that the ***nature*** of the relationship between these Activities is the same for all companies. The precise form of the relationship between the decrease of Exit Events due to the arrest of Entry Events (or vice versa) will differ among Entities. Clearly, the financial condition or "solvency" of each Entity will affect this relationship. That is, solvent companies have the ability to pay their creditors quickly and less solvent or insolvent companies will pay at slower and slower rates.

We must therefore create a measure to capture the financial condition of the company that is relevant to the Entity Process described in Figure 1. However, we cannot measure every transaction of a company since it would make the analysis burdensome and of no practical use. Rather than studying individual transactions, we create surrogate measures that capture these Events. The obvious database for our measures is the Entity's **balance sheet** since it captures the **net effects** of all the Entity's transactions.

Referring to Figure 1, there are service inputs being turned into product, along with the mirror image of turning receipts into payment. We therefore want to capture in our measures the Entry and Exit activities that are associated with the creation of product and the payment of service inputs.

When constructing our surrogate ***money*** measure of Entry Events we realize that not all Entry Events are turned into product. In particular, some go into inventories and supplies, while some go into plant and equipment. At the same time, however, we also realize that some of the plant and equipment is 'consumed' as depreciation during the production of the product. Our surrogate measure, "R", noted below, is constructed to capture these observations. (Money) Entry Events are: **Total Assets plus Accumulated Depreciation, minus Net Plant, Equipment, Inventory and Supplies.**

To capture the effects of Exit Events we turn to the "other side" of the balance sheet. We remove the net worth of the company from this side of the balance sheet, since it reflects what the company has retained from its operations. What is left therefore is the **Total Liabilities** of the company which become the surrogate measure of Exit Events and which we symbolize by the letter "**P**".

The two surrogate measures, R and P, represent the accumulated effects of Entry and Exit Events over the company's lifetime as of the balance sheet date. The **Stability Ratio** is the ratio **R/P** and captures the company's condition with respect to what it has built up in terms of Entry Events relative to Exit Events.

By linking balance sheets together over time, we can see the evolution of the company in terms of how it operates (the modality of the Stability Ratio) and the options that that modality presents. In doing so, we elevate the balance sheet from being a "snapshot" of a company's financial condition (the standard interpretation) to a dynamic document that "tracks" a company's financial and operational footpaths.

We can now return to the postulate that a is proportional to $\log_a b$, and b is proportional to $\log_b a$. The Stability Ratio is the proportionality factor that we seek:

$$a = \left(\frac{R}{P}\right) \times \log_a b \quad (1)$$

$$b = \left(\frac{R}{P}\right) \times \log_b a \quad (2)$$

Equation (1) means that Exit Events a decrease further after Entry Events have decreased due to ceased Exit Events b (mathematically given by $\log_b a$), where the strength of the reduction depends on the company's Stability, and similarly for equation (2) with the roles of Entry and Exit Events exchanged. A company with a strong Stability Ratio can withstand temporary stresses due to arrested Entry and Exit Events better, because it has more Operational Assets than Operational Liabilities.

At this point one may inquire why we would use the Stability Ratio in both cases and not the

inverse, P/R, for one of the relationships, as the two appear to be of opposite direction. The reason we use the Stability Ratio in both cases is that the structure of the Entity in both cases remains the same, whether we are looking at Exit Events in terms of the diminished level of Entry Events due to (other) arrested Exit Events (encoded in the logarithm), or Entry Events in terms of the diminished level of Exit Events due to arrested Entry Events. Therefore, the Stability Ratio is used in both cases. Embodied in this assertion is the notion that there is no ***unique*** direction to production. In this sense we do not distinguish between service inputs and output or product, since each can be viewed as playing either role. It is just as correct to say that an Entity is in the business of paying labor, buying supplies, etc., as it is to say it is in the business of selling cell phones and collecting payments. When unions and governments talk of "job creation", for example, they are in fact looking at a company in this way.

In Figure 2, we reproduce the Entity Process of Figure 1 along with the mathematical relationships between Entity activities and their associated diminished levels that we have derived above.

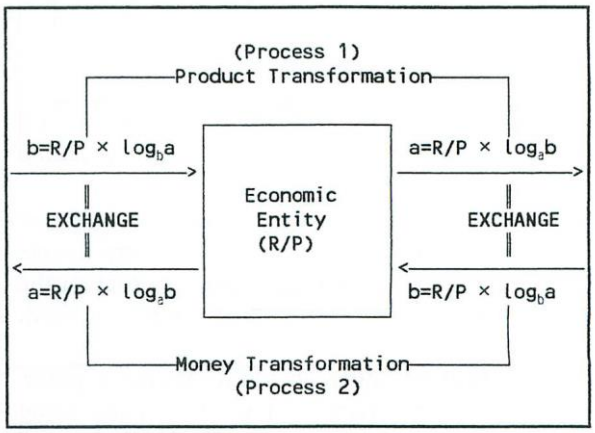


Figure 2: Entity Process

To graph equations (1) and (2) we must re-write them such that all *a*s or *b*s occur only on one side of the equalities instead of on both sides. We abbreviate **R/P** to be equal to **ω**, that is, (1) becomes $\boldsymbol{a = \omega \log_b a}$. We then divide by ω and obtain $\boldsymbol{a/\omega = \log_b a}$. We transform (2) in a similar manner. Using the definition of the logarithm (on page 2), we can now rewrite equations (1) and (2) in a power-law or exponential form,

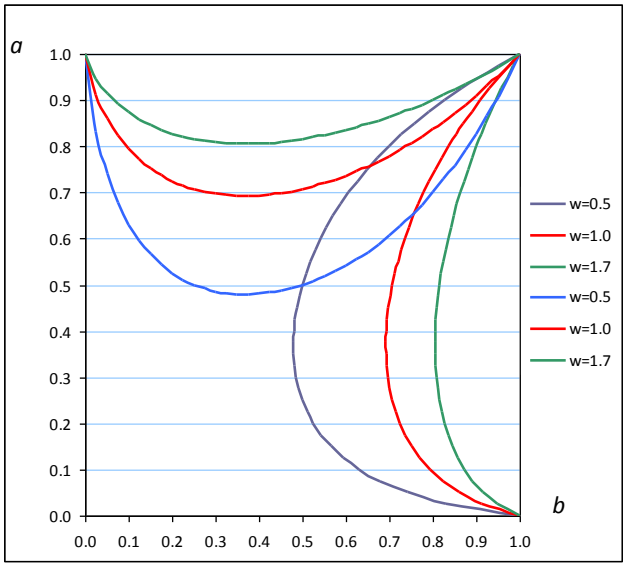
$$b = a^{\left(\frac{a}{\omega}\right)} \qquad (3)$$

$$a = b^{\left(\frac{b}{\omega}\right)} \qquad (4)$$

In words, as already stated above, Entry and Exit Events are related to each other by a **power law**, and we have established that the power is determined by the Stability Ratio, R/P = ω, which is the ratio of Total Assets R to Total Liabilities P.

Equations (1) and (2) (or their rearranged, exponential forms (3) and (4)) are referred to as the **E-Conditions** in Accounting Dynamics. They are the structural equations that represent the fundamental nature of Entity activity with respect to Entry and Exit Events.

Figure 3 graphs the E-Conditions for values of the Stability of 1.7, 1, and 0.5. Note that as the Stability Ratio falls in value, the arc lengths become longer.



The horizontal branches of the E-Conditions in Figure 3 represent the process associated with Entry Events ($b = a^{(a/\omega)}$), while the vertical

branches represent the process associated with Exit Events (a = ($a = b^{(b/\omega)}$). From Figure 1, we know that Entry and Exit Events happen at both ends of the Entity where exchange takes place. Whether we are referring to service inputs being exchanged for payment or product being exchanged for receipts, both exchanges are represented ***identically*** by the E-Conditions. The graph of the E-Conditions therefore applies equally to both exchanges.

In describing the events for the remainder of this paper, we will do so in terms of product being exchanged for receipts.

From Figure 3 we can read off a number of properties of the E-Conditions.

1. The points where the horizontal and vertical branches intersect are the points where both equations are simultaneously true, that is, where Exit and Entry Events are equal and the equations (3) and (4) are mutually consistent.
2. The arc lengths of the branches become longer, approaching 3.0 as the Stability approaches zero. The arc lengths become shorter and approach 1.0 as the Stability tends towards infinity.
3. All branches, irrespective of the value of the Stability Ratio, pass through and intersect at the point where $a = b = 1$.

The fact that the point $a = b = 1$ is special, in a sense that we will define below, can also be seen mathematically by examining equations (3) and (4). If we place the values $a = b = 1$ into equation (3) or (4), we obtain $1 = 1^{(1/\omega)}$. This equality is true for any value of the Stability ω, because 1 raised to any power always remains 1. So the point where $a = b = 1$ represents a special circumstance in Accounting Dynamics because regardless of the value of the Stability, the E-Condition arcs always pass through that point.

We interpret this in our economics as the production process (the Entity Process as represented by the E-Conditions) being associated with something that rises to a "unit", but does not go beyond it. In other words, the point $a = b = 1$ signifies the end of the production process. The end of the production process is marked by another occurrence, however, and that is the **appearance of product**. The coordinate $a = b = 1$ is therefore the point where the production process ends and product itself appears.

Remember, however, that there are two processes within the Entity, production and exchange. The point $a = b = 1$ is also the end of the second process that is within the Entity. That process is the collection of receipts for payments. At $a = b = 1$ therefore, we are at the end of our collection process. At the end of our collection process is, of course, *payment*.
Therefore at $a = b = 1$ **three** things occur: (1) Exit Events equal Entry Events ($a = b$), (2) the production and collection processes are complete, (3) product and payment appear. Given these three occurrences that take place, the point $a = b = 1$ defines for us the point of ***exchange*** (sale).

The production and collection processes, as stated by the E-Conditions, and the product and payment that appear at the end of these processes at $a = b = 1$, is, of course, an *abstract* representation of the Entity. This means that Entry and Exit Events are not measured in terms of some actual currency (e.g. dollars, Euros, or Yen), but in abstract units. The abstract product obtained from the production process is defined as a *unit delivery of output* which is exchanged for the abstract payment defined as a *unit collection of receipts*. These abstract units of product and payment which define for us exchange, act as our ***numeraire***, that is, as a measure of the worth of different goods and services relative to one another. Instead of specifying the value of our abstract product and payment in some definite currency, they always appear in *units*, that is, a and b assume a value of 1 at the end of the production process. Given this built-in numeraire, ***we do not have to depend on a subjective theory of value***. We simply have product and payment appearing in units, the unit itself being a measure of activity.

Defining The Market Conditions

(Market-Exchange Events, *between* balance sheets)

The E-Conditions derived above describe Entry and Exit Events as seen from the perspective of the Entity. Let us now look at these events and the associated E-Conditions from a different perspective, namely those who are outside the Entity, that is to say "the market" for the entity's goods or services.

The E-Conditions represent the productive processes that occur ***within*** each Entity. In their logarithmic forms, equations (1) and (2), these processes are interpreted as the arresting of one type of Event that causes the other type of Event to diminish. In other words, one type of Event restrains the other. In their rearranged, exponential forms given by Equations (3) and (4) however, no such restraint exists. Just as the logarithmic form of the E-Conditions has economic meaning, so, too, does the exponential form.

To properly interpret the exponential forms of the E-Conditions, we must consider them in the way they were derived. Since the exponential forms arise from rewriting the logarithms in terms of powers, which is the inverse operation of taking logarithms, we have a sense that equations (3) and (4) must represent something that is opposite to what the logarithmic forms (1) and (2) represent. Since the logarithmic forms represent a process that is restrained, the exponential forms must represent something that is not restrained.

All transactions of the Entity with its buyers and suppliers (the "market") are recorded in one set of accounting records, that of the Entity itself. All of these Events, as we have seen above, restrain each other within that single set of accounts. The Events of the Entity's buyers and suppliers, however, are contained in many sets of books. The buyers' account with the Entity does not restrain the suppliers' accounts just as the account of one supplier to the Entity does not restrain the accounts of other suppliers to the Entity and so on. Therefore, if we examine the purchase and sales Events for an Entity from the perspectives of all ***other*** companies involved, these companies do not encounter the same set of restraints as the Entity under consideration. The accounts of the buyers and sellers, are "opposite" in character to those of the Entity since what is entered on the debit side of the Entity's account is entered on the credit side of its suppliers or buyers and vice versa.

However, all of the various accounts that are involved in exchanges with the Entity, and which are held by all its buyers and suppliers, can be imagined as defining a single ***Trading Entity***. That Trading Entity is characterized by the fact that buying and selling Events ***do not*** restrain each other as in the case of the Entity itself. Given this concept of a Trading Entity, a^a (for the sake of simplicity, from now on we set the Stability Ratio, ω, as equal to 1.0 unless stated otherwise) refers to the Entry Events of the Trading Entity that are the Exit Events *a* of the Entity. In other words, the mathematical expression a^a summarizes the Entry Events of all the companies that do business with the Entity, which is given by all the net Exit Events of the Entity. Likewise, b^b refers to the Exit Events of the Trading Entity that correspond to the Entry Events *b* of the Entity. That is, the exponential forms a^a and b^b refer to the Events *a* and *b* of the Entity as seen from the perspective of the Trading Entity.

The following table summarizes the relations between Exit and Entry accounts for the Entity and its Trading Entity:

	Entry Events	**Exit Events**
Entity	b	a
Trading Entity	a^a	b^b

The exponential forms of the E-Conditions therefore represent how "exchange" manifests itself in the Trading Entity. This exchange is, however, given by the final record in the books. Striking a "Bargain" or making a "market" are not recorded, but simply the Entry or Exit Events for the Entity on one side of the books and for the Trading Entity on the other side of the books.

When exchange takes place, it can be described as "something" that disappears from one side of the exchange and appears on the other. In the same way, "something that equals it" also disappears from the second side of the exchange and appears on the first side. This description of exchange gives us our exchange relation. That is, when Exit Events *a* disappear from the Entity,

they appear as a^a in its Trading Entity. The disappearance of a is represented by a approaching zero, and through exchange it appears in the Trading Entity as a^a, which approaches 1. This is consistent with the notion that product and payment appear in units, as noted before in the E-Conditions. Similarly, as Entry Events b of the Entity disappear, and Exit Events b^b of the Trading Entity approach 1, that is, the Entry Events are backed up into the Trading Entity. The exchange relations can therefore be expressed as:

$$a^a - a = 1 \quad (5)$$

$$b^b - b = 1 \quad (6)$$

In words, equation (5) means that the Entity makes a payment or delivers product to another company, encoded by the term ($-a$), where the minus sign signifies the outflow of payment or product. This payment or product is recorded as an Entry Event by another company, as a^a. The fact that this exchange always appears in units (a company does not deliver half a product) means that on the right hand side we have the unit 1.

Equations (5) and (6) tell us that exchange drains the Entity of the unit Exit and Entry Event, that is a and b are reduced from 1.00 to zero as they appear in the Trading Entity as a^a and b^b. Given that a and b for the Entity have been reduced to zero, does this mean that Entity Activity comes to an end? That would be the case only if the Entity itself then disappeared. As stated earlier, there is a feedback loop within the Entity Activity which manifests itself by the resumption of Activities. We must go one step further and recognize therefore that as Exit and Entry Events tend to fall towards zero, they start up again since economic activity in general does not cease when one particular aspect of economic activity is finished (for example, the completed production and sale of one car does not mean the end of the whole car manufacturing process). The aforementioned feedback loop as seen from the perspective of the entire Trading Entity can now be described as a feedback between Entry and Exit Events of the Entity b and a and the Entry and Exit Events of the Entity's surroundings a^a and b^b, the Trading Entity. The question that remains to be answered is thus what the nature of this type of feedback is.

We know that the Entity's Exit Events a act as the Trading Entity's Entry Events a^a. Therefore, if a increases, so does a^a. From this we postulate that the **replenishment** of a^a as a result of the replenishment of a as seen from the perspective of the entire Trading Entity has the mathematical form a^{a^a} and similarly, that the **replenishment** of b^b as a result of the replenishment of b has the mathematical form b^{b^b}. Furthermore, by extending our exchange relation in equations (5) and (6) and applying it to a^{a^a} and b^{b^b} and the exponential forms a^a and b^b in precisely the same way that the exponential forms a^a and b^b relate to a and b in equations (5) and (6), we obtain:

$$a^{a^a} - a^a = 1 \quad (7)$$

$$b^{b^b} - b^b = 1 \quad (8)$$

Equations (5) and (6) gave us the exchange relation as exchange takes place and reduces the Events to zero. Given that the Events start up again, that is we assume that the company does not disappear right after selling its product but goes right back to doing the same thing over and over again, equations (7) and (8) describe a more complete exchange relation where the production and exchange Events are continually replenished.

Again, in order to be able to graph and study the equations (7) and (8) we must rewrite them such that a and b appear only on one side of the equality, just like the E-Conditions (1) and (2) were rewritten as (3) and (4). We start this rearrangement with (3) and (4), $\boldsymbol{b = a^{(a/\omega)}}$ and $\boldsymbol{a = b^{(b/\omega)}}$, then raise these two equation to the power ω, which gives us $\boldsymbol{b^\omega = a^{(a/\omega)\omega}}$ or $\boldsymbol{b^\omega = a^a}$, and likewise $\boldsymbol{a^\omega = b^b}$. Using these equalities for a^a and b^b by substituting b^ω for a^a and a^ω for b^b in (7) and (8), we find:

$$a^{b^\omega} - b^\omega = 1$$

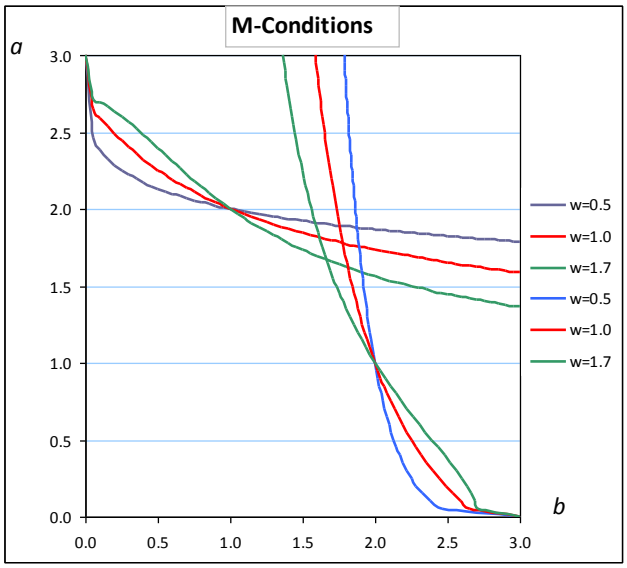
$$b^{a^\omega} - a^\omega = 1$$

Now, let us look at the first expression. We bring b^ω to the right-hand-side, obtaining $a^{b^\omega} = 1 + b^\omega$. Raising both sides by the power $1/b^\omega$, using

$(a^{b^\omega})^{\frac{1}{b^\omega}} = a$. and performing an analogous rearrangement for the second expression, we arrive at the final forms:

$$a = (1 + b^\omega)^{\frac{1}{b^\omega}} \qquad (9)$$

$$b = (1 + a^\omega)^{\frac{1}{a^\omega}} \qquad (10)$$



Expressions (9) and (10) are called the M-Conditions and represent the **exchange relation** in the market ***with Activity replenishment*** from the point of view of the entire Trading Entity. The M-Conditions thus summarize the feedback between Entry and Exit Events of the Entity and the Entry and Exit Events of its surrounding Trading Entity, with the strength of the feedback again encoded by the Stability Ratio, ω. Figure 4 graphs the M-Conditions for Stability values of 0.5, 1, and 1.7.

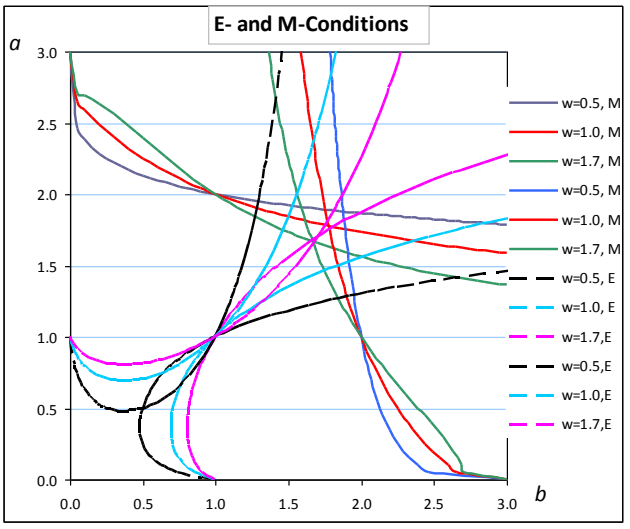
As before, we can read off a number of properties of the M-Conditions from Figure 4. The most relevant for our purposes here is that the horizontal and the vertical branches intersect along the diagonal between the points $a = b = 1$ and $a = b = 2$. The precise intersection point depends on the value of the Stability Ratio of the entity and approaches $a = b = 2$ as ω falls to zero and approaches $a = b = 1$ as ω tends towards infinity.

The *Value* of the Process of Production

The **E-Conditions** describe for us the process of production and product appears at the point $a = b = 1$. We have noted above that this is an "abstract product" in abstract units, which are defined by the fact that the abstract product appears simultaneously with the abstract unit of payment. Thus the end of product and payment production processes define for us a measure (or numeraire) by which we can **value the processes themselves** instead of using any specific currency.

The process of production for Entry Events, represented by the horizontal branches in Figure 3, begins at $a = 0$, $b = 1$ and ends at $a = b = 1$. Conversely, for Exit Events, which are represented by the vertical branches, the production process begins at $a = 1$, $b = 0$ and ends at $a = b = 1$.

The arc length of a vertical branch in Figure 3 between the points $a = 1$, $b = 0$ and $a = b = 1$ represents the value of the process needed to produce one unit of product (that is, <u>one</u> unit of Exit Event b), using the aforementioned intrinsic measure of value.



Likewise, the value of the process needed to collect payment is the arc length of a horizontal branch between the points $a = 0$, $b = 1$ and $a = b = 1$. It is measured per unit of payment.

The fact that the length of the two arcs are equal for a given value of the Stability ω indicates that the value of the processes are equal at the point of exchange $a = b = 1$. The value of the process of production, whether it be for Entry or Exit Events, is therefore the length of the arc.

Going back to the E-Conditions, the arc length depends on the value of the Stability Ratio (see Figure 3). As the Stability Ratio falls, the arcs bow out more and more, and the arc length increases, which means that the value of the production process increases. This is because a decrease in the Stability Ratio is equivalent to a **deepening of capital**, that is, plant equipment and inventories and other liabilities increase ***relative to*** total assets. This increase in liabilities and decrease of assets leads to a higher effective cost of the production process, graphically represented by an increase in the arc lengths in Figure 3.

Exchange Value: The *Value* of the Product

The M-Conditions, on the other hand, describe for us the exchange between the Entity and its Trading Entity. The solution to the M-Conditions which are given by the points where the two branches of the M-Conditions in Figure 4 intersect, always occur on the diagonal between the points $a = b = 1$ and $a = b = 2$. As mentioned above, the precise intersection point depends on the value of the Stability Ratio and approaches $a = b = 2$ as ω (the Stability Ratio) falls to zero and approaches $a = b = 1$ as ω tends towards infinity. A Stability Ratio of infinity means that total liabilities P are 0.

The precise location of this intersection point, as it depends on the Stability Ratio, is central to our valuation objective. The length of a straight line from one of the coordinate axes to the intersection point defines another important measure of value. (Since the intersection points lie on the diagonal, the lengths from either axis to the intersection point are equal). Just as in the previous section, where the arc length in Figure 3 represented the value of the production process, here the length of the straight line from the coordinate axis to the point where the M-Conditions intersect in Figure 4 measures the value of the product as viewed from the entire exchange process. This measure is again given in **units of product**.

To help convince ourselves that these lengths are reasonable measures for the valuation of production and exchange, let us consider an extreme case. When the Stability Ratio goes towards infinity, the intersection point of the M-Conditions in Figure 4 is $a = b = 1$. This means that the exchange value as measured by the straight line from one of the axes to the intersection point is equal to 1.0. The production value as measured by the arc length in Figure 3 also becomes 1.0 when the Stability Ratio approaches infinity. Given that a low Stability Ratio is tantamount to a deepening of capital for the Entity, a Stability Ratio of infinity implies that the Entity has no capital. An Entity with no capital cannot have a process of production, and the process of production disappears, effectively becoming a ***non-process*** of production, mathematically signified by a production value of 1.0. In Figure 3 graphically, as the Stability goes towards infinity, the arcs curve out less and less, and are deformed into straight lines lying directly on the coordinate axes when the Stability is infinity.

The Exchange Value also collapses when the Stability Ratio tends to infinity. With no process of production, there is no value added from the non-production process. This means that at the limit when the Stability becomes infinity, Entry Activities are exactly equal to Exit Activities as they enter and exit unchanged, and the exchange value is 1.0.

Both exchange and production values are equal to each other and to 1.0, as measured by the above defined geometric lengths, when the Stability tends to infinity. This fact demonstrates that these geometric lengths are reasonable measures for production value and exchange value.

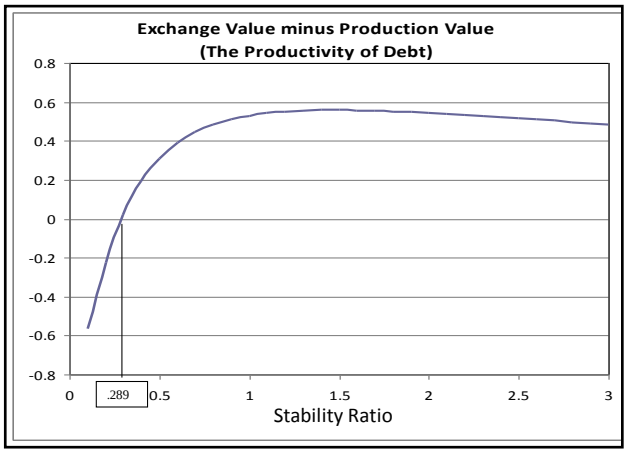
Figure 6 combines Figures 3 and 4 and graphs both E- and M-Conditions for values of the Stability of 0.5, 1, and 1.7.

What Is 'Insolvency'?

As the Stability Ratio falls from infinity and capital formation begins, the Entity develops a process of production. This is reflected in the E-Conditions as they begin to bow out to form arcs (showing that an actual 'business' forms, with entry and exit events) and their length increases from 1.0. At the same time, the point where the M-Conditions intersect moves up along the diagonal towards the point $a = b = 2$. As this happens, the exchange value becomes greater than 1.0 as well (value could be said to be added to the economy). Subtracting the Production Value from the Exchange Value, we will find that the exchange value will be greater than the production value for all Stability Ratios greater than 0.289… Graphically (Figure 5), the length of the line from the M-Condition intersection point to the axis is greater than the arc length of the horizontal and vertical E-Condition branches. However, at Stability Ratios lower than 0.289… when capital deepens, the value of the production process is greater than the value of the product in exchange. [Note that at a Stability Ratio of .289, the inverse way of looking at this ratio is that there is $3.50 of debt outstanding, 'P', per dollar of 'R'.]

In other words, at a Stability Ratio greater than 0.289 the company could be said to "make a profit", and at a Stability Ratio of less than 0.289 the company "loses money". Thus there is a critical breakpoint at a Stability Ratio of 0.289 indicating a change in the company's solvency state. In order to increase its 'profitable' business activities at this point, the company has to increase its Stability Ratio again. One way that businesses which become insolvent, as defined, do this is by selling assets and paying down its liabilities (debt) to the level, that is, its Stability Ratio, where the company can meet the servicing requirements of its liabilities once again.

Below we plot the difference between the exchange value and the production value for Stability Ratios between 0 and 3. Note that if we extend the curve into the hyper-solvent end of the spectrum, the curve becomes asymptotic to the X-axis at the zero mark. Since we are measuring the



productivity of debt, when there is no debt at all, there is a zero productivity associated with debt. On the other hand, since the curve rises from a 'pure-equity' condition, the curve also shows that to achieve maximum productivity of total capital employed, debt is absolutely necessary, but is certainly ***not*** a necessary evil[iii].

Implications

The Stability Ratio is a deceptively simple ratio derived from balance sheet accounts. It is calculated by taking Total Assets *plus* Accumulated Depreciation, *minus* Net Plant, Equipment and Inventories and dividing this by Total Liabilities. The strength of the Stability Ratio comes from the underlying theory from which it is constructed. This theory focuses on the activity of a company (entity) in terms of Entry and Exit Events. This framework is extended to include the company's surrounding Trading Entity, which is the amalgam of all the individual companies (entities) which do business with that company itself. There is a feedback between these Entry and Exit processes, both from the perspective of the company and the Trading Entity. The Stability Ratio encodes and embodies the strength of this feedback.

While the theory in its totality identifies several breakpoints which identify different solvency states for a company, in this paper. I have only highlighted one breakpoint, 0.289, because it is the start of the condition where the **value in**

production has become ***greater than*** the **value in exchange**. It is as if the entity was attaching dollar bills to its product going out the door. Dr. Atrill termed this condition a "scientific bankruptcy" because, whether it is acknowledged or not, the economic consequences of bankruptcy hold, namely that value is being destroyed by permitting the entity as structured to continue. In other words, the company is better off selling its assets than using them for whatever business it is in. This is the "must sell assets" condition.

The other breakpoints that are identified by the theory are as useful as 0.289, but are beyond the intent and scope of the particular analysis. I should add, however, that these Stability breakpoints allow us to make incisive observations of a company's financial state. As occurs most starkly at .289, the analysis becomes even more powerful when the Stability Ratio is in the process of violating one of the breakpoints. These transitions mark clear changes in the company's solvency state and these changes in state tend to result in a change in a company's behaviour, as well as the behaviour of its Trading Connections, in **logical and predictable** ways. As any given entity approaches one of the breakpoints, the change in behaviour will always tend to have the same general characteristics. The forecasting ability of Accounting Dynamics is therefore a quantum leap forward for the world of economics.

Measuring an Entire Economy

For an economy in the aggregate, the R or 'incoming activity" is equal to the GDP, and P, the debt both short and long term, is (of course) the total debt of the economy. I ascertained this for several reasons. First and foremost, when I analyzed the Debt/GDP Ratio of the US many years ago for the 20th Century, I found that it peaked out at roughly .689. This is the peak at the ***reciprocal*** of the Marginal Efficiency of Debt Curve, and is what we call the Atrill Solvency Curve, and is the calculated point where **R+P** (***total*** **economic activity**) is maximized, as opposed to R (GDP) per unit of P (debt) which is the MPD Curve measure where the R itself is maximized. I theorized that if the US economy adhered to what we think of as the 'efficiency discipline' at the top, then it should adhere to the insolvency parameters at the bottom.

Following from that, and much more practically, as I was following the solvency course of Greece and Spain, I observed that the GDP of both countries plunged virtually immediately once they had crossed the .289 boundary condition. You will also observe above that once the US crossed that second-order insolvency condition in **2007-8**, the US economy went into an ugly plunge, most horribly in the banking, housing and auto sectors, all three of which were themselves in a condition of bankruptcy and had to be bailed out.

I was not alone in this observation. The Harvard Economist, Kenneth Rogoff, had also observed that of the economies that he had studied which became insolvent (their GDP and currencies collapsed), it ***seemed*** as if that event came at the point where those economies were carrying $3½ (or whatever currency units) per $dollar of GDP. In other words, in practice, according to his observations, at the ratio of .289, those economies moved into a condition of extreme stress (not his term, as far as I know, but it is the term that we use when measuring the solvency condition of weak companies and now, weak economies).

Fortunately, in 2009, the US Fed reacted and adjusted very quickly and pulled the economy back up and out, and a larger collapse was averted. In this effort, the Fed's balance sheet became heavily laden with the debt that it had purchased to stabilize the US economy. The big question – with a very much unknown answer – is ***if*** the US enters another ***balance sheet*** recession, can it do the same thing a second time? And, more to the point, do we want to find out?

[i] Equally, we could assume a speeding up of the processes of exchange because that kind of event often places other kinds of stresses on a balance sheet. For present purposes, however, it is the

slowing down kinds of stresses that I wish to pursue.

[ii] The linear proportionality between **a** and **b** and their logs with the proportionality factor being the Stability Ratio is a **postulate**. One might observe that there could be other mathematical ways of measuring the 'slowing down' (or 'speeding up') effect other than the use of logarithms. While Dr. Atrill left it to others to determine whether or not there is a better surrogate measure of this process which could be employed instead, the forecasting value of the results that Dr. Atrill obtained are so powerful that they speak for themselves.

[iii] One could expand the limits of the curve to cover the extremely solvent end of the spectrum. The curve gradually becomes asymptotic to the '0' plane, which is due to the fact that there can only be "no debt", not negative debt; so at a Stability Ratio of nearing infinity, no stress is caused by (no) debt. However, at high Stability Ratios, entities which are equity heavy also produce a drag on the economy (although unlike debt pressures, it can never be negative). Economies that operate at these kinds of levels are very close to operating on a barter basis and tend to be very low energy kinds of economies. This, for instance, is more or less where China was before it began its great migration to a much more 'capitalist' approach. Clearly, rising up the Debt Productivity Curve by starting to employ leverage produces very rapid growth as the mathematics of the curve promises.