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# The macro-economics of repressed stagflation. Part 2: The crisis of 2009+ and a reduction of the working week

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## Abstract

The current macro-economic crisis can be diagnosed as repressed stagflation bursting into the open. The Obama Administration and EU stimulus packages prevent economic collapse but do not tackle stagflation itself yet. Without proper measures, a protracted period of high unemployment or high inflation and continued instability can be expected. Instead, macro-economic theory can come at ease with deflation as a temporary state that is logically implied by the notion of price stability. What is crucial is to keep people in jobs. With proper tax measures the NAIRU is shifted to the proper position. The current situation seems to require a (temporary) reduction of the working week, for some areas even from 5 to 4 days.

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## Introduction

The path towards recovery consists of three elements: (a) institutional safeguards, (b) restoration of the optimal path, (c) measures to get to that path. Colignatus (2009b) considered the institutional setting and here we will look more into the macro-economics of the shift. We use only a small “back of the envelope” model without interactions to highlight the importance for the current situation of a reduction of the working week.

The order of presentation of this paper is as follows. First we review the general case of repressed stagflation. Then we discuss the optimal path, with the normal working week. Then we discuss the temporary reduction of the working week to get to the optimal path. But before we proceed, it is best to highlight the theoretical position of the working week.

## The working week in the current crisis

Reduction of the working week is not advisable in the situation of structural failure and as an escape from painful restructuring. But it is proper in the current situation.

The discussion on the financial markets has clarified what system risks are. A capital requirement rule may work for a single bank but is ineffective and even counterproductive when many banks drop below the line (which they do because many banks do so). A credit default swap works for a single default but is ineffective and even counterproductive when many credits default (which they do because many credits default). The intention of this paper is to underline that the same reasoning holds for unemployment insurance.

Firing people and subsidize search with unemployment insurance may work for a single individual looking for a fitting job but is ineffective and even counterproductive in a system failure when large masses become unemployed (because large masses become unemployed).

The best reaction in the situation as it has evolved in 2009+ is a reduction of the working week, so that people stay in jobs, maintain their skills and contacts, and maintain a prospect for sustained income. US unemployment currently is 8.1% and forecasted to rise to 10%, while for the EU almost 12% is expected, see CPB (2009). We best avoid that large sections of the population lose their income, cannot pay their mortgages and credit card debts, and thereby aggravate problems for businesses and banks. Working time reduction will set a floor in the economy and governments and the markets can work towards recovery from there.

This paper will focus on a particular mechanism. Consider 100 identical workers in a factory who are willing to work 10% less hours in order to prevent the unemployment of 10 of their fellows. The hourly wage remains the same to match costs with productivity. These 100 workers then will suffer a reduction of 10% of income, though due to the tax system perhaps only 7% in disposable income. However, the unemployed need support and taxes will rise to pay for the benefits and retraining, so disposable income may indeed drop by some 10% too. Though a reduction of working hours would be good, the tax system apparently still penalizes it. Thus, 100 workers want to do a good thing but get stuck in indecision, for they have to balance a 10% probability of getting fired with a loss of income of 10%. To help them make the right decision we can also adjust the tax system, reduce taxes for the first brackets and increase them in the higher brackets, so that there are greater benefits of working less and more penalties for working too much.

Labour taxes have a long history. In the days up to the French Revolution, see W. and A. Durant (1967), Turgot first abolished the *corvée* – forced and unpaid labour by subjects for their landlord – with the argument that a skilled labourer like a teacher should not do the work of an unskilled labourer like working on the maintenance of roads, so that taxes were more efficient.

This also turned a feudal allegiance into an economic relationship. There was notable unrest when the *corvée* was later enacted again, a bit unwisely for the French king. In the same way, it seems that a 8.1% unemployment “insurance” premium is better than a 8.1% reduction of labour time to make room for the unemployed. However, when the skill levels are comparable and when the problem consists of the shortage of actual jobs, then a reduction in labour time starts making sense. It does not make sense to give 8.1% of benefits to unemployed to look for jobs that don’t exist. Instead, we better recognize the system crash for what it is, observe that the system of unemployment “insurance” is not intended for this kind of crisis, reduce the working week, and start the recovery from that base.

## The Great Stagflation and the present subcase of repressed stagflation

CEA Chair Romer (2009) compares the current crisis with the Great Depression and, drawing various lessons, concludes with “The final lesson that I want to draw from the 1930s is perhaps the most crucial. A key feature of the Great Depression is that it did eventually end.” My problem with this conclusion is that this ending meant that we got the Great Stagflation. It is too simple to say that Great Depression ended in World War II because this is not what Romer intended to argue. But following her intentions her presumed “end” still does not exist. In recent decades stagflation has been repressed by deregulation and financial innovation and the subsequent US-China trade and savings imbalance, so that easy money reduced unemployment without causing inflation. But obviously there will be re-regulation and more control, plus fiscal stimulus and quantitative easing, so stagflation will raise its head again. Leijonhufvud (2008) warns for this too. Stagflation might be preferred to a prolonged recession but we would rather see a return to a 1950s situation of optimality and avoid unnecessary pitfalls.

Colignatus (1990, 2005, 2009b) contain the theory of the Great Stagflation. The current crisis is only one example out of many cases of mismanagement of the economy. Basically, our system of democracy, with the checks and balances of the executive, legislative and judiciary branches, needs refitting with more checks and balances. The basic example lies with the influence of taxation on labour – with tax including social “insurance” premiums. A subsequent example is the current crisis. Colignatus (2008) presented the analysis of repressed stagflation. Much of the international discussion on structural reform concentrates on the financial and monetary system. The reasoning apparently is that “this is a credit crunch” and “hence that is the problem that must be solved”. My suggestion is to dig deeper. The true underlying process is repressed stagflation – since we hadn’t really solved stagflation but only covered it up with deregulation and financial innovation, the way the Iraq war has been financed and the subsequent world savings imbalance.

There have been warnings in the profession and these did not get sufficient attention. This again points to the structural problem of the checks and balances. See e.g. Guzman (2003) and Frontline (2003) for summaries of the financial deregulation. Barone (2009) is a useful summary of John B. Taylor’s confirmation that the US Fed did not retract on deregulation but maintained a low interest rate policy. Greenspan’s presumption apparently was that markets would correct themselves. Taylor puts it that a situation of risk was misdiagnosed by Bernanke as one of deficient demand. It is dubious whether there then is really much difference between Greenspan and Bernanke. Note though that Barone curiously selects a single kind of deregulation instead of widening the net.

Reading the recession report by the Dutch Central Planning Bureau (2009), it appears that the official line of analysis in this country is rather shallow. That is, the analysis is that the financial deregulation gone haywire, with the implied idea that it would be sufficient to find proper re-regulation, a restoration of trust and a subsequent world rebalancing of savings. Again, this is like a doctor diagnosing that the patient has cancer while we better go one level deeper with the analysis that smoking causes cancer.

A caveat is in order. My possible contribution here is very limited. It concerns only theory and a bit of logic. I have looked at some websites and noted that The Economist, the Financial Times and <http://www.voxeu.org/> are very active while the official modelling institutes at <http://www.un.org/esa/policy/link/> and <http://www.euroframe.org> seem inactive or must be active behind the scenes – and the journals naturally have their lead times. This may be a time and moment when regressions on past relations and reaction times no longer apply, see Caballero (2009ab) on the shift to “Knightian uncertainty”. Thus, while I would greatly prefer the context of a corroborated macro-economic model, it seems that it is fitting of the times to provide only limited theory and logic.

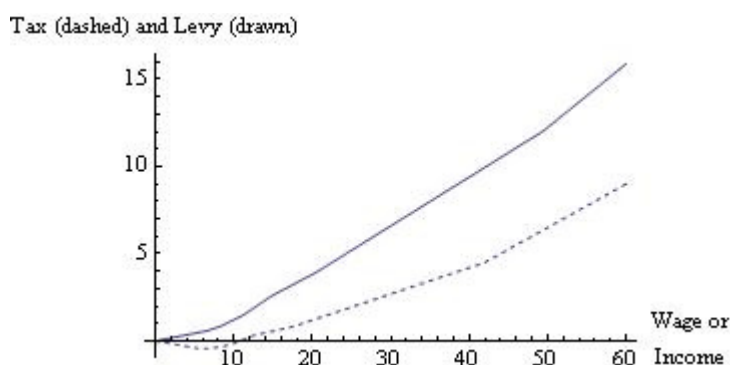
There is a difference however between how we got here and how we get out. Colignatus (2009a) highlighted the use of consumer durables for recovery from less dramatic figures, and already mentioned some other reforms such as a world currency. Now we try to deal with double digit unemployment. See **Appendix A** for additional reforms other than the restoration of the optimal path and the reduction of the working week.

### Restoration of the optimal path

In the 1960s the economy started to diverge from its optimal path due to a misguided tax policy – including social “insurance” premiums. Europe suffered more than the US, not quite because of its larger welfare state but rather because this was financed by premiums that lacked exemption for the working poor (who hence became unemployed and needed more support again). The tax policy caused a tax void below gross minimum wage costs. That is, since people are not allowed to work below the minimum wage, workers with that level of productivity don’t earn anything that can be taxed, even though the tax code presumes that they do. Currently there are also too low marginal tax rates, including a switch from the income tax to the sales tax or VAT. See Colignatus (2005).

In the past I my example came from The Netherlands due to lack of sufficiently exact information on other countries and because of the national complexities of tax, insurance and minimum wage laws. Now Wikipedia (2009) gives some more clarity on the situation in the US. These calculations for the US are still indicative only, given the complexities. Let us proceed however in stylized fashion, see **Appendix B**. Premiums are levied on wages (gross earnings), and taxes are levied on income, i.e. wages after deduction of premiums. Taxes and premiums thus have different bases. The levy is defined as the sum of taxes and premiums, and the levy will be measured at the same base as the premiums. **Figure 1** then contains the stylized US 2009 income tax and levy situation, where the tax includes the (negative) tax credit and where the levy includes FICA only.

**Figure 1: US 2009 income tax and levy (tax plus FICA), \$1000**

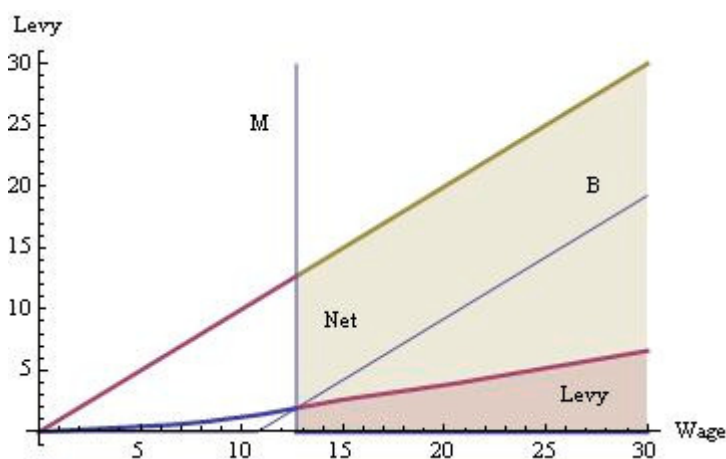


Subsequently we can consider the gross minimum wage costs. At \$6.55 per hour, imputed hours and employer FICA they are \$12.7 thousand per year. Net minimum income is \$10.8 thousand. Levies in the tax void (the \$10.8 – 12.7 thousand range) can be abolished without costs since those official levies are not collected since people are not allowed to work there anyway.

The levy plot includes the following elements, see **Figure 2**:

- (1) the levy line,  $\text{levy}[x]$
- (2) the 45-degree line,  $y = x$ , so that the difference between the levy and the 45-degree line gives net income
- (3) the benefit line parallel to the 45-degree line, i.e. that part of net income that is required for subsistence and the replacement rate,  $\text{ben}[x] = x - B$
- (4) the minimum wage  $x = M$  given by the intersection of levy and benefit line,  $x = \text{levy}[x] + B$

**Figure 2: US 2009 Levy plot, \$1000.**  
**Minimum wage costs \$12.7 and net minimum income \$10.8**



The first step towards structural recovery is to abolish the tax void. Thus raise tax exemption to the net level of the minimum wage, so that net minimum income = gross minimum wage costs. The tax void should actually include VAT. For the EU this will be dramatic. For the US there apparently still is a sales tax of 8%, see Chetty and Vaitilingam (2009). In general however sales tax or VAT should be reduced to 1%. There is ample reason to abolish the VAT but it can be kept purely for statistical measurement of business activity (i.e. as a check on other statistics). Note that the sizeable reduction of VAT will support the reduction of working hours by relatively increasing disposable income.

The second step is to raise the highest marginal income tax rate to say 90%. While the statutory marginal rate would be 90% the dynamic marginal rate would be much lower of course. Colignatus (2005) contains a tax function with three parameters. Two parameters have been used above, both exemption and the limit marginal tax rate. The third parameter can be determined from the income distribution and the required tax proceeds. Obviously, there can be tax exemptions for education and other useful durable consumer goods, see Colignatus (2009a). Such exemptions preferably are not administered in the tax code, obscuring the tax base, but via explicit subsidies administered by the relevant agencies.

National debt is a useful investment for pension funds but otherwise it can be kept at a low level. Deficit financing is highly overrated. Deficit and monetary financing carry the risk of inflation. Much of the current problem has been caused by pumping too much money into the system and the cure cannot be to pump more into it. Taxation can step in, and economists need to understand the notion of the “dynamic marginal tax rate”, see Colignatus (2005).

Along the optimal path, we can be neutral to inflation or deflation. That is, when there is an inflation of 2% the next target is  $-2\%$  so that the overall rate averages out at 0%. The idea is that the value of money remains stable over time. The current policy has a target of about 2% but if the outcome is 4% then the new target remains 2% so there is constant overshoot. Rather than being afraid of temporary deflation the better issue is to make it work.

## Making the shift via a reduction of the working week

The key point is to keep people employed. Not only because of their income but also because of their skills and social contacts. Let people search for jobs but from a job and not from idleness. Unemployment insurance is a decent invention but not necessarily smart. The best way to keep people employed in the present circumstances is to reduce the working week, in some areas even from 5 to 4 days. In itself, speaking about a move from 5 to 4 days is rather blunt and we can imagine all kinds of subtleties. No doubt these subtleties will be enacted in the bargaining between all parties involved. The point made here however is the general argument and target. The reduction would be at the same hourly wage. When taxes cannot compensate the reduction of income then there is also a reduction of demand, whence some overshoot. When demand picks up again then there can be flexible adjustments. Overtime should be allowed immediately however for workers who depend upon a five day working week to earn a living income or who have a mortgage to the same effect.

The reasons for this rather drastic reduction in working hours are:

- (1) Due to the repressed stagflation, our economies have been stimulated with cheap money and easy credit. A current stimulus is thought to be temporary but would have to be permanent to maintain the imbalance – which clearly isn't sustainable.
- (2) Due to the repressed stagflation, our economies have relied too much on external trade and neglected the home market, see Colignatus (1996). Currently, huge flows of labour need to be redirected towards the home market. There is much discussion about restoration of international trade and the prevention of protection. Enlightening are Eichengreen & Irwin (2009) on the Great Depression and Yi (2009) on current interdependencies. But trade is greatly overrated. What the economies in the 1930s lacked was a general understanding amongst economists and policy makers of *The General Theory* (which understanding apparently still is lacking in sufficient generality). The recovery did not come by abolishing protection but by WW II. A targetted development of the home market would have worked too. Yes, trade is very useful, but at times some protection can be advisable (and there are always strategic sectors).
- (3) The EU has hoards of hidden unemployment stored away in welfare state benefits and discouragement. This is part of the regime of repressed stagflation. When we start tackling repressed stagflation then these hoards come available and need to be absorbed as well.
- (4) There is some backlog of reduction of labour time anyway.
- (5) Demand has dropped dramatically all over the world. CEA Chair Romer (2009) mentions the US fiscal stimulus of 3% for two consecutive years but we may all wonder about the drop in credit, the drop in demand from other countries, the consequences of the stress test on banks, and what happens to the unemployed with credit card debt and subsequently the solvency of their banks. Romer (2009) mentions that US unemployment now is 8.1% but it doesn't seem to be the bottom. In the mean time, technological progress continues. Indeed, the US Fed FOMC (2009) expansion with \$1 trillion is a step in the right direction though at the cost of US inflation and a lower dollar exchange value. While it seems that monetary easing is the only recourse left, we should rather look into the real economy.

## A stylized calculation

**Appendix C** and **Table 1** give a stylized calculation for the US 2008-2010, with two scenario's for 2010. Each variable  $X$  (top) associates with  $zX$  (bottom) with reduced hours.

**Table 1: US 2008-2010 Stylized reduction of the working week**

	2008	2009	2010	2010Alt
AverageTaxRate	0.173	0.173	0.173	0.173
CapitalTaxRate	0.000	0.002	0.005	0.018
Demand	30967	30470	29808	26496
DisposableIncome	26273	26015	25671	23952
Employed	0.935	0.92	0.9	0.8
GrossIncome	33120	33120	33120	33120
NetIncome	27390	27390	27390	27390
RealDisposableIncome	24171	23934	23617	22036
RealNetIncome	25199	25199	25199	25199
Surplus	6796	6537	6191	4460
Tax	5730	5730	5730	5730
TaxReceipts	7459	7353	7211	6500
zAverageTaxRate	0.194	0.181	0.163	0.059
zCapitalTaxRate	0.005	0.009	0.014	0.039
zDisposableIncome	27046	27046	27046	27046
zEmployed	0.98	0.98	0.98	0.98
zGrossIncome	31599	31092	30416	27037
zHours	7.63	7.51	7.35	6.53
zHoursReductionRate	-0.046	-0.061	-0.082	-0.184
zMarginalRate	0.530	0.508	0.476	0.225
zNetIncome	25453	25453	25453	25453
zRealDisposableIncome	26776	26776	26776	26776
zSurplus	6089	5593	4930	1618
zSurplusDifRate	-0.023	-0.031	-0.042	-0.107
zTax	6146	5639	4963	1583
zTaxReceipts	6293	5797	5134	1822

The calculation assumes a gross income per hour of \$18.4, which is the level of productivity that is not affected. There are 8 hours per day for 225 days, giving \$33120 gross annually, net income \$27390 and real net (i.e. after 8% VAT) of \$25199. Reduction of the working week is calculated here as a reduction of hours but in practice will affect the week in order to be effective. When reducing hours, this real net of \$25199 is kept constant, so that consumer demand is not affected. VAT is reduced to 1%, tax exemption is set at \$20000, and the result is a marginal tax rate to make up for the gap between gross and net income. Preferably, the marginal tax rate is high, to discourage workers from working more, to maintain the reduction of the working week (see also Manders (1997)).

The labour force is set at 1, with 6.5% unemployment in 2008, 8% unemployment in 2009, and alternatively 10% or 20% unemployment in 2010. When reducing hours, there will remain 2% friction unemployment, giving employment of 0.98.

The row zHours gives the hours per day alternative to the standard 8 hours, with the percentage reduction rate immediately below that. With 10% unemployment there are 7.35 hours per day, and with 20% unemployment there are 6.53 hours per day. The first main effect is the reduction of annual gross income (since the pay per hour remains the same). The effect on real net income however has been neutralized as above. With 10% unemployment the statutory marginal tax rate becomes 47.6% while with 20% unemployment it is somewhat surprisingly low at 22.5%. The explanation of the latter is that gross income is so much reduced that exemption should be larger than \$20000.

The state of aggregate demand in this “back of the envelope” model is given by gross income times the number of employed. With unemployment rising from 6.5% to 10% there apparently is an (exogenous) shock from aggregate demand of \$30967 (times the labour force, here 1 but rather 150 million) to \$29808 (times the labour force). Government disposable income is called “surplus” here and consists of aggregate tax receipts (income tax and VAT) minus the benefits for the unemployed (assuming a welfare state). With unemployment rising from 6.5% to 10% the surplus drops from \$6796 to \$6191 (times the labour force), or even \$4930 with a reduction of the working week.

The target for the surplus can be set at \$6800 (i.e. the 2008 value) and the missing revenue can be recovered from a wealth tax (directly applying Ricardian equivalence). While the wealth tax is 0% in the base situation in 2008, the rise to 10% unemployment requires 0.5% per dollar (assuming \$20 trillion taxable wealth), and, if the working week is reduced, 1.4% per dollar.

These points can be noted: (1) These are extremes. We can imagine some reduction in net income and some reduction in the government surplus, so that the burden is shared. However, this would imply a reduction of aggregate demand and subsequently more unemployment and a greater need to reduce hours. (2) The high level of exemption will have high costs for lost tax revenues in the lower brackets, but these can be recovered by the higher marginal rate on the higher incomes. Possibly higher incomes are taxed so much that a wealth tax is not even needed. But it seems instructive to at least include it in the scenario’s to see what it might contribute. For example, for some countries, there will be unemployment funds, i.e. storages of wealth, rather than pay-as-you-go unemployment insurance. (3) The tax on wealth is primarily a financial issue. If wealth consists of stocks, then sale of the stock would reduce its value even more, so we might imagine flexible arrangements. (4) In real terms, the economy basically balances (forced) leisure (and its distribution) with income/ consumption (and its distribution). The true benefits would only appear in 2011-2015. The only reason to adopt a reduction of the working week lies in the maintenance of skills, contacts and social cohesion. This should show up as a better result than have unemployment destroy those. Perhaps the reduction of the working week by 6% in 2009 would already prevent a rise of unemployment in 2010 to 10% or more. These advantages would have to corroborated by a proper model.

## Conclusion

The current financial crisis is part of an overall crisis of our democratic system. Reforms are required not only with respect to the monetary and financial system but to the checks and balances of our democratic system itself and also to other areas where our system of democracy has been failing, such as the welfare state, the environment and innovation. The question on the nationalisation of banks can best be answered from the angle whether they can sustain and support all such reforms.

For macro-economics itself, the current crisis can be diagnosed as repressed stagflation bursting into the open. The Obama Administration and EU stimulus packages prevent economic collapse but do not tackle stagflation itself yet. Without proper measures, a protracted period of high unemployment or high inflation and continued instability can be expected. Instead, macro-economic theory can come at ease with deflation as a temporary state that is logically implied by the notion of price stability. What is crucial is to keep people in jobs. With proper tax measures the NAIRU is shifted to the proper position. The current situation seems to require a (temporary) reduction of the working week, for some areas even from 5 to 4 days.

## Appendix A: Other reforms

Colignatus (2009a) already mentions some other reforms. Our thinking does not stop and we can identify also these points:

- (a) It would be too simple to think that this crisis can so easily be solved and then is the last one. The approach followed by the Obama Administration has its risks. The approach suggested here does not exclude background risk either. Hence, we need plans for appropriate feedback either when this crisis lasts too long or, if solved, there is another one in a few years. A good plan is to create investment banks that monitor the economy and that step in in times of need, see Colignatus (2005). The standard example is countercyclical maintenance and extension of infrastructure, if they would get the timing right, but there ought to be more imaginative examples that these banks can create themselves. Another line of activity of these national investment banks is to enhance overall innovation by supporting “open source” activities. The modern economy contains ever more complexity with myriad niches for innovation and advancement. Most of those opportunities are not reaped because of R&D financing and copyright mechanisms. A prime example is that research by publicly funded universities becomes locked behind commercial copyright. Instead, a national investment bank could estimate the value of a contribution, pay an advance that need not be refunded, put the contribution into the open domain, monitor the actual use, and supplement the payment based upon that actual use. Clearly, a national investment bank would need funding by taxation on the commercial market for commodities and services but these commercial activities would benefit as well.
- (b) EU will require reforms of the welfare state while the US, that apparently wants to move in the European direction, can benefit from the lessons learned.
- (c) There is mention about a “green deal”. Apparently, there are many misunderstandings about this as well. Economists can contribute by providing sound information by means of an index of environmentally sustainable economic growth, as in the Tinbergen & Huetting approach, see Colignatus (2009c). Reduction of the growth of world population would be important here as well.
- (d) A key question becomes whether our monetary and financial system can sustain and support the shocks implied by such changes in the real economy. If we cannot affirm that then nationalisation of banks would be appropriate. If we have reason to think that it can, then guardianship might be sufficient. PM 1. Of course, the US Fed should rather be nationalised in any case. PM 2. Note that the reasoning on “zombie banks” sometimes is convoluted. Basically there seems little amiss with the banks themselves but the true cause is in the outstanding loans. When businesses fail, banks are tempted to keep them afloat for otherwise they have to write down the implied failed loans. But the first cause lies with the businesses. Reduction of the working week would help businesses by avoiding severance pay. In general, the discussion on “zombie banks” would benefit from a sharper focus on the first cause.
- (e) As economists did not recognize the proper cause of the Great Stagflation (with the tax system and social security as the base example), their focus came upon deregulation, and with it came an ideology / culture of incentives, bonuses and rising salaries for executives. When it is recognized that deregulation and liberalisation are greatly overrated, there can also be more realism in pay.

Obviously, we need to reform the monetary and financial system for reasons of itself, see Phillipon (2009) and Buiters (2009) and others for suggestions. Some points are surprisingly obvious.

Caballero (2009ab) suggests that the current crisis has been caused by a shift of demand for AAA paper rather than deregulation and financial innovation and the subsequent world savings imbalance. In itself it is consistent that there is a demand for paper with high return at no risk. It is more convincing however that the authorities wanted to fight stagflation with market liberalisation across the board, whence the story unfolds. So I would rather be with Thoma (2009). The “Caballero plan” causes too many questions. The premise is that “Knightian uncertainty” only erupted in the second half of 2008 while it would not exist five years from now. Rather, we would presume that investors know that this kind of uncertainty is *always* present. If we had this “insurance” already in place then the government would now be bleeding a lot. We may wonder whether this really is an insurance or again a system risk.

PM. At the same time I wonder what the actual situation is. Is the Glass-Steagall Act still repealed and not yet re-enacted? Are hedge funds still allowed to this very day to cause whatever havoc? Are the current share prices still unreliable due to deregulation and financial innovation? Or have our monetary and financial authorities already introduced some necessary controls, other than providing capital and forbidding naked shorts? Clearly, my contribution to this aspect of the puzzle can be only very limited.<sup>1</sup>

## Appendix B: Levy plot in *Mathematica*

The following is the code for the levy plot, using the existing code in The Economics Pack.

```
Needs["Economics`Pack`"]
ResetAll
Economics[Taxes]

FICARates = {{0, 2 * (.062 + .0145)}, {106.8, 2 * .0145}};
Premium[x_] = Max[0, PieceWiseLinear[x, FICARates]]

EITCRates = {{0, .0765}, {5.596, 0}, {7, -0.0765}, {12.6, 0}};
TaxCredit[x_] = PieceWiseLinear[x, EITCRates]

Allowance[ ] = 5.7 + 3.65;
TaxRates = {{0, 0.1}, {8.026, 0.15}, {32.551, 0.25}, {78.851, 0.28}, {164.551, 0.33}, {357.701, 0.35}}
Tax[x_] = PieceWiseLinear[x - Allowance[ ], TaxRates] - TaxCredit[x]

minwagecost = 6.55 * 225 * 8 * (1 + .062 + .0145) / 1000
Subsistence = NetIncome[minwagecost] / ReplacementRate
FindMinimumWage[ ]

LevyPlot[0, 30, Premium, Tax, PlotRange → All, BaseStyle → {FontSize → 11}]
```

---

<sup>1</sup> I do feel like mentioning that a capital reserve requirement of (a curiously fixed) 8% makes sense in a gold standard, where there are some costs in storing the metal. When such costs don't exist in our electronic world, a requirement of 100% becomes feasible. Whether this is useful or even attainable given current low levels remains to be seen. Computer simulation models will be interesting here. Another point that I wonder about is how a stock-funded company can borrow money, thus become in debt, and still pay dividend – apparently from that borrowed money which has a high Ponzi element. But such issues are not the reasons why we are in the current crisis and they are only mentioned to highlight the wonders of money and finance.

## Appendix C: Calculation in *Mathematica*

The following is the input code, using the existing code in The Economics Pack. Exogenous variables are indicated with suffix [t], parameters are assigned values, and the remainder are endogenous.

```
Needs["Economics`Pack`"]
ResetAll
Economics[Model]

SetOptions[Model,
  Begin → 2008,
  Equations →
  {LabourForce == Employed + Unemployed[t],
  GrossIncome == Hours GrossIncomePerHour NDays,
  Demand == GrossIncome Employed,
  DisposableIncome == NetIncome Employed + Benefit Unemployed[t],
  RealDisposableIncome == (1 - VAT) DisposableIncome,
  Tax == MarginalRate (GrossIncome - Benefit),
  AverageTaxRate == Tax / GrossIncome,
  NetIncome == GrossIncome - Tax ,
  RealNetIncome == (1 - VAT) NetIncome,
  TaxReceipts == Tax Employed + VAT DisposableIncome,
  Surplus == TaxReceipts - Unemployed[t] Benefit,
  CapitalTaxRate == CapParm1 (CapParm2 - Surplus) ,

  LabourForce == zEmployed + zUnemployed,
  zEmployed zHours == Employed Hours,
  zHoursReductionRate == zHours / Hours - 1,
  zGrossIncome == zHours GrossIncomePerHour NDays,
  zTax == zMarginalRate (zGrossIncome - zExemption),
  zAverageTaxRate == zTax / zGrossIncome,
  zNetIncome == zGrossIncome - zTax ,
  RealNetIncome == (1 - zVAT) zNetIncome,
  zDisposableIncome == NetIncome zEmployed + Benefit zUnemployed,
  zRealDisposableIncome == (1 - zVAT) zDisposableIncome,
  zTaxReceipts == zTax zEmployed + zVAT zDisposableIncome,
  zSurplus == zTaxReceipts - zUnemployed Benefit,
  zSurplusDifRate == (zSurplus - Surplus) / Demand,
  zCapitalTaxRate == CapParm1 (CapParm2 - zSurplus)
  },

  Coefficients → {LabourForce → 1, GrossIncomePerHour → 18.4,
  Hours → 8, NDays → 225, Benefit → 12 * 850,
  zExemption → 20000,
  MarginalRate → .25, zUnemployed → .02, VAT → .08,
  zVAT → .01,
  CapParm1 → 150 10^6 / (20 10^12), CapParm2 → 6800},

  SetData →
  {Unemployed → {.065, .08, .10, .20}}

];

Model[];
nsp = NSolvePeriod[2008, 2011]
res = Prepend[ Prepend[nsp, Endogenes] // Transpose, {"", 2008, 2009, 2010, "2010Alt"}]
```

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