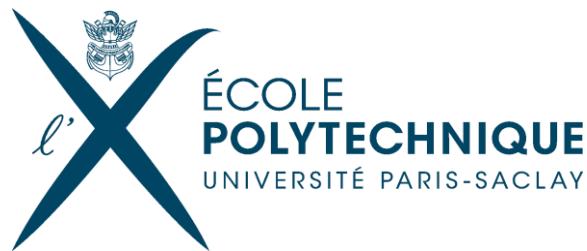


Debts & Financial Crisis

Post Keynesian models with Debts & Austrian model
with Capital accumulation
2020-2021



Blog : vlozeve.blogspot.com

Email : vlozeve@gmail.com/vladimir.lozeve@natixis.com

Could macroeconomics policy smooth the business cycles using discretionary rule like Taylor rule, and solve the business cycle problem ?

The new neo classical synthesis i.e. mainstream economics using a mixture of monetarist concept (inflation targeting according adaptative expectations) and Keynesian concept (output gap) pretend to mange the business cycle and to avoid recession and financial crisis.

The Taylor rule (econometric model) define the nominal short term rate. The Central bank could adapt its monetary policy in order to manage the cycle.

$$i_t = \pi_t + r_t^* + a_\pi(\pi_t - \pi_t^*) + a_y(y_t - \bar{y}_t)$$

Expected inflation Output Gap

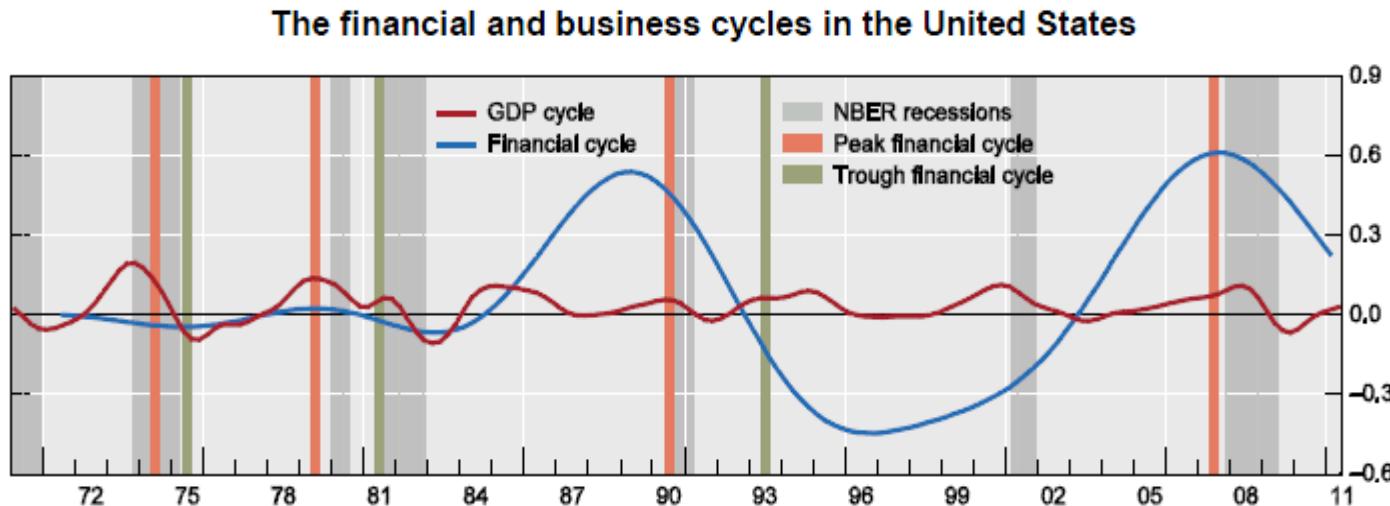


In this equation, i_t is the target short-term nominal interest rate (e.g. the federal funds rate in the US, the Bank of England base rate in the UK), π_t is the rate of inflation as measured by the GDP deflator, π_t^* is the desired rate of inflation, r_t^* is the assumed equilibrium real interest rate, y_t is the logarithm of real GDP, and \bar{y}_t is the logarithm of potential output, as determined by a linear trend.

Wikipedia 2017

The failure of the Neo Classic and Neo Keynesian economics

Fiscal and Monetary policy have decreased **the volatility of the GDP Cycle** before the Great Financial Crisis (GFC) but the low volatility of the business cycle has hidden the **increasing volatility of the Financial cycle**. The stock of debts and money were not integrated in the mainstream macro model and then not used to manage the monetary and fiscal policy.



Orange and green bars indicate peaks and troughs of the financial cycle measured by the combined behaviour of the component series (credit, the credit to GDP ratio and house prices) using the turning-point method. The blue line traces the financial cycle measured as the average of the medium-term cycle in the component series using frequency-based filters. The red line traces the GDP cycle identified by the traditional shorter-term frequency filter used to measure the business cycle.

Source: Drehmann et al (2012).

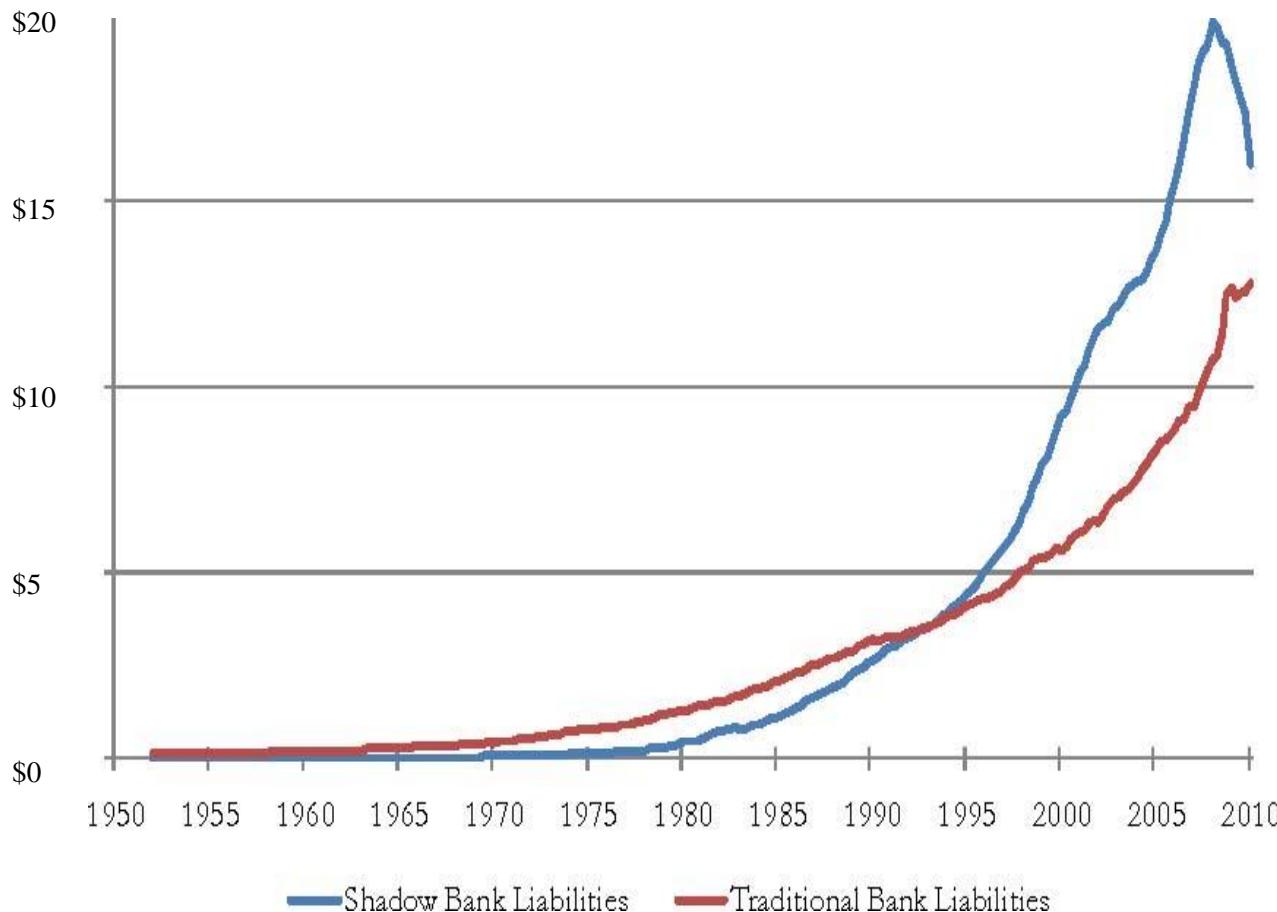
Claudio Borio The financial cycles and macroeconomics BIS 2012

Does money matter ?

© Théo Jalabert



Exponential growth of the Bank and Shadow money since the end of "Les Trentes Glorieuses"



Shadow Bank Liabilities vs. Traditional Bank Liabilities, \$ trillion

Source: Flow of Funds Accounts of the United States as of 2010:Q1 (FRB) and FRBNY

Do Debts matter 1 ?

Is there any relation between Debt Ratio and Financial crisis ?

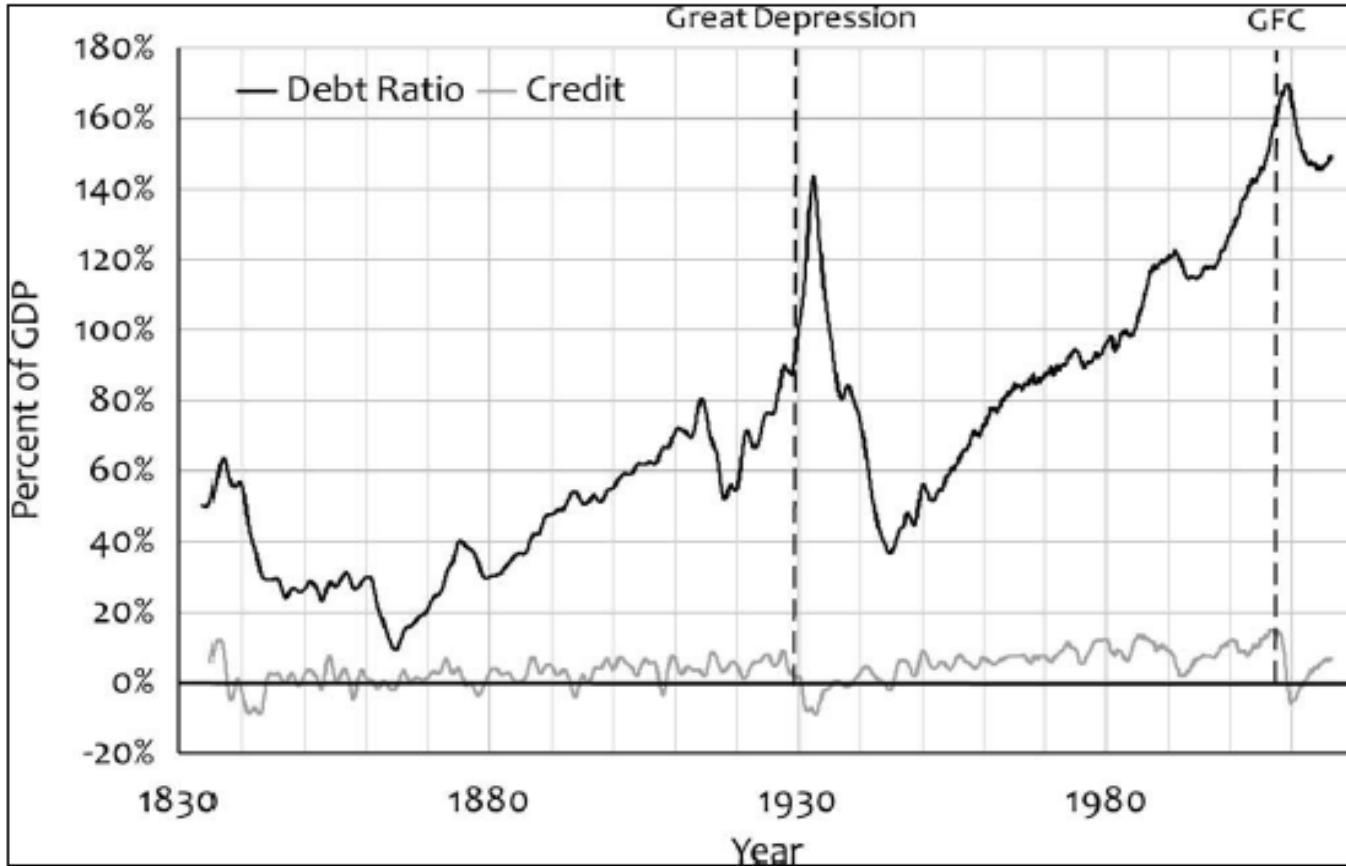


Figure 19. US private debt and credit from 1834

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Do Debts matter 2 ?

The exponential increase in Private Debt to GDP ratio before the GFC

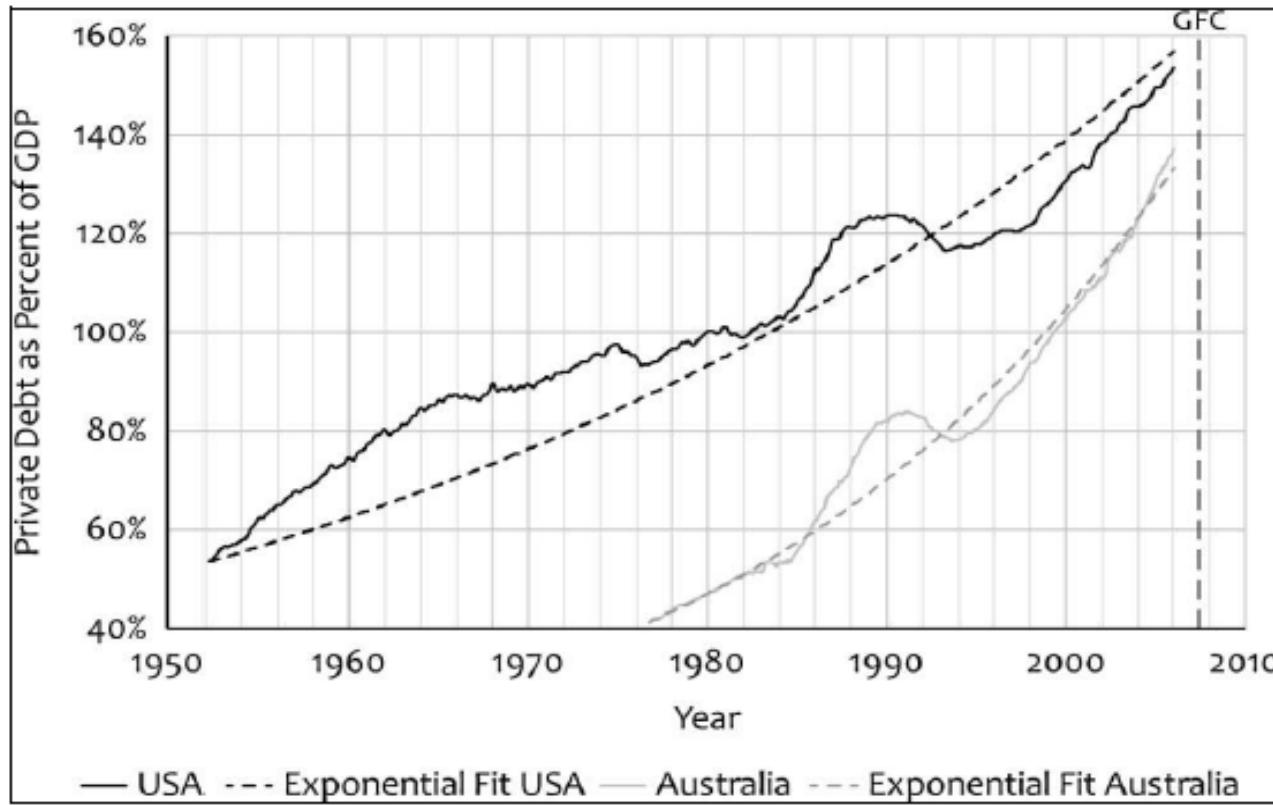


Figure 6. The exponential increase in debt to GDP ratios till 2006

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Do Debts matter 3 ?

Before the GFC the stock of debts (Debt to GDP ratio) and the flow of new debts (Debt growth rate) reach a critical point : 150% and 10% respectively

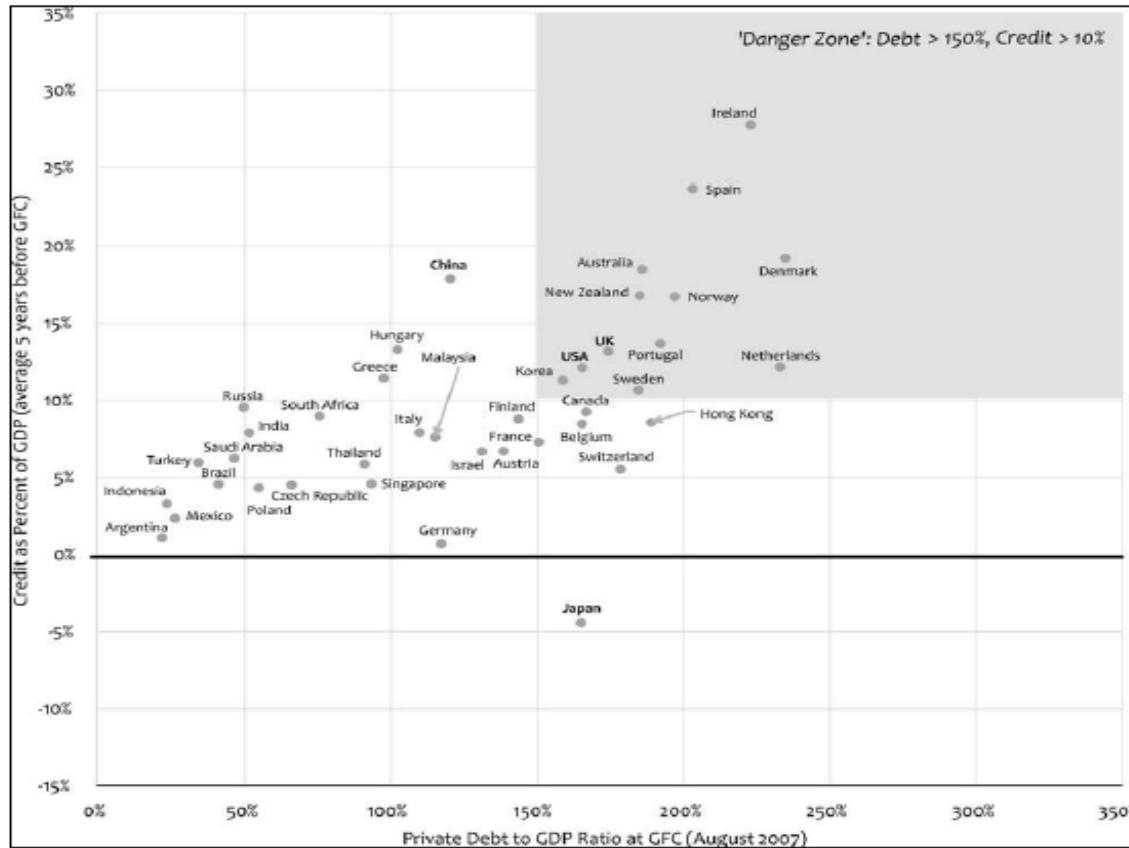


Figure 15. Private debt ratio levels and growth rates for five years before the GFC

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Do Debts matter 4 ?

After the GFC some imbalance remains mainly in China

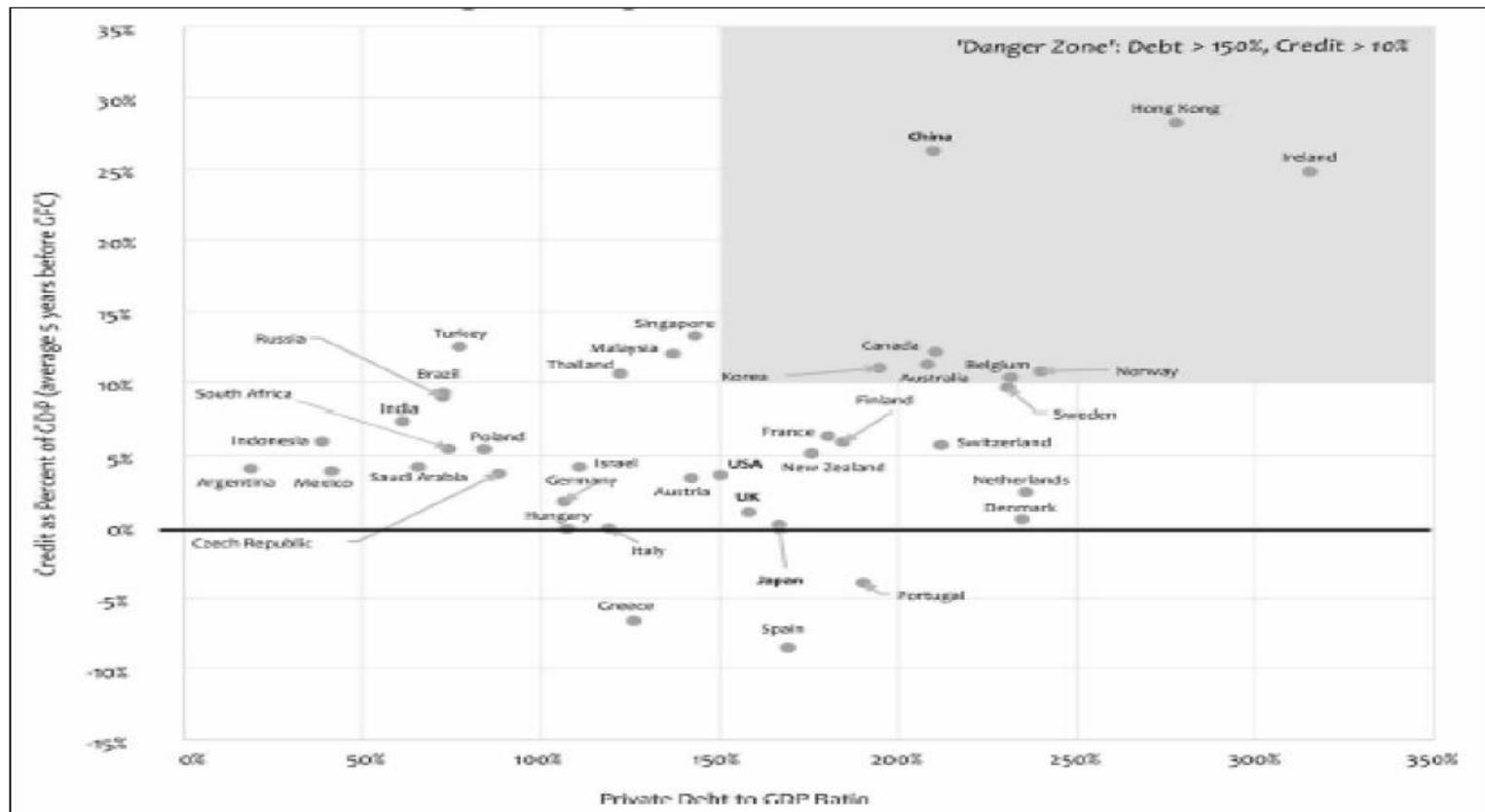


Figure 17. Private debt ratio levels and growth rates for last five years

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Do Debts matter 5 ?

House Price increased tremendously in the US before the GFC

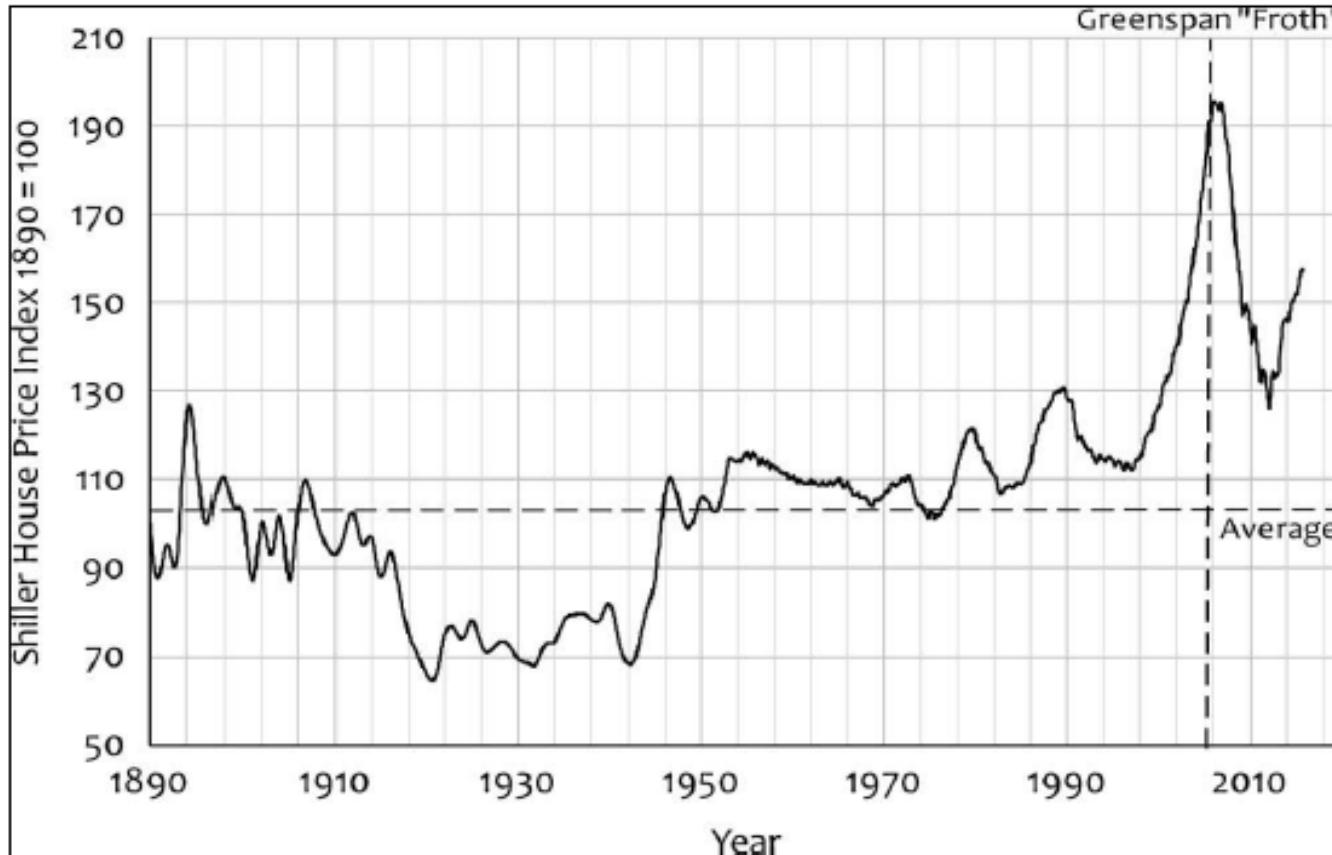
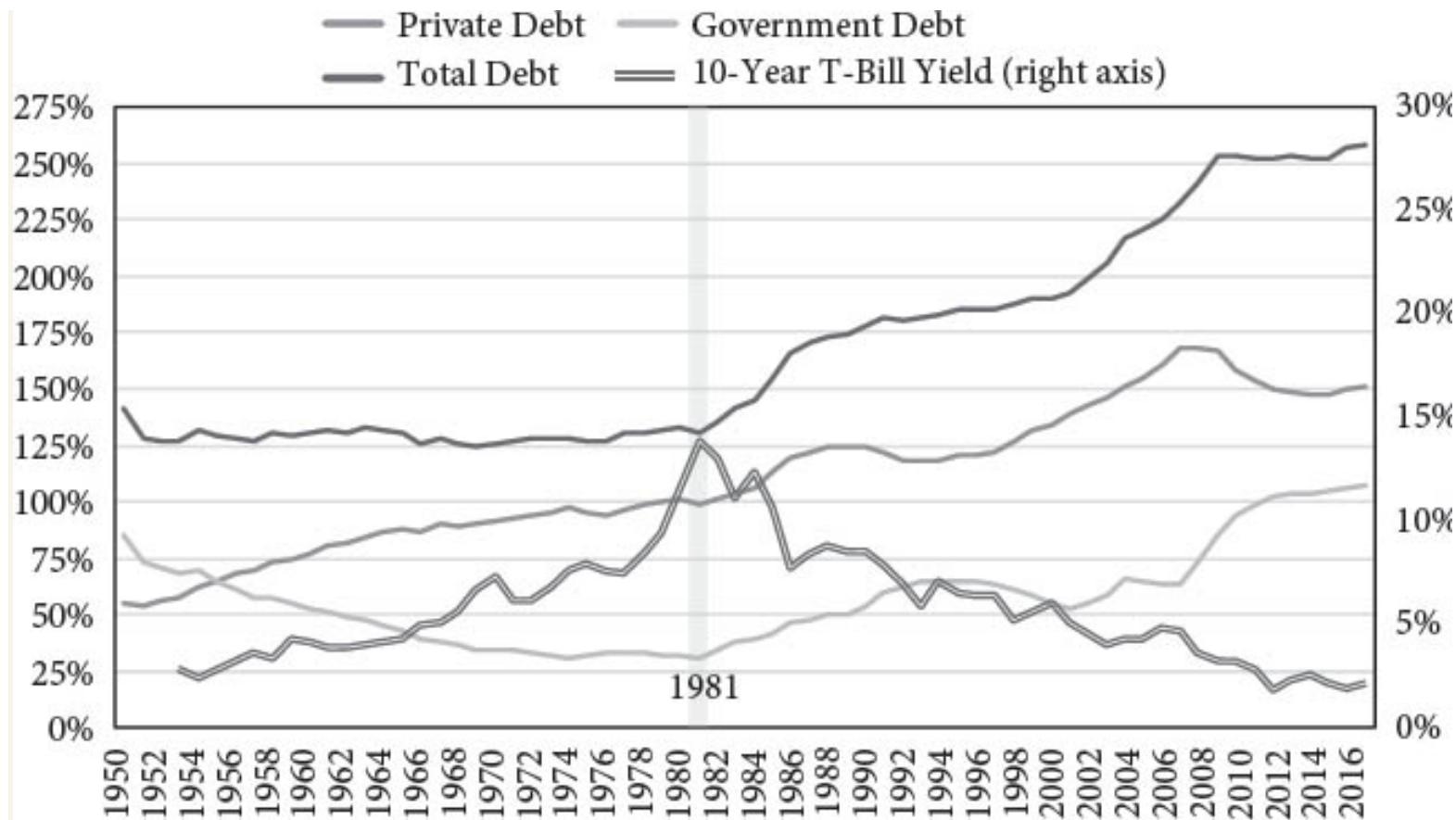


Figure 9. US real house price index since 1890

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Do Debts matter 6 ?



United States: Debt as a Percentage of GDP and Long-Term Interest Rates (10-Year T-Bill Yield), 1950–2017 *Left axis scale for all but 10-year T-Bill* *Right axis as % of GDP*

Richard Vague A Brief History of Doom Two Hundred Years of Financial Crises 2019

Do Debts matter 7 ?

<i>Billions of Dollars</i>	1923	1928	1931	1923–1928 <i>Change</i>
GDP	\$85.3	\$97.0	\$77.4	\$11.7
Federal Debt	\$22.4	\$17.6	\$16.8	\$(4.8)
Private Debt	\$116.4	\$156.4	\$148.6	\$40.0
Business Debt	\$62.6	\$86.1	\$83.5	\$23.5
CRE (est.)	\$12.1	\$16.7	\$18.8	\$4.6
Utility (est.)	\$12.2	\$17.2	\$18.3	\$5.0
Household Debt	\$53.8	\$70.3	\$65.1	\$16.5
Mortgage	\$27.3	\$39.9	\$42.1	\$12.6
Memo: Broker Loans	\$1.6	\$6.4	\$2.1	\$4.8
Bank Suspensions	646	499	2,294	-147

<i>As Percentage of GDP</i>	1923	1928	1931	1923–1928 <i>Change</i>
Federal Debt	26%	18%	22%	-8%
Private Debt	136%	161%	192%	25%
Business Debt	73%	89%	108%	15%
CRE (est.)	14%	17%	24%	3%
Utility (est.)	14%	18%	24%	3%
Household Debt	63%	72%	84%	9%
Mortgage	32%	41%	54%	9%
Memo: Broker Loans	2%	7%	3%	5%

Richard Vague A Brief History of Doom Two Hundred Years of Financial Crises 2019

In order to solve the conundrum we will add the yearly flow of new
US Debts (Credit growth) to the Keynesian Aggregate Demand :

© Theo Jalabert



$$Y = C + I + G + D$$

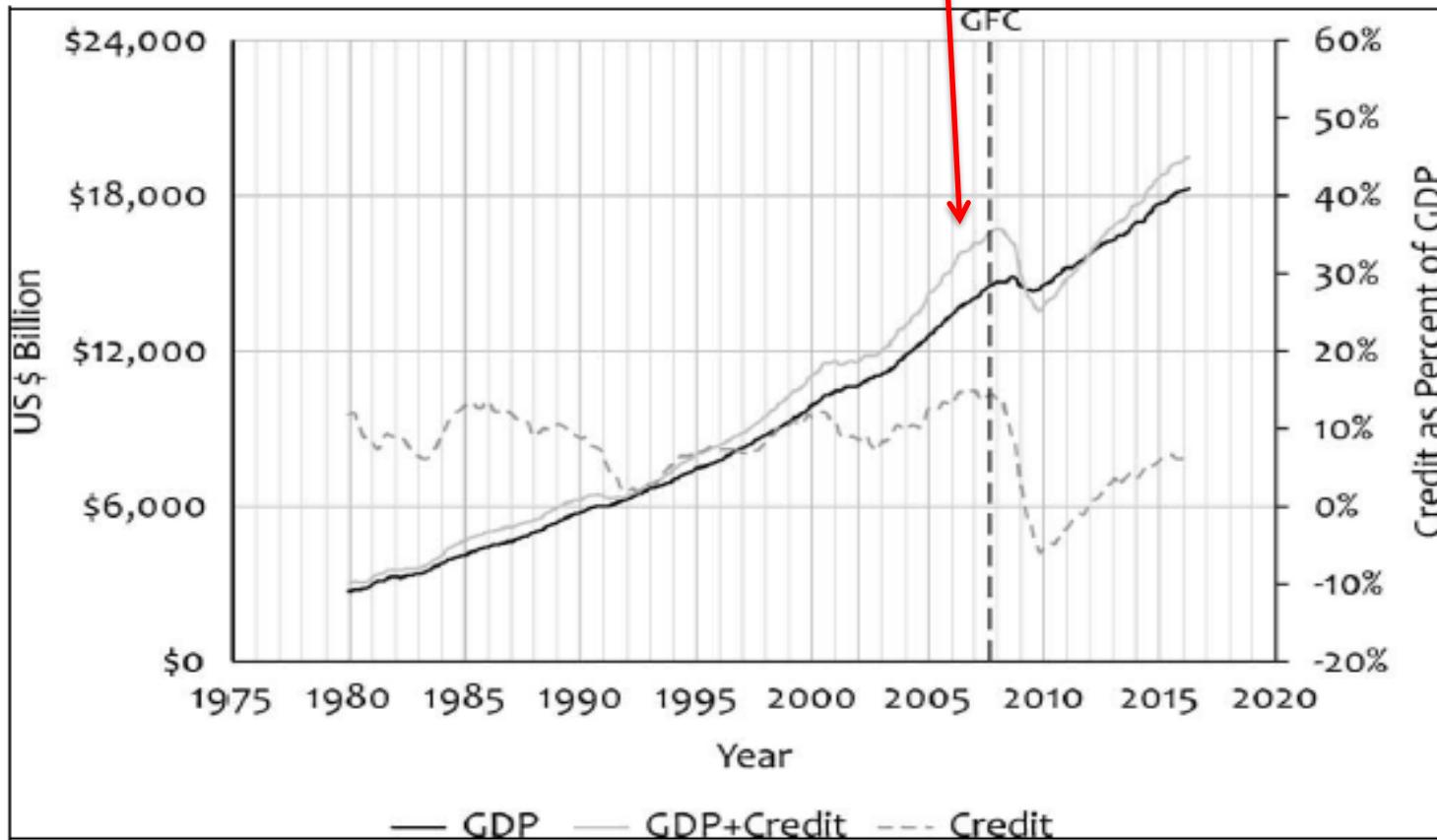


Figure 7. USA GDP and credit

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The same with the Japanese Debts ...

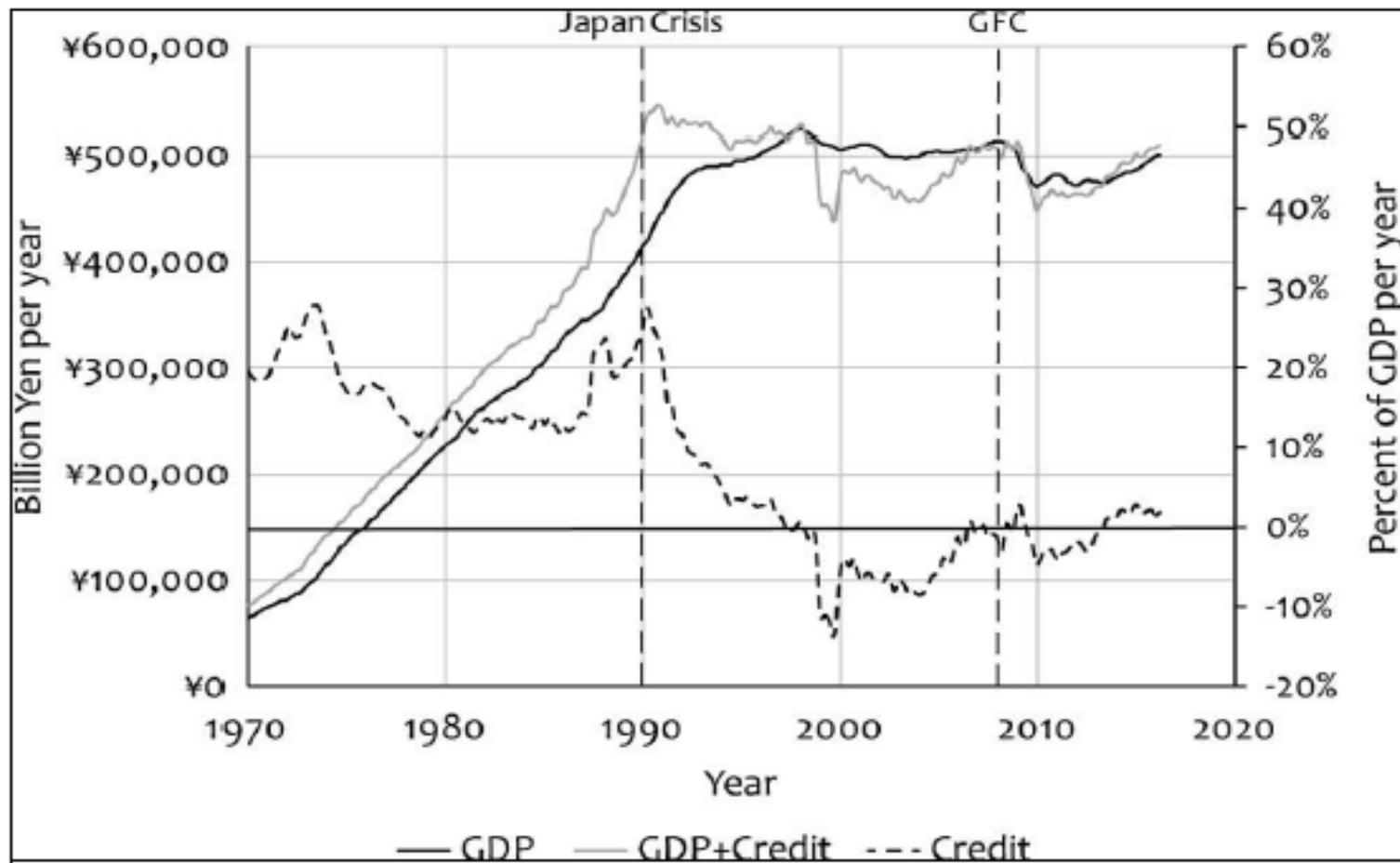
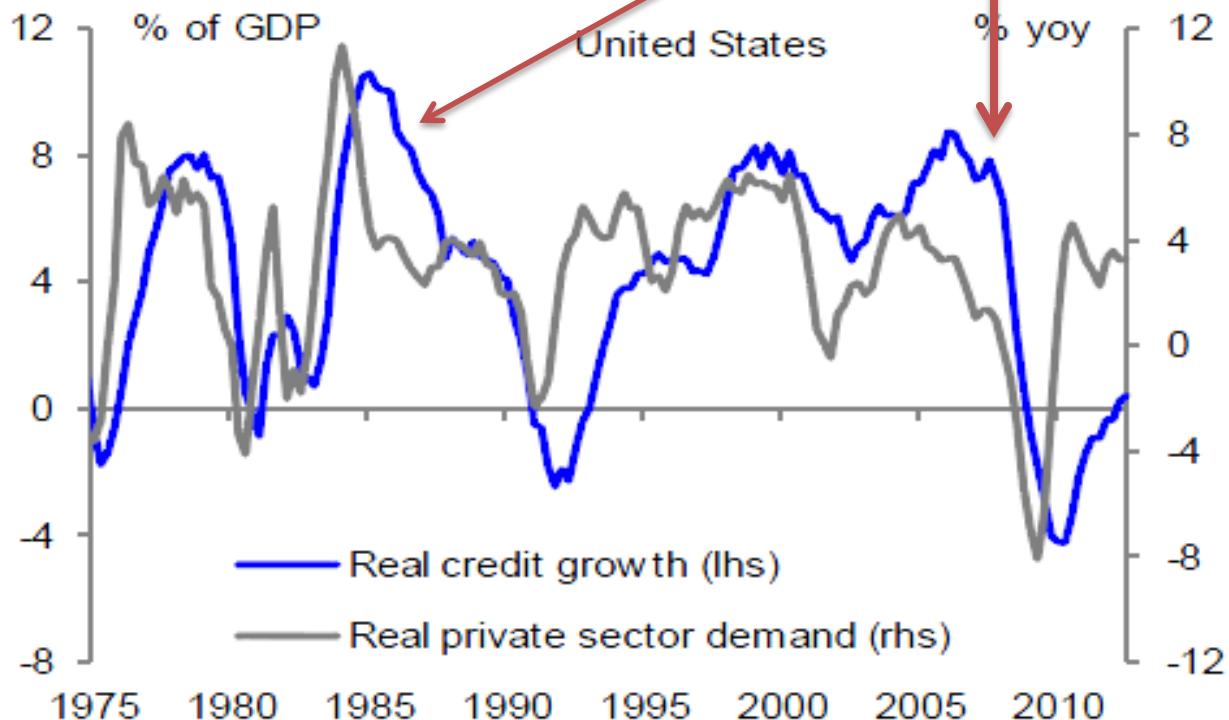


Figure 14. The smoking gun of credit for Japan

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But the credit growth could not explain the fall of Aggregate Demand during the crisis. There is a lag the credit growth is decreasing **after** the decrease of the Aggregate Demand !!

Chart 1. Credit growth and real private sector demand

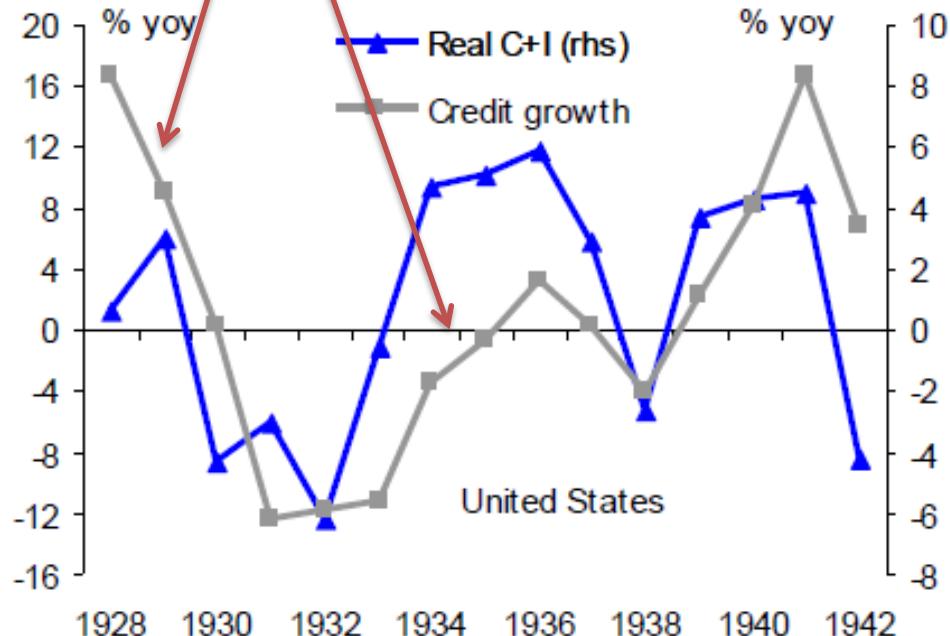


Source: Deutsche Bank, BEA, US Federal Reserve

Biggs, Mayer Bringing credit back into the monetary framework 2013

During the Great Depression of the 30's the credit growth with the same lag !!!! Do Debt matter ???

Chart 6. US credit growth and demand growth during the Great Depression



Source: Deutsche Bank, BEA, Bureau of the Census, US Federal Reserve

Biggs, Mayer Bringing credit back into the monetary framework 2013

Do we have some macro model able to explain the Great Financial Crises ??

Can we relate the business and debt cycles ?

The DSGE (Dynamic Stochastic General Equilibrium) a Neo classic General Equilibrium Model used by central bank wasn't able to predict the financial crisis. Why ?

The DSGE model is build under the neo classics assumptions of no money or debt interference (David Ricardo "Money is a veil"). **The model is settled on the assumption of methodological individualism** i.e. no group effect. In that case the debt of an individual is the loan of somebody else then **after aggregation all the debts are cancelled.**

But the debts are lent by the Banking system to households and firms. In case of over indebtedness the financial system is bankrupt and cannot lend anymore, households and firms are bankrupted and have to deleveraged generating a deflationary cycle.

Heterodox economists as Fisher, Minsky, Kindelberger and the Austrians economist : Hayek, Schumpeter, von Mises, Haberler have integrated the debt cycle within the GDP cycles.

We will introduce different debt models in order to explain the GFC :

- Biggs, Mayer, Pick Debt Macro Model / Richard Koo Balance Sheet Recession
- Hyman Minsky Post Keynesian Financial Instability Hypothesis
- An Austrian diagrammatical modelization with debt



A macro model with Debt

The « credit impulse » and not the credit growth as a driver of the Business Cycles

Credit and economic recovery DNB Working Paper N°218 July 2009

Credit and Economic Recovery: Demystifying Phoenix Miracles March 2010

Bring credit back into the monetary policy framework! August 2013

Flow of new credit i.e. credit growth vs variation of credit growth stock-flow analysis

$$Y = GDP = C + I \quad (\text{stock equation})$$

$$\Delta GDP = \Delta C + \Delta I \quad (\text{flow equation})$$

(Let remind that IS LM is a flow model using yearly national account)

Hypothesis Investment expenditure I is fully financed by borrowing then :

If $I = \Delta D$ with ΔD flow of new credit i.e. credit growth then $\Delta I = \Delta \Delta D$ as variation of credit growth :

$$\Delta GDP = \Delta C + \Delta \Delta D$$

The change of GDP is related to the second derivative of credit ($\Delta \Delta D$) ie « credit impulse » i.e. variation of credit growth rather than credit growth (beware of stock-flow error) .

Then a credit-led rebound in domestic demand growth can occur even while credit growth is negative and debt level fall.

And a credit-led fall in domestic demand growth can occur even while credit growth is positive and debt level increase.

Complete Biggs Mayer Pick macro model

Let consider a two sectors economy with durable goods $Y_{d,t}$ and consumption good $Y_{c,t}$.

$$Y = Y_{c,t} + Y_{d,t} = C_t + I_t$$

2 Production functions

$$Y_{c,t} = C_t = AK_t \text{ with } K_t \text{ and } Y_{d,t} = I_t = f(N_t)$$

N_t : employed labor K_t : Capital stock A : TFP

Capital goods depreciate at rate δ It additional investment at t :

$$K_t = (1 - \delta)K_{t-1} + Y_{d,t} = K_t = (1 - \delta)K_{t-1} + I_t$$

Profit maximization then interest rate : $r = A - \delta$

Credit dynamics Firms are paying rK_t with left income use to repay stock of credit δK_t :

$$D_t = (1 - \delta)D_{t-1} + Y_{d,t} \text{ Investment are financed by debt}$$

$$Y_{c,t} = AK_t = AD_t = (\delta + r)D_t \quad Y_{d,t} = I_t = \Delta D_t + \delta D_{t-1}$$

$$Y_{d,t} = I_t = \Delta D_t + \delta D_{t-1}$$

Then $Y_t = Y_{c,t} + Y_{d,t} = (\delta + r)D_t + \Delta D_t + \delta D_{t-1}$

Biggs Mayer Pick macro model

as $\delta D_t = 2\delta D_t - \delta D_{t-1}$ and $\Delta D_t = D_t - D_{t-1}$

$$Y_t = (\delta + r)D_t + \Delta D_t + \delta D_{t-1}$$

$$Y_t = 2\delta D_t - \delta D_{t-1} + rD_t + \Delta D_t + \delta D_{t-1}$$

$$Y_t = 2\delta D_t + rD_t - (\delta D_t - \delta D_{t-1}) + \Delta D_t$$

$$Y_t = (2\delta + r)D_t - \delta(D_t - D_{t-1}) + \Delta D_t$$

$$Y_t = (2\delta + r)D_t - \delta \Delta D_t + \Delta D_t$$

$$Y_t = (1 - \delta)\Delta D_t + (2\delta + r)D_t$$

The GDP : Y_t as a function of the growth of the stock of debt and of the stock of the debt.

Then we can calculate the growth of GDP as

$$y_t = \frac{Y_t - Y_{t-1}}{Y_{t-1}}$$

The « credit impulse » i.e. the variation of credit growth is the main determinant of the business cycle

$$y_t = \frac{Y_t - Y_{t-1}}{Y_{t-1}} = (1 - \delta) \frac{\Delta D_t - \Delta D_{t-1}}{Y_{t-1}} + (2\delta + r) \frac{\Delta D_t}{Y_{t-1}}$$

- The growth of GDP y_t is not a function of the stock of credit D_t but of the variation of credit growth : $\Delta D_t - \Delta D_{t-1}$, and of the credit growth (flow of new credit) : ΔD_t .
- First term is called the “credit impulse” and the second term is the credit growth, second and first derivatives are weighted by the size of GDP of the preceding year.
- With Capital depreciation : $\delta = 5\%$ and interest rate : $r = 2\%$ then $1 - \delta$ the coefficient of “credit impulse” is larger than $2\delta + r$ the coefficient of stock of credit.
- *If $\Delta D_t = \Delta D_{t-1}$ the GDP growth y_t is driven by the year on year credit growth ΔD_t . When $\Delta D_t \neq \Delta D_{t-1}$ and $(1 - \delta) > (2\delta + r)$ the credit impulse is the main driver of the business cycle.*

Biggs Mayer Pick macro model

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The GDP growth is time dependent of the variation of the credit growth.
Correlation lag will appear in time series analysis

If the stock of credit grows at rate α_t then $y_t = \frac{(1-\delta)K_{t-1} + I_t}{K_{t-1}} = 1 + \alpha_t$

$$\text{As } I_t = (\alpha_t + \delta)K_{t-1} \text{ and } Y_{c,t} = AK_t = AD_t = (\delta + r)D_t$$

$$Y_t = (\alpha_t + \delta)K_{t-1} + (\delta + r)K_t$$

$$Y_t = \frac{(\alpha_t + \delta) + (1 + \alpha_t)(\delta + r)}{(1 + \alpha_t)} K_t$$

Economic growth $y_t = \frac{\alpha_t(1+\delta+r)+2\delta+r}{\alpha_{t-1}(1+\delta+r)+2\delta+r} (1 + \alpha_{t-1}) - 1$

Given that $\alpha > -\delta$ and $I_t > 0$

$$\frac{\partial y_t}{\partial \alpha_t} = \frac{(1 + \delta + R)(1 + \alpha_{t-1})}{\alpha_{t-1}(1 + \delta + r) + 2\delta + r} > 0$$

$$\frac{\partial y_t}{\partial \alpha_{t-1}} = -\frac{[\alpha_t(1 + \delta + r) + 2\delta + r](1 - \delta)}{[\alpha_{t-1}(1 + \delta + r) + 2\delta + r]^2} < 0$$

Debt & House prices in the US

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The House price are correlated to mortgage credit acceleration

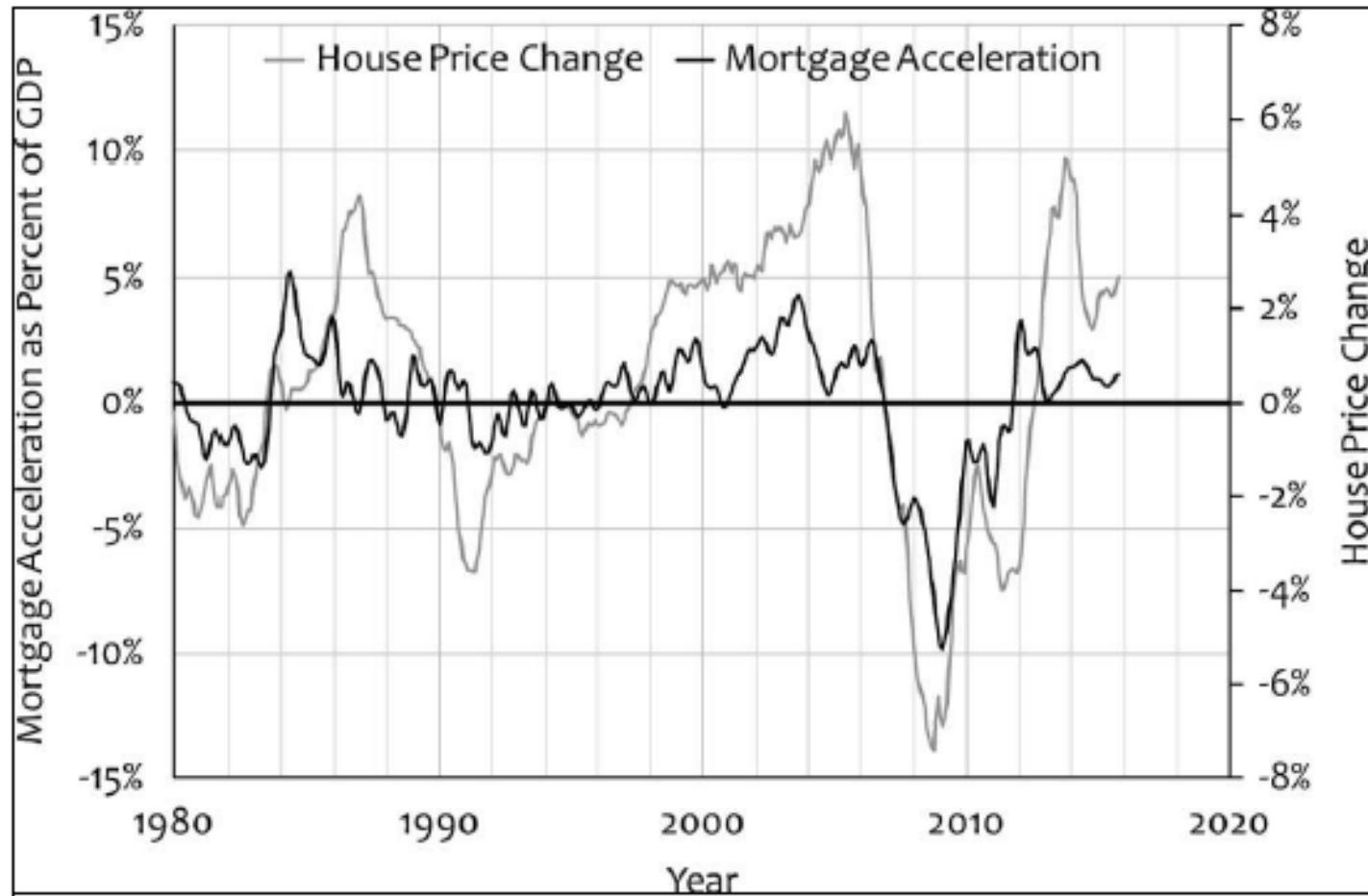


Figure 10. Mortgage debt acceleration and house price change

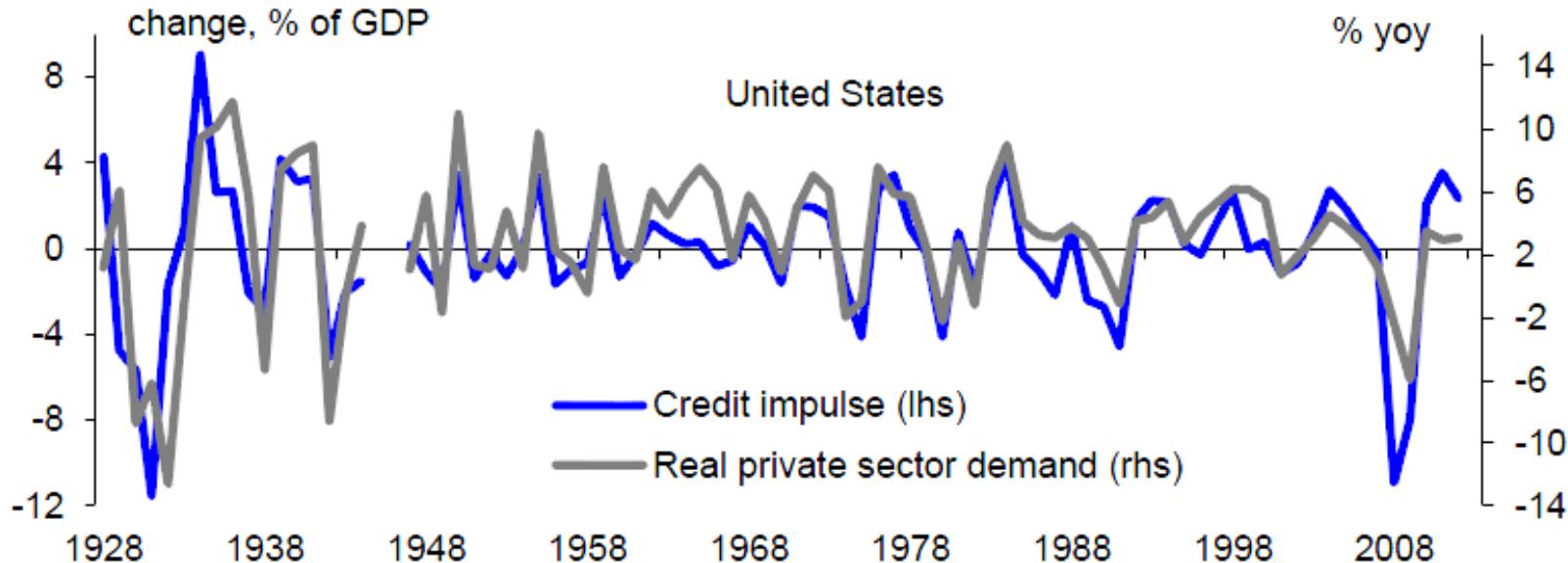
Steve Keen Can we avoid another financial crisis 2017

The credit impulse ie the second derivative of credit stock rather than the credit growth (first derivative) is perfectly correlated to the business cycle

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Chart 2. US credit impulse and real private spending growth

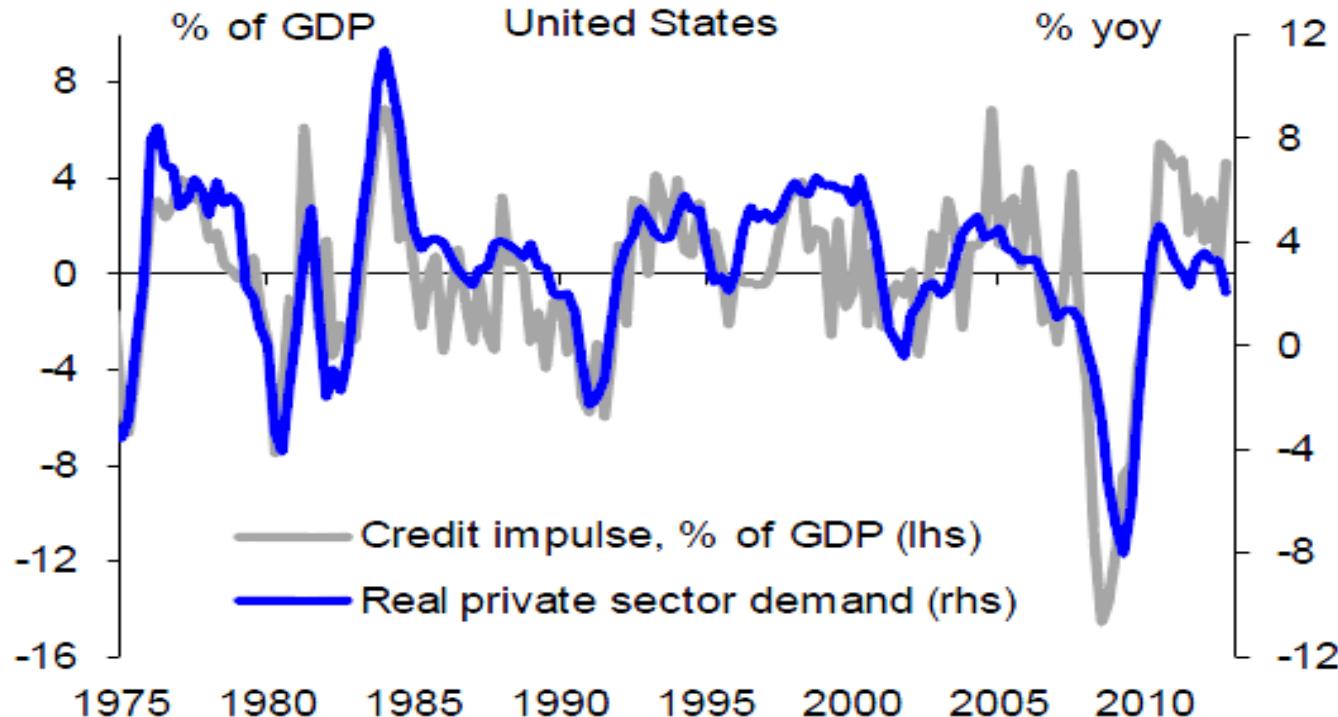


Source: Deutsche Bank, BEA, Bureau of the Census, US Federal Reserve

Biggs, Mayer Bringing credit back into the monetary framework 2013

The US credit impulse explains the fall of the Aggregate Demand during the Great Moderation and GFC

Chart 12. US credit impulse and demand growth



Source: Deutsche Bank, BEA, US Federal Reserve

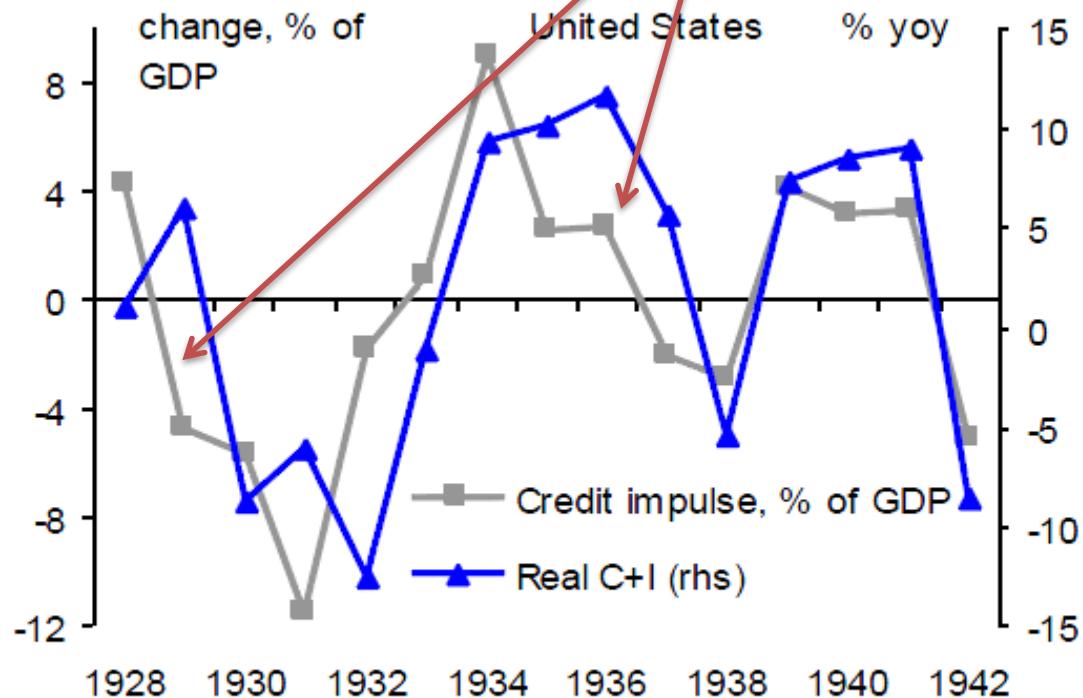
Biggs, Mayer Bringing credit back into the monetary framework 2013

The US credit impulse precedes clearly the demand growth during the Great Depression

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Chart 7. US credit impulse and demand growth during the Great Depression



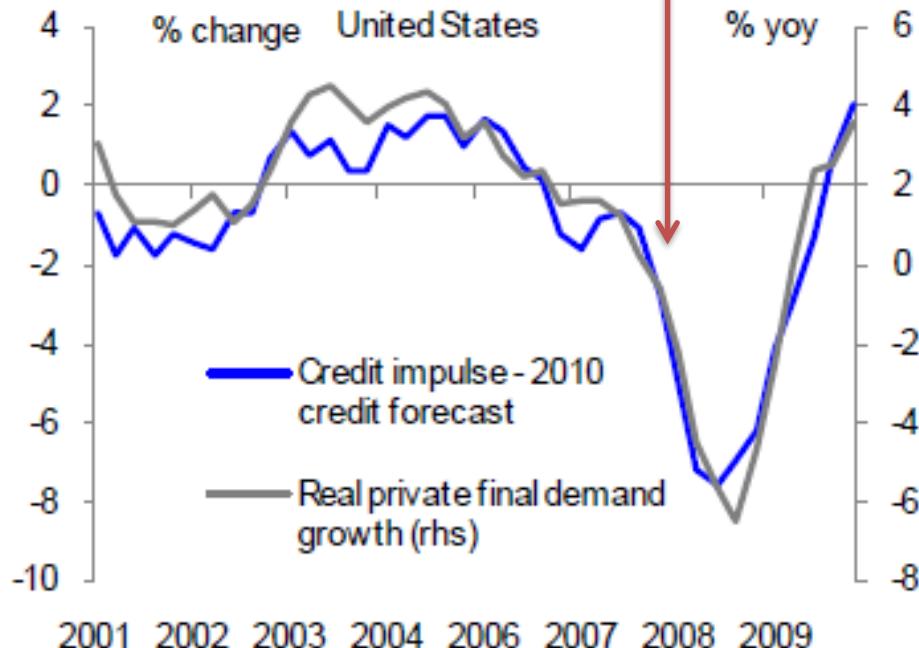
Source: Deutsche Bank, BEA, Bureau of the Census, US Federal Reserve

Biggs, Mayer Bringing credit back into the monetary framework 2013

The reprisal of US credit impulse explain the quick US recovery after the GFC

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Chart 11. US credit impulse and demand growth



Source: Deutsche Bank, IMF

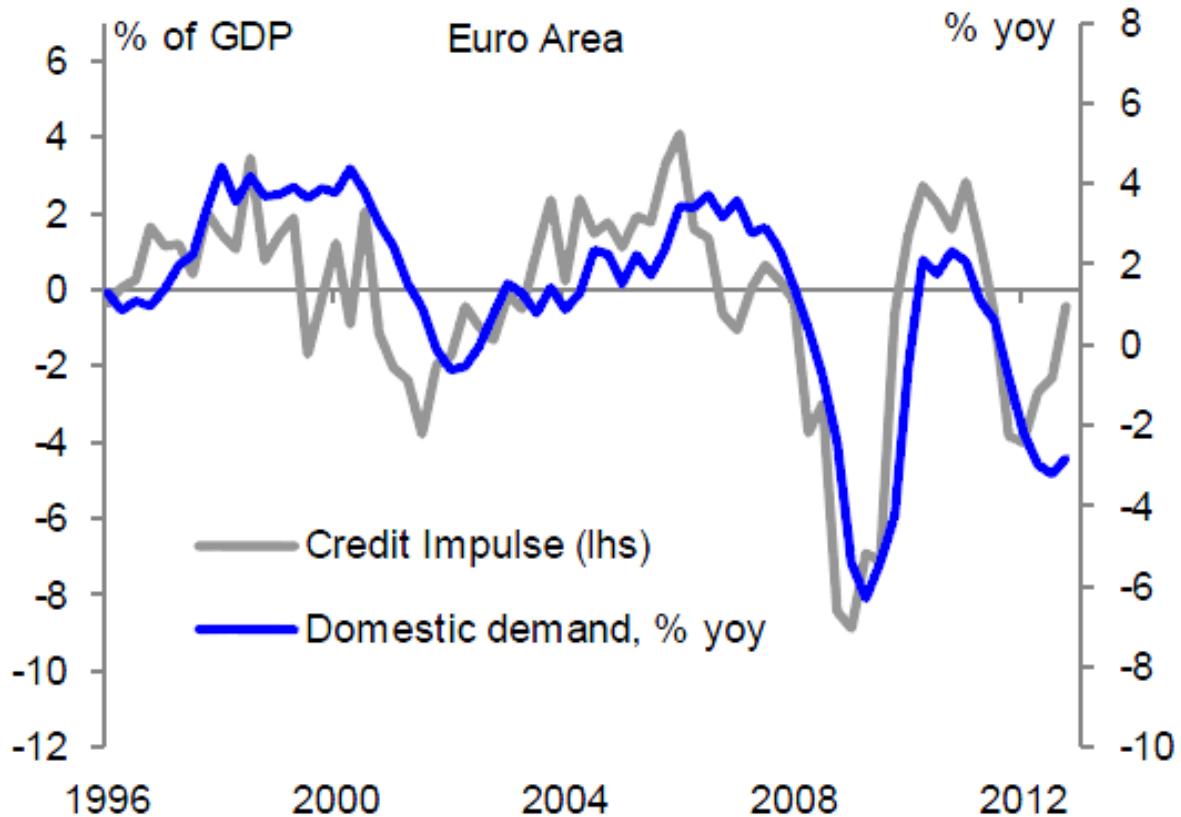
Biggs, Mayer Bringing credit back into the monetary framework 2013

The EUR credit impulse is also strongly correlated to the European business cycle

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Jalabert

Chart 13: Euro area credit impulse and real private demand growth



Source: Deutsche Bank, ECB, Eurostat

Biggs, Mayer Bringing credit back into the monetary framework 2013

The origin of the Great Financial Crises and The Quantitative Easing trap

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The GFC has been generated by the sharp deceleration of the credit in 2006.

The cure was a massive QE that helped to counterbalance the sharp decline of the credit impulse.

But the QE is generating a new speculative bubbles developed (Equity, Real Asset ...)

It is very difficult to stop the QE as the credit impulse could generate new crisis as in the US in 1934-36.

Euro zone and Japan are now locked in the QE trap.



Richard Koo

Balance Sheet Recession

A neo fisherian Interpretation of the Debt Crisis

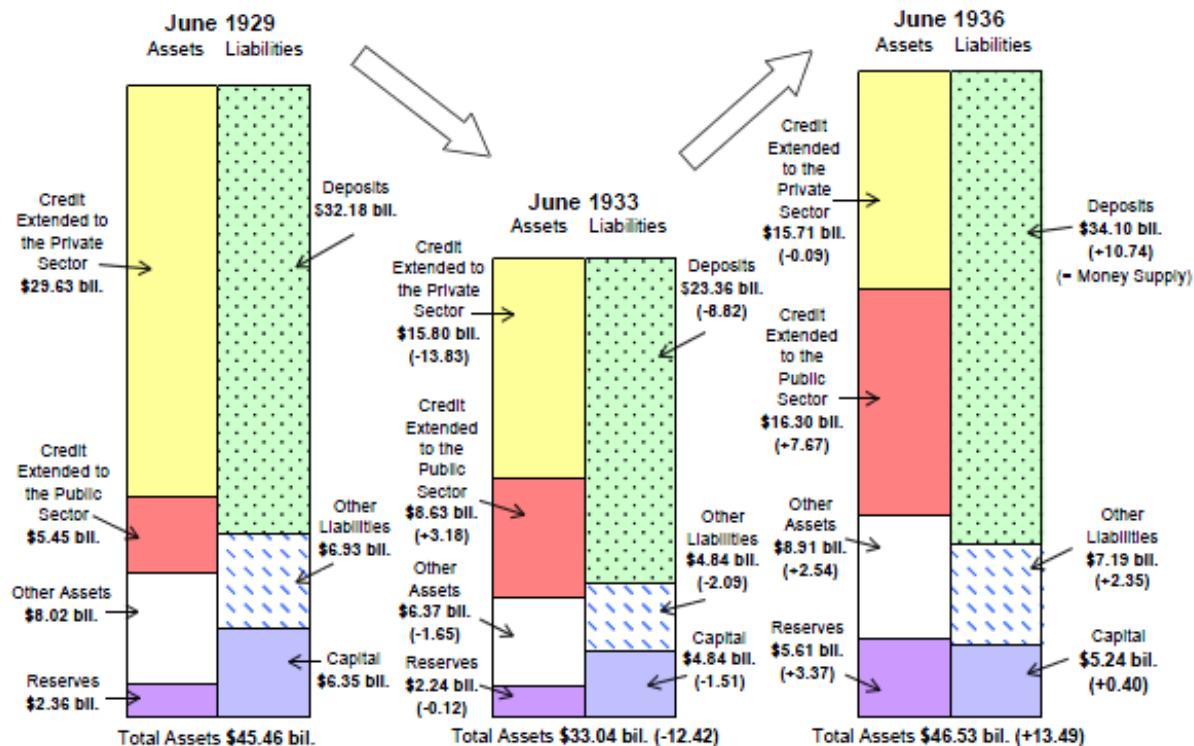
The Escape from Balance Sheet Recession and the QE Trap: A Hazardous Road for the World Economy
John Wiley 2014

The Other Half of Macroeconomics and the Fate of Globalization
John Wiley 2018

From 1929 to 1933 US money supply collapsed as the banking balance sheet decreased of 27%. The Fed monetary policy was pro cyclical.

Exhibit 8. Post-1933 US Money Supply Growth Was also Made Possible by Government Borrowings

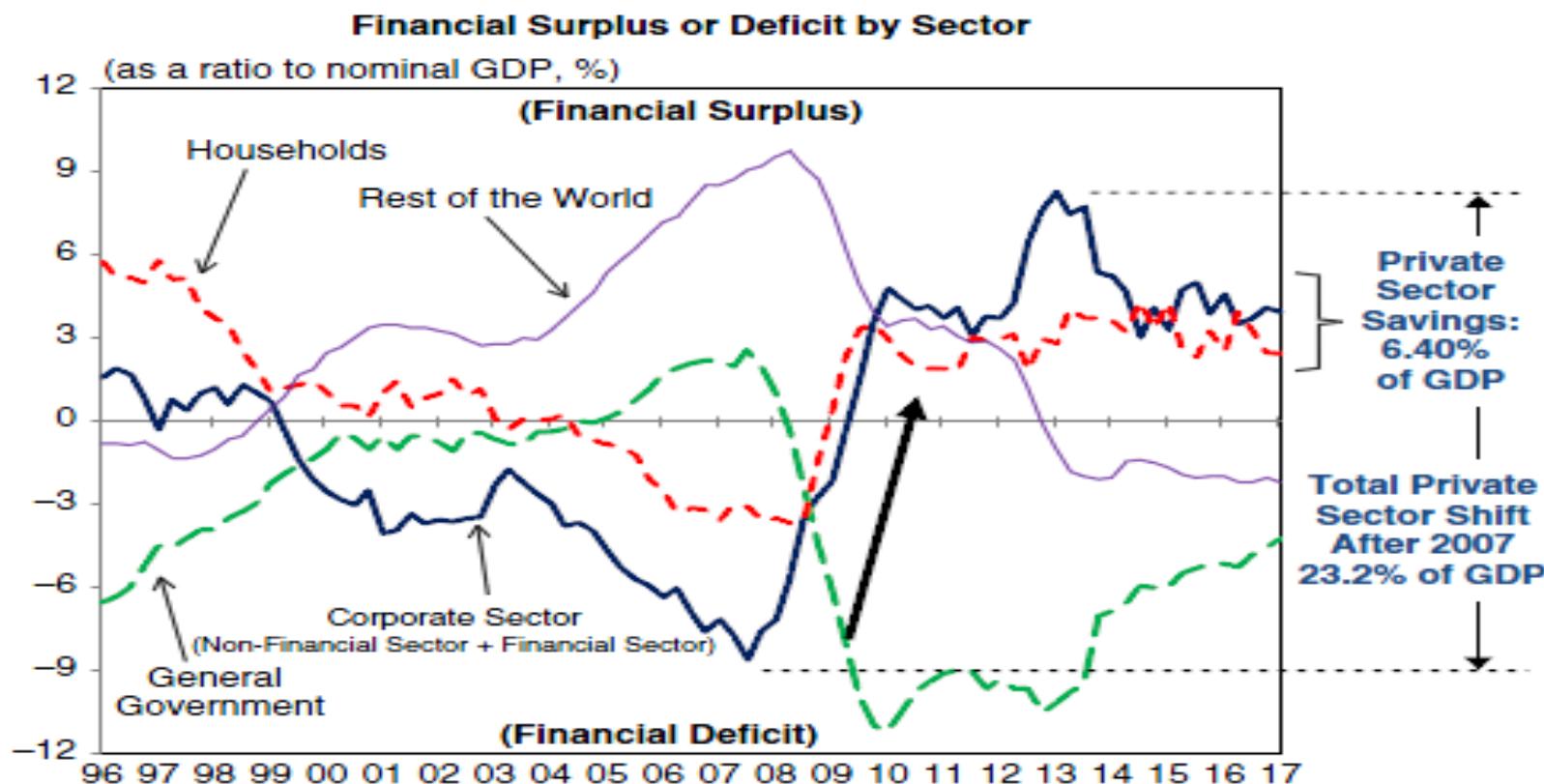
Balance Sheets of All Member Banks



Source: Board of Governors of the Federal Reserve System (1976) *Banking and Monetary Statistics 1914-1941* pp.72-79

After a binge of borrowing prior to 2006, Spanish households and firms deleveraged and increased their saving

FIGURE 2.6 Spanish Households Increased Borrowings After Dotcom Bubble, But Are Now Deleveraging



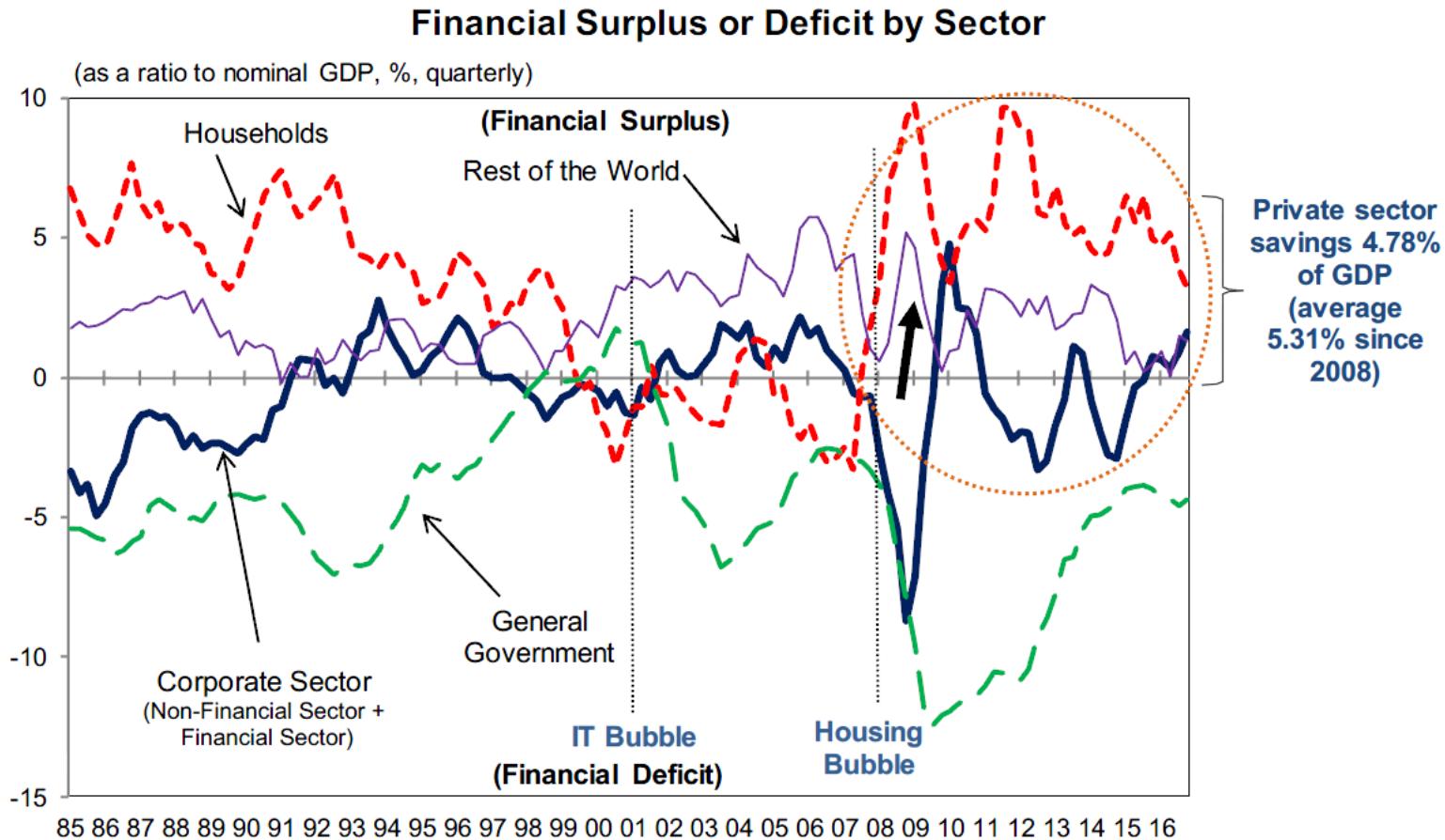
Notes: All entries are four-quarter moving averages. For the latest figures, four-quarter averages ending in 2017 Q1 are used.

Sources: Banco de España and National Statistics Institute, Spain

After 2006 US households and firms deleveraged and increased saving.

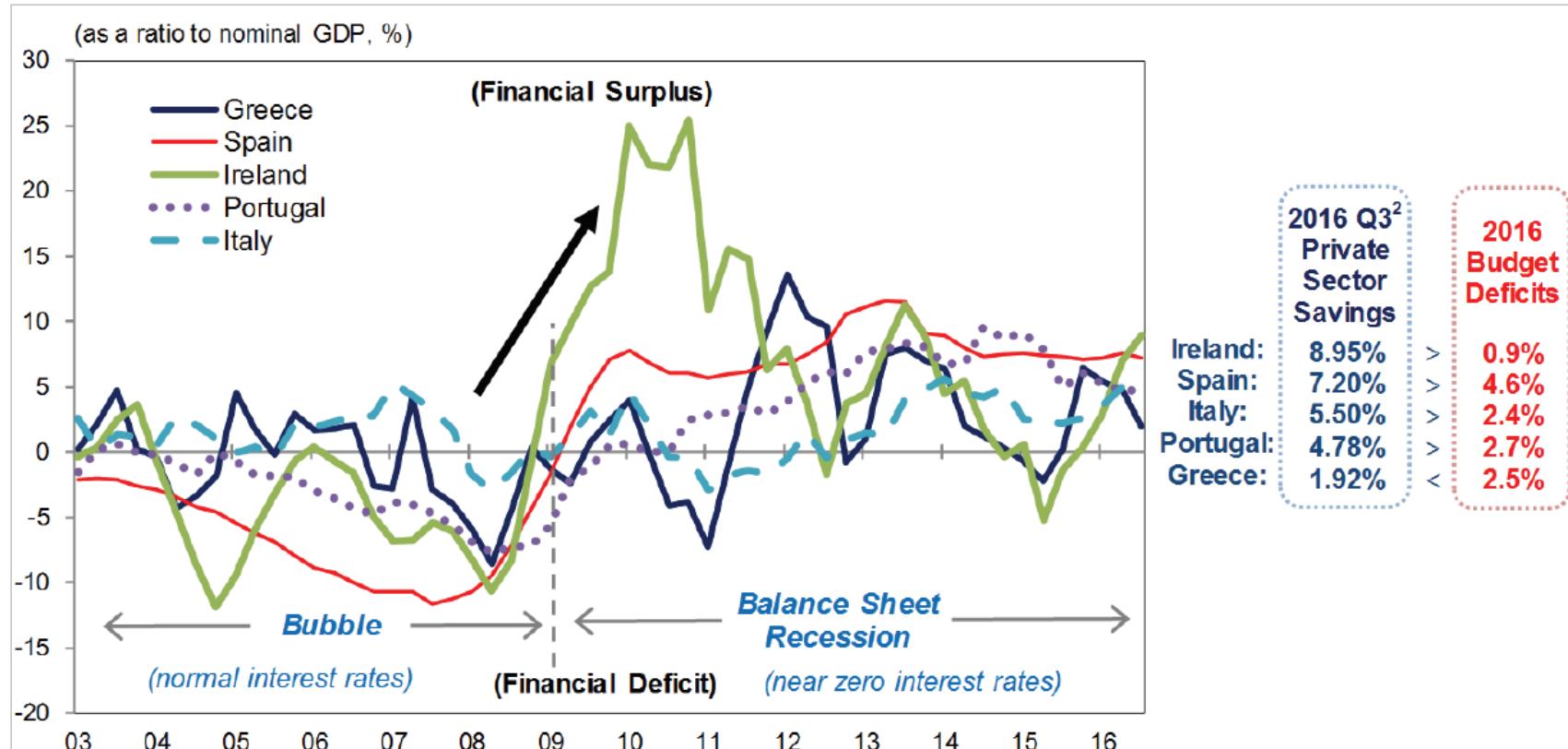
© Théo Jalabert

US Private Sector has Been saving 5.31% of GDP on Average with Zero Interest Rates since 2008 but US budget deficit compensate that saving and demand contraction.



Note: All entries are four-quarter moving averages. For the latest figures, four-quarter averages ending in 2016 Q4 are used.
 Sources: FRB, US Department of Commerce

In the EUR zone Budget deficit don't compensate households and firms saving and deleveraging. Fiscal policy is not contra cyclical as there is no EURO federal budget



Notes: 1. Private Sector = Household Sector + Non-Financial Corporate Sector + Financial Sector

2. All entries are four-quarter moving averages. For the latest figures, four-quarter averages ending in 2016 Q3 are used. Budget deficits in Euro area in 2016 are from November 2016 release by European Commission.

3. Except Greece.

Sources: Based on the flow of funds data from Bank of Greece, Banco de España, National Statistics Institute, Spain, The Central Bank of Ireland, Central Statistics Office Ireland, Banco de Portugal, Banca d'Italia and Italian National Institute of Statistics and IMF



Hyman Minsky

A Post Keynesian Model of Financial crisis

Financial Instability Thesis

Can it Happen Again ? Routledge 1982

No General Equilibrium : The debt and Asset market overshoot

© Theo Jansen 



ex post Keynesian accounting equilibrium $I = S$



If $\text{ex ante } I > S$. The households' over investment in real estate is not financed by the households' saving then we must have ex post $I = S + \Delta D$ with ΔD as increase of the households' debt.

The households over investment ΔI had been financed by an increase of the households' indebtedness as $I + \Delta I = S + \Delta D$. When the financial crises occur first $\Delta D = 0$ and $I + \Delta I > S$ then $\Delta I < 0$ and $\Delta D < 0$ and $\Delta S > 0$.

***BUT the system could not return to the equilibrium $I = S$ with $\Delta D < 0$ and $\Delta I < 0$ and $\Delta S > 0$
then $I + \Delta I < S + \Delta S$***

- Financial Instability before the crisis (Ponzi finance)

Investment is increasing, households are dissaving : $\Delta I >> \Delta S$ as $\Delta I > 0$, $\Delta D > 0$ and $\Delta S < 0$. Over investment generated by the increase of debts in the financial sector which feed an increase of the real asset value which generate an increase of debts

- Financial Instability during the crisis and afterward

Value of real assets collapse which generated an over indebtedness of households. The value of households debts $>$ value of real assets financed by the debts. Households are defaulting and are deleveraging $\Delta D < 0$ and are increasing their saving $\Delta S > 0$. Then the value of assets are shrinking faster than the value of debts hence the deflation and the Keynesian liquidity trap (Irving Fisher Debt deflation 1933).

As household are defaulting the value of the loan on the assets side of the banks' balance sheet are shrinking. Value of Banking Assets $<$ Value of Banks' debts then the financial system is bankrupted.

No return to a General Equilibrium : Fiscal and Monetary policy has to stabilize the system after the crisis

© Théo Lalabert



There is no stable general equilibrium as in neo classic economic theory. Financial Instability generated an auto feed disequilibrium then only the Central Bank and the State could restore an equilibrium.

The State has to restore the Effective Demand as the households' and firms' Demands is shrinking

ex post Keynesian accounting equilibrium with State $I + G = T + S$

and $I - S = T - G$ with $I - S$ as surplus of the private sectors and $T - G$ the surplus of the State

Before the crisis $I + G + \Delta I = T + S + \Delta D$

After the crisis $\Delta I < 0$ $\Delta D < 0$ and $\Delta S > 0$ and $I + G + \Delta I < T + S + \Delta S + \Delta D$ then the State act as demander of last resort as the households and firms are bankrupt then $I + G + \Delta G = T + S$ with ΔG as Keynesian fiscal stimulus.

The Central Bank has to restore the Liquidity as the Banking system is bankrupt

As we have seen the monetary Policy is ineffective as LM is horizontal (liquidity trap). But the Central bank has to restore the confidence in the broken financial system and to provide liquidity first in the financial system in order to avoid a financial meltdown and then in the real economic system has the banking could not lend to households and firms. The Monetary expansion avoid a fire sell of all assets position (financial and real) by asset holder unable to refinance them.

Why the Great Financial Crisis less devastating than the Great Depression ?

Why the GFC has not finished as the Great Depression of the 30' ?

1 *The Relative size of governments is now far larger than in the 30'. A greater deficit could occur.*

During the 30's the relative size to GDP of the US government was small then the fiscal stimulus was ineffective. The fiscal stimulus occurred only during the Second world War.

2 *There is now a large outstanding government bond markets*

Central bank could generate a big Quantitative Easing with the bond market. Furthermore the bond market could soak the excess liquidity in order too attenuate the liquidity trap and the deflationary pressure.

3 *The Central banks Fed, ECB, BOJ, PBOC could act quickly as lender of last resort*

During the 30's the Gold Exchange Standard had constrained a quick monetary expansion as the liability side of the Central Banks was linked to the Gold stock on the asset side. The QE has prevented the collapse of asset values as asset holders and Banks could refinance their debts rather than being forced to sell out their position.



Diagrammatical Austrian Modelization with Time and Money of unsustainable growth

F.A. Hayek Monetary Theory and the Trade Cycle

<https://mises.org/library/monetary-theory-and-trade-cycle-0>

Roger W. Garrison Time and Money The macroeconomics of Capital Structure Routledge

Roger W. Garrison Austrian Macroeconomics: A Diagrammatical Exposition

<https://mises.org/library/austrian-macroeconomics-diagrammatical-exposition-0>

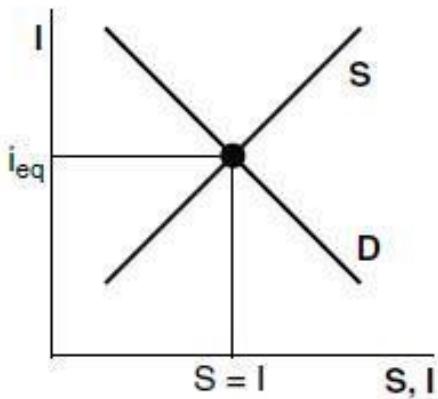
NB : The diagrammatical presentation has been made by Roger W. Garrison from concepts previously developed by F.A. Hayek , L. von Mises and others austrian economists

The Market for loanable funds

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- S : The Supply for loanable fund as the willingness to lend at different interest rates it include loans but also retail earnings and equity purchase
- D : The Demand of loanable funds as the borrowers' intention to participate in the economy's process. It refers to mean of production, not financial instruments, plant, equipment, intermediate goods, durable goods, human capital...
- i_{eq} : market clearing at which $S = I$ also call natural rate. If a pure and perfect neo classical market it will be equal to the cost of capital of a maximizing firm (cf previous Growth Theory lecture) . NB This is not the risk free interest rate (Risk neutral probability of B&S).
- $i_{eq} = \text{nominal rate (real rate + inflation)} + \text{risk premium or more generally the weighted cost of capital (loan+ equity)}$ which equal the marginal product of capital or profit rate for a maximizing firm.



The market for loanable funds

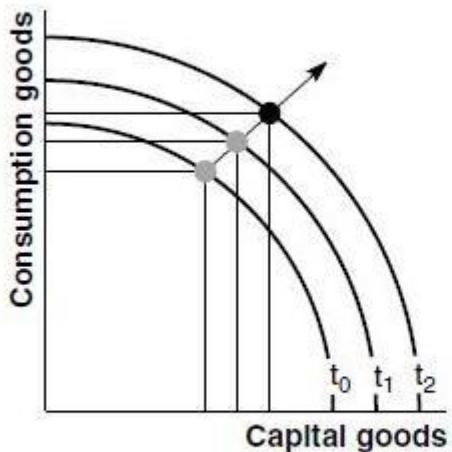
The production possibilities frontier 1 (PPF)

PPF represents the trade off between consumer goods C and capital goods I for a certain level of GDP.

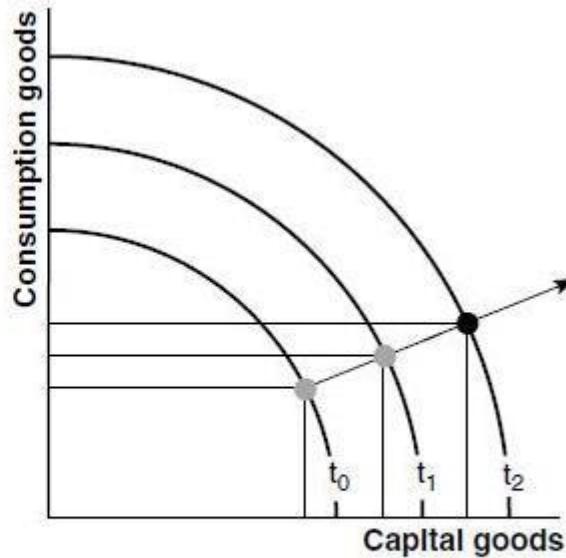
On a static basis equilibrium (ex post) the trade off is made by a move along one PPF curve.

Year to year expansion is described by a shift of the PPF curve from t_0 to t_n .

- Developing countries : quick capital intensive growth ($I > C$) on the right side
- Developed countries : slow capital intensive growth ($C > I$) on the right side



Developed countries
Slow Growth from consumption



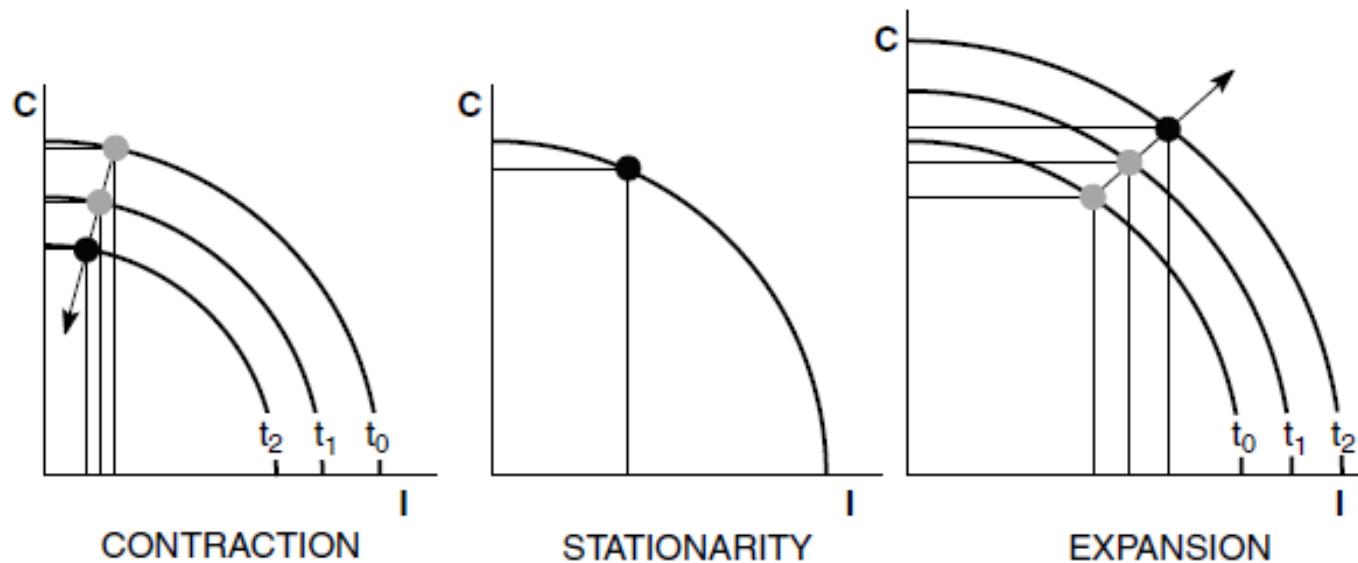
Developing countries
High Growth from investment

The production possibilities frontier 2 (PPF)

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PPF graph could represents 3 dynamical states of an economy : Contraction / Stationarity / Expansion.

On a dynamical process the PPF could move from one level to another. The move from one PPF to another one is a change of a static equilibrium to another one. Neo classical economics : dynamic as an infinitesimal change from one static equilibrium to another one.

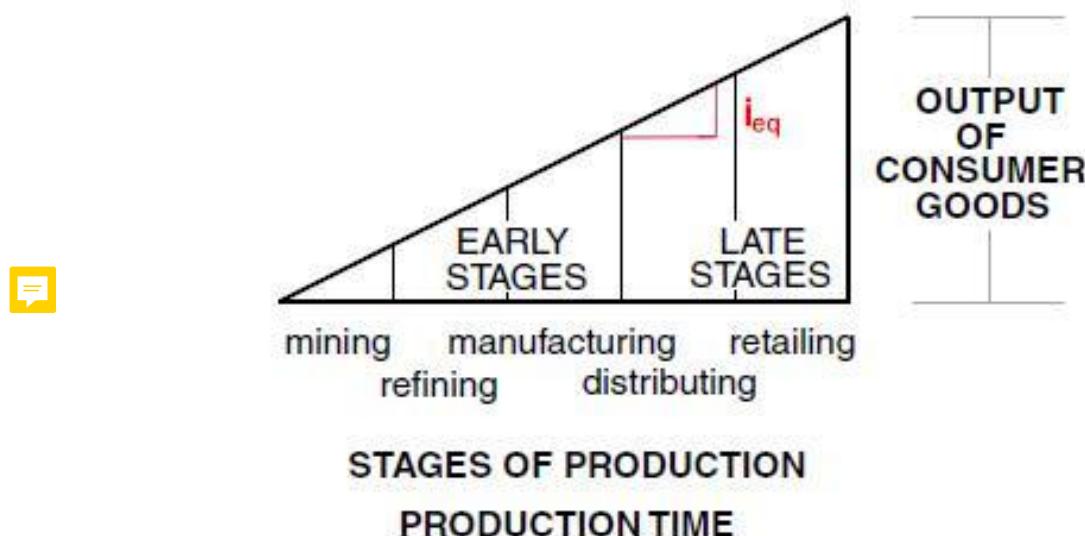


The hayekian triangle : The intertemporal structure of production 1

The hayekian triangle introduce the time frame of the production process of the consumer goods which not appeared in mainstream economics and connect it to the market of loanable fund (ieq).

Output of Consumer goods are produce with investment good (I) during the sages or production.

- Abscissa : Stages of production as Value is added during production process could be express in time unit (t)
- Ordinate : Value of the intermediary and final output of Consumer products in €
- The area of the triangle is the Value Added of consumer goods created during the stages of production at each time t
- The hypotenuse of the triangle is proportional to i the natural rate which generate a trade off between C and I. The trade off is materialize by a move along the PPF curve.



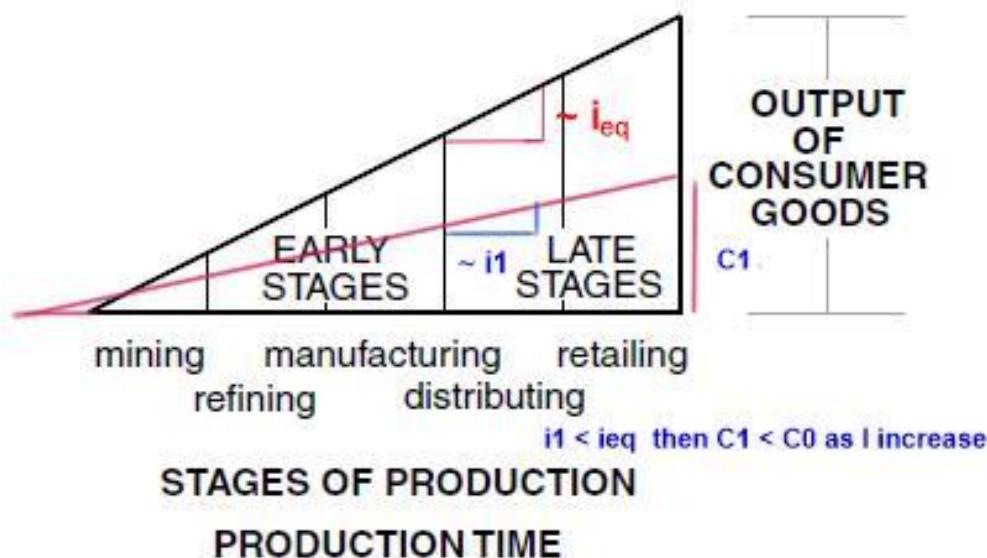
The hayekian triangle : The intertemporal structure of production 2

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On the PPF curve (not during time) : What happen if the natural rate decrease from i_{eq} to i_1

- $I = f(i)$ with $df/di < 0$ and $C = f(i)$ with $df/di > 0$: substitution of C by I during the production process from C to C_1 below.
- Production Time of C , T is a function of i : $T = f(i)$ with $dT/di < 0$ as i decrease the production time increase (from black hypotenuse to red hypotenuse red below)

The slope and length of the hypotenuse of the triangle is proportional to the natural rate i_{eq} i.e. the lower (higher) the natural rate then the longer (shorter) the production process will occur and the lower (higher) the absolute value of final stage of the production process of consumer good as Investment (consumer goods) divert consumer Goods (investment).

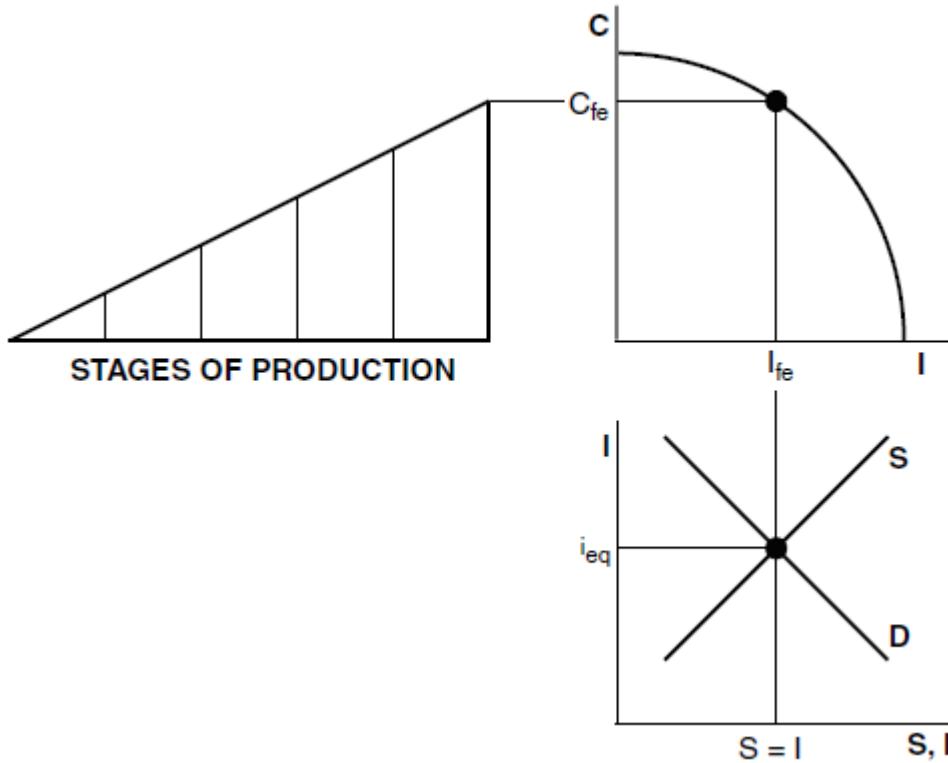


The macroeconomics of capital structure

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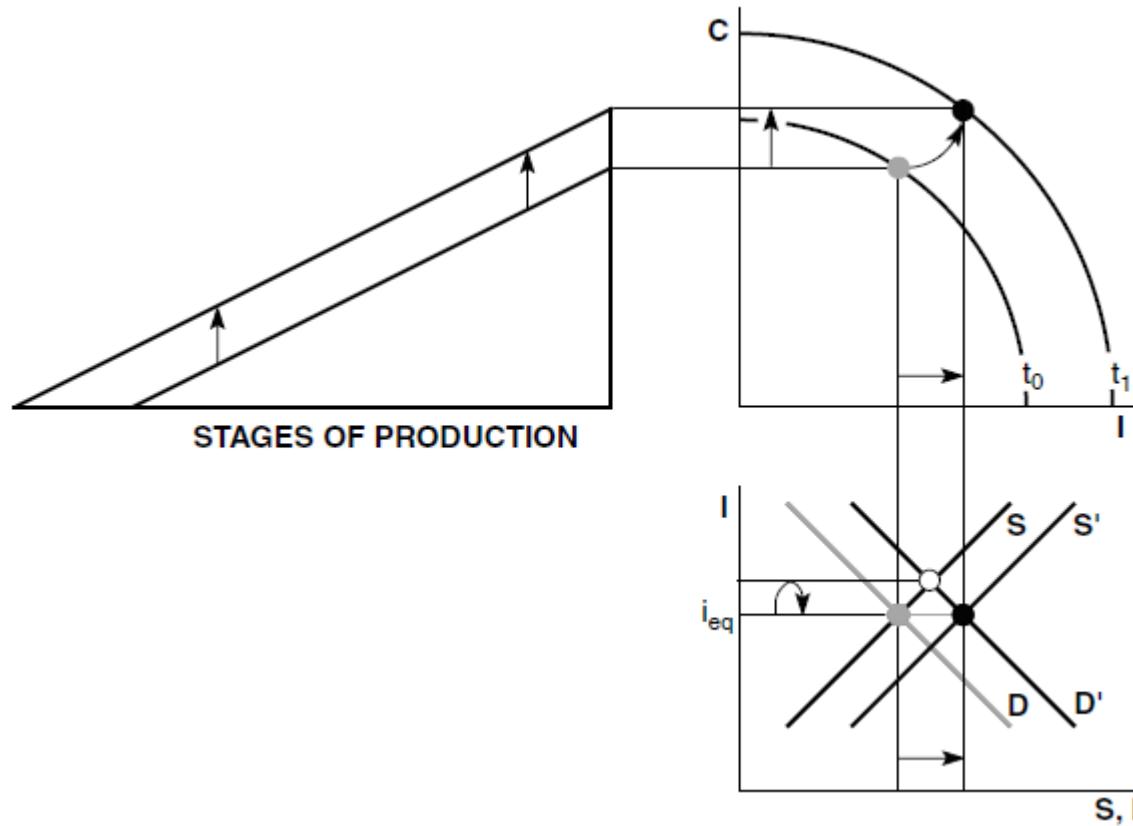
In that modelization the time structure of the stage of production is linked to the market for loanable funds by the PPF.



Sustainable growth : Technology-induced growth

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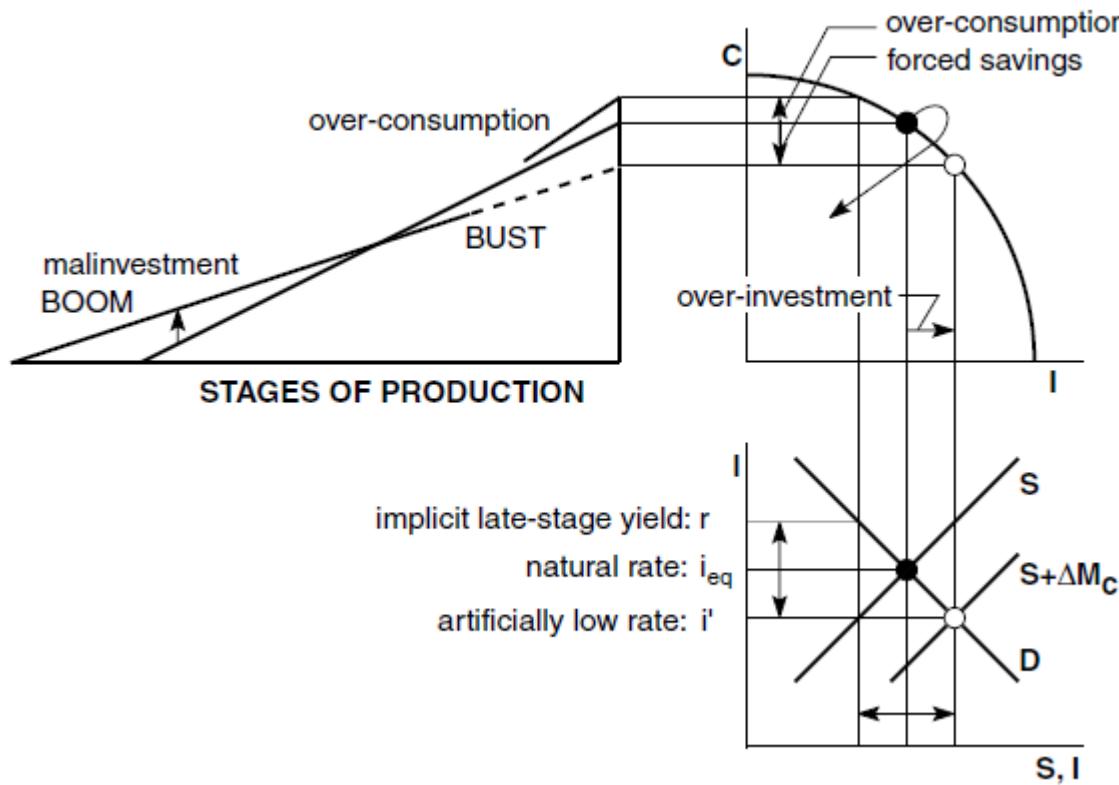
1. Rising productivity induces a rising demand for means of production from D to D' (profit maximizing firm) which induce a temporary rise if i . Then the saving is rising following the rise of i and of the revenue from S to S' . The supply of loanable funds decrease the interest rate to its long term level.
2. C and I are both increasing then the economy reach a higher and stable PPF in t_1 .



Unsustainable growth generate by monetary creation and rising global indebtedness

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1. The increase of money & debts ΔM_c induces an increased saving from S to $S + \Delta M_c$ which lower i_{eq} to i' then malinvestment (von Mises) occurs increasing I of ΔI .
2. C is not decreasing as ΔI as been financed by ΔM_c (no substitution effect), furthermore C increases of ΔC with the artificially lower rate i' and the false expectations of the boom generating an overconsumption.
3. C and I are both increasing but are generated by malinvestment as commercial or residential real estate in the US



Unsustainable growth generate a boom and a bust then a secondary deflation

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1. The new equilibrium lie outside the sustainable PPF of the economy. The consumption and Investment level are not compatible with the real capacity of the economy : the **boom**.
2. When the crisis occur, after a random shock, the consumption and Investment have to return to their the initial equilibrium : the **bust**.
3. But the time necessary to erase the malinvestment could be very long whatever the fiscal and monetary policy is implemented.
4. Furthermore the economic system will not come back to the equilibrium it could overshoot creating the so call Hayekian **secondary deflation**.

