1 Summary Time = Money

1.1 Time to value

1.1.1 Money has no value. Only time has

Finance does two things. It provides a marketplace that allows people and organisations to trade both in real goods and services and in their exposure to real risks and opportunities. We call this distribution. Secondly it is a ledger that accounts for all transactions between people and organisations within an economy. We call this registration. Finance is humanity's tool to enable efficient cooperation in maintaining and growing their economies. Finance does not create value itself; it is a zero-sum game.

The main priorities of people are to survive and to grow (make things better for themselves and others). In order to survive people spend part of their time (labour) by providing services and by transforming natural resources like matter and energy into useful consumption goods. The natural resources they use do not bear any universal value, they are just there. People also aim to grow by investing another part of their time (also labour) into creating capital goods, such that they can either (1) maintain an equal level of production in the future with less labour or (2) enjoy more future consumption by working equal hours. Capital goods include knowledge, human skills and expertise, social networks and alike. The efficiency gain obtained by investing in capital goods is the only driver of real economic growth per capita and is commonly referred to as labour productivity increase.

In this line of thinking we can denote the costs of all raw materials and (semi-)finished goods (which in fact are all services) in terms of human time spent (historic costs accounting method). The value of these goods can also be denoted in terms of human time; it equals the net present value of the expected future productivity gains (labour savings) the goods will bring minus the net present value of the costs (amount of labour) that remain required to get the goods into a final useful state. This way we can separate finance from the real economy which has the benefit of analytical convenience and allows us to disregard complex financial dynamics when observing economies.

1.1.2 The Zen of aggregated value

The value of a well-functioning[1] economy $V(s)$ at the end of year 0 that invests a fraction s of its aggregated production Y_i into capital goods at any given year i in the future is described by formula (4.24).

$$V(s) = \frac{(1-s)Y_0}{(\delta_0+\delta_T-g(s))}, which\ equals\ V(s) = \frac{(1-s)Y_0}{(\delta_T-g_r(s))}, with\ g(s) = \delta_0 + g_r(s)\ if\ s > s_0 \quad (4.24)$$

Y_0 is the aggregated production of the economy in year 0 (present time) denoted in units labour of reference year 0, δ_0 is the weighted average depreciation rate of all capital goods in the economy, δ_T is the depreciation rate of human time that is the average of the (negative) drifts of the expected remaining lifetimes of all individuals within the economy which are assumed to evolve as Brownian motions. The depreciation rate of human time reflects the fact that present time is more valuable to humans than future time[2] (our time today is given, tomorrow you might not be there). Finally, $g(s)$ is the annual growth of the economy which is a function of the investment rate s. Note that part of the investment rate s_0 is required as maintenance investments to avoid decay of the capital goods such that $g(s_0) = \delta_0$. So real growth $g_r(s)$ which equals $g(s)$ minus δ_0 occurs if s is larger than s_0. For formula (4.24) to be valid δ_T must be larger than the real growth $g_r(s)$ and the people must use all future time released by productivity increases as labour (and not leisure)[3].

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[1] Well-functioning means that (1) the people in the economy do the best they can and work together efficiently, (2) jobs are allocated to people who are best fit to perform them and (3) the people set rational priorities regarding investing in capital goods.

[2] δ_T is the equivalent of the risk-free rate in corporate finance.

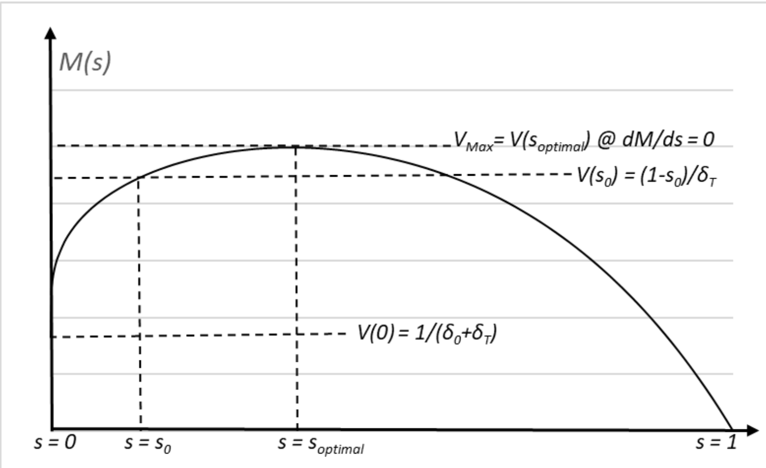
[3] In asset pricing this is called a self-financing process, which means that all dividends are reinvested

1.1.3 Diminishing marginal returns and the optimal investment rate

If we apply the law of diminishing marginal returns it seems plausible that *g(s)* can be written as (4.29), which we can use to rewrite *g(s)* in formula (4.24).

$g(s) = g_{max}s^{\gamma}, 0 \leq s \leq 1 \; and \; 0 < \gamma < 1$
(4.29)

Now we can divide $V_S(s)$ by Y_0 and rewrite equation (4.24) to present the value of an economy as a multiple *(M(s))* of the aggregated production at present *(Y_0)*, such that $M(s) = V_S(s)/Y_0$. Such a function is plotted below.



The figure shows that the value of an economy has a maximum at the optimal investment rate. This value can be derived if we differentiate *M(s)* to *s* and solve this for *dM/ds=0,* like formula (4.31).

$$\frac{dM(s)}{ds} = \frac{d}{ds}\left(\frac{1-s}{\delta_0+\delta_T - g_{max}s^{\gamma}}\right) = 0 \qquad (4.31)$$

1.1.4 Aggregated time accounting and quality of life

Please find below the aggregated time statements of a closed well-functioning economy for years *0* to years *i*. Assets are capitalised at "historic costs".

Aggregated profit & loss account				
Line item	**Operator**	**Year 0**	**Year 1**	**Year i**
Revenues	+	Y_0	$Y_0(1+g)$	$Y_0(1+g)^i$
Opex	-/-	$(1-s)Y_0$	$(1-s)Y_0(1+g)$	$(1-s)Y_0(1+g)^i$
EBITDA	=	sY_0	$sY_0(1+g)$	$sY_0(1+g)^i$
Depreciation	-/-	δ_0Y_0	$\delta_0Y_0(1+g)$	$\delta_0Y_0(1+g)^i$
NOPLAT	=	$(s-\delta_0)Y_0$	$(s-\delta_0)Y_0(1+g)$	$(s-\delta_0)Y_0(1+g)^i$

Table 4.4 Aggregated profit & loss account denoted in units of useful human time in the present year (aggregated production Y_0)

Aggregated time flow statement				
Line item	**Operator**	**Year 0**	**Year 1**	**Year i**
EBITDA	+	sY_0	$sY_0(1+g)$	$sY_0(1+g)^i$
WC Adjustments	-/-	0	0	0
Capex	-/-	φsY_0	$\varphi sY_0(1+g)$	$\varphi sY_0(1+g)^i$
Free Time Flow (FTF)	=	$(1-\varphi)sY_0$	$(1-\varphi)sY_0(1+g)$	$(1-\varphi)sY_0(1+g)^i$

Table 4.5 Aggregated time flow statement denoted in units of useful human time in the present year (aggregated production Y_0)

Aggregated Balance sheet				
Line item	**Operator**	**Year 0**	**Year 1**	**Year i**
Assets				
Capital goods at the beginning of period	+	*0*	$(\varphi s-\delta_0)Y_0$	$(\varphi s-\delta_0)Y_0+\ldots+(\varphi s-\delta_0)Y_0(1+g)^{i-1}$
Investments (capex)	+	φsY_0	$\varphi sY_0(1+g)$	$\varphi sY_0(1+g)^i$
Depreciation	-/-	δ_0Y_0	$\delta_0Y_0(1+g)$	$\delta_0Y_0(1+g)^i$
Capital goods at the end of period	=	$(\varphi s-\delta_0)Y_0$	$(\varphi s-\delta_0)Y_0+(\varphi s-\delta_0)Y_0(1+g)$	$(\varphi s-\delta_0)Y_0+(\varphi s-\delta_0)Y_0(1+g)+\ldots+(\varphi s-\delta_0)Y_0(1+g)^i$
Liabilities				
Equity at the beginning of period	+	*0*	$(\varphi s-\delta_0)Y_0$	$(\varphi s-\delta_0)Y_0+\ldots+(\varphi s-\delta_0)Y_0(1+g)^{i-1}$
NOPLAT	+	$(s-\delta_0)Y_0$	$(s-\delta_0)Y_0(1+g)$	$(s-\delta_0)Y_0(1+g)^i$
Dividend (FTF)	-/-	$(1-\varphi)sY_0$	$(1-\varphi)sY_0(1+g)$	$(1-\varphi)sY_0(1+g)^i$
Equity at the end of period	=	$(\varphi s-\delta_0)Y_0$	$(\varphi s-\delta_0)Y_0+(\varphi s-\delta_0)Y_0(1+g)$	$(\varphi s-\delta_0)Y_0+(\varphi s-\delta_0)Y_0(1+g)+\ldots+(\varphi s-\delta_0)Y_0(1+g)^i$

Table 4.6 Aggregated balance sheet denoted in units of useful human time in the present year (aggregated production Y_0)

In the statements above φ is the investment rate, which is the fraction (percentage) of EBITDA (sY_i) that is reinvested in creating future value.

We can now define the annual increase (or decrease) in quality of life in year *i* (accounted for based on historic costs) as the amount of labour investment in capital goods minus the depreciation of capital goods $(s-\delta_0)Y_i$ during the period *i*.

This equals $NOPLAT_i = (s-\delta_0)Y_0(1+g)^i$ which is the equivalent of the net profit of an unlevered company in financial accounting. The time dividend or free time flow $DIV_i = FTF_i = (1-\varphi)sY_0(1+g)^i$ is the share of the increase in quality of life that was spent on increased future leisure time. The remaining part $(\varphi s-\delta_0)Y_0(1+g)^i$ is reinvested in increased future consumption which is accounted for by adding this to the equity reserves of the economy valued at historic costs.

Formula (4.24) assumes that all productivity increases are reinvested in the economy (a self-financing process which implies φ equals 1). We did not take leisure time into account. Obviously, once people enjoy more leisure time (time dividend) this impacts the growth of future consumption. Therefore, we should account for this by including the fraction φ of available labour sY_i that is used for creation of capital goods. If we adjust formula (4.24) we get formulas (4.32) and (4.33):

$$V_s = \frac{(1-\varphi s)Y_0}{(\delta_0+\delta_T-g(\varphi s))} => V_s = \frac{(1-\varphi s)Y_0}{(\delta_T-g_r(\varphi s))}, if\ s > s_0 \qquad (4.32)$$

$$M = \frac{V_s}{Y_0} = \frac{(1-\varphi s)}{(\delta_0+\delta_T-g(\varphi s))} = \frac{(1-\varphi s)}{(\delta_0+\delta_T-g_{max}\varphi s^{\gamma})}, with\ 0 < s < 1, 0 < \gamma < 1\ and\ 0 < \varphi < 1 \qquad (4.33)$$

If φ is smaller than 1, formulas (4.32) and (4.33) describe the value of the quality of life by means of consumption (at fair value instead of historic costs) and disregard the value of time dividends. The value of time dividends is simply obtained by subtracting formula (4.32) from formula (4.24), which equals the summation of (4.32) when φ is replaced by $(1-\varphi)$, which describes the summation of an indefinite series of free time flows valued at their future level of quality of life compared to present time discounted by the depreciation rate of human time.

The annual aggregated production is commonly denoted as $Y_i = A_i L_i$ wherein Labour (L_i) is a function of population growth and the time dividend rate $(1-\varphi)$ to account for adjustments in the annual working hours multiplied and A_i is a production efficiency function that is driven by the investment rate *s* and the labour productivity growth. By separating labour and productivity we can monitor efficiency gains and population growth separately.

Summarising it appears that people in a well-functioning economy that invest part of their labour supply in the creation and maintenance of capital goods increase labour productivity which they can use to improve their future quality of life. They can freely decide whether they spend the annual increase in quality of life on (1) more future leisure time or (2) more future consumption.

1.2 Money to share

1.2.1 How time valuation relates to asset pricing

The risk-free rate is the depreciation of life expectancy with a premium for volatility

Transactions of capital goods in the real economy happen because different people have different views on the value of a capital good (or a set of expected future free cash flows). The individual value perception of a capital good is driven by (1) a plan (i.e. the expected future growth of the existing cashflows and the required investment rate), (2) the predictability of these cashflows and (3) the time perspective of the individual (time value of time). The value perception of an individual can be modelled with existing corporate finance techniques (like the net present value method), however we might want to reconsider the meaning of both the risk premium (equity premium) and the risk-free rate, that currently may not align too well with the dynamics in the real economy.

As an individual looks further into the future, she will less likely be alive and therefore she will value present time over future time based on her chances on survival. For example, imagine a person that has a 20% chance on dying every year. She will value next year at 80% compared to the value of this year, the year thereafter at 64% etcetera. Any given year *i* years into the future will be worth $(1-r)^i$ for her, equal to the chance she still lives that year. In this example *r* represents the chance on dying every year.

Young people that live a healthy and safe life have a longer expected remaining lifetime than old people or young people that live an adventurous life or live in a dangerous environment. We can possibly model the expected remaining lifetime $(T(t))$ as Brownian motion, with the depreciation rate of the expected remaining lifetime (δ_T) as (negative) drift. Both the drift and the volatility (σ_T^2) of the expected remaining lifetime are driven by the behaviour and environment of the individual and increase as she gets older. These dynamics do not fundamentally differ for companies that aim for acquisitive growth, except that the drift now reflects the (annual) chance on default and both the drift and the volatility are driven by (1) the sector dynamics and (2) the behaviour (like financial leverage) of the company. Based on this interpretation the risk-free rate in fact represents the “time value of time” of an investor instead of the return on an investment opportunity in a riskless asset.

The expected growth reflects the knowledge of the buyer with a discount for unpredictability

With this individual time value of time in mind the company (or individual or investor) observes a capital good or a free cash flow (both referred to as “asset”). Based on its own knowledge and specific sector dynamics the company projects a growth and required investment rate curve on the present free cashflow to estimate the expected future free cashflows. In analogy with the interest rate curve this also might be well modelled with Brownian motion, wherein the drift represents the expected future growth and the volatility reflects the level of unpredictability.

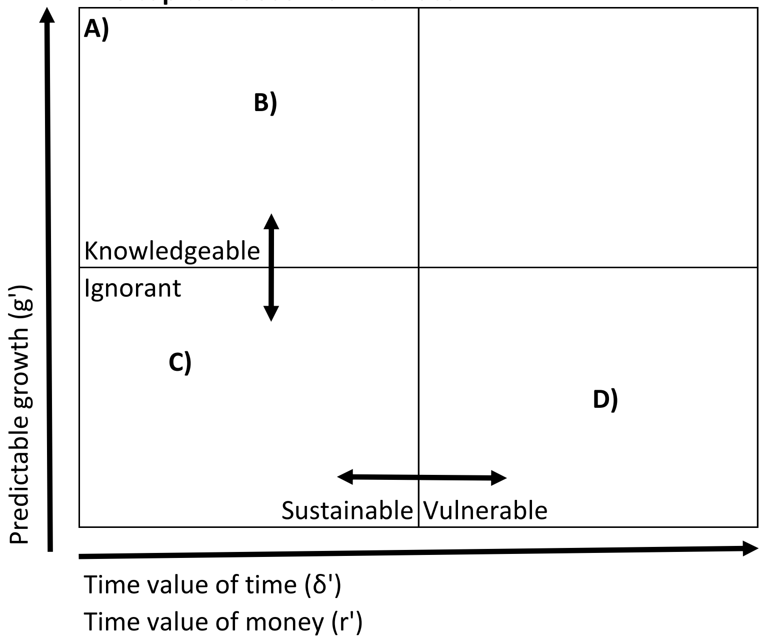
Net present value and the financial capital markets

If we now simplify both curves by assuming both the risk-free rate and the future expected growth constant over time and by modelling volatility as a premium on the risk-free rate and a discount on the expected future growth than this yields a formula equal to the well-known net present value formula that we obtain when we summarise the expected future cashflows to infinity. The difference is that the risk premium *r* now represents the sum of a discount μ_g regarding unpredictability of future growth and a premium μ_r regarding the volatility of the “time value of time” that is applicable to the buyer’s situation. Secondly, the risk-free rate represents the depreciation on the expected remaining lifetime of the buyer and not the return on an investment opportunity in a riskless asset. In formula we can write the following.

$$Value = \frac{FCF_{t=1}}{r-g} = \frac{FCF_{t=1}}{(r_f+\mu_r)-(g-\mu_g)} = \frac{FCF_{t=1}}{(r_f+\mu_r+\mu_g)-g} \tag{5.3}$$

Perhaps this interpretation can help explaining the “equity premium puzzle” and the “risk-free rate puzzle”. The figure below shows how different organisations have different perspectives on the value of an asset. Investors in the left-upper corner attribute a high value to a specific asset and investors in the right-bottom corner attribute a low value to this asset. It shows that pension funds (C) for example should be more risk-neutral than highly-levered companies and trade buyers (B) have an advantage regarding growth and predictability.

The Capital Goods Market Place



Comments

g'= g - µg
r' = rf + µr (money)
δ' = δT + µT (time)

Value ≈ FCF/(r'- g')

A) Natural owner
B) Strategic buyer
C) Institutional investor
D) Seller

1.2.2 How aggregated time accounting relates to economics

Microeconomics

Every transaction within any economy is an exchange between time and money. This means that economic transactions yield to time flows in the real economy that move in the exact opposite direction like cashflows do in the financial system. Hence companies have both cashflows and time flows. Companies create value for humans by continuously increasing labour efficiency. The free time flows and free cashflows this process generates are partly reinvested in the company for ongoing economic growth. The remaining money (excess cash) and time (redundant labour) is distributed back to respectively the shareholders (dividend payments) and the employees (dismissals). However, because employees and investors generally are different people, the employees that receive time dividend (dismissals) do not have the monetary income (dividend payments) to spend this time as leisure. Therefore, most employees have no option but to work equal hours in the future[4] and virtually all productivity increases in capitalism-based economies always have been reinvested out of necessity into consumption growth instead of spending more leisure time.

[4] See also David Graeber’s book Bullshit Jobs (Simon & Schuster, 2018), that argues that 25% of the jobs in western economies are considered useless by the people who occupy these jobs

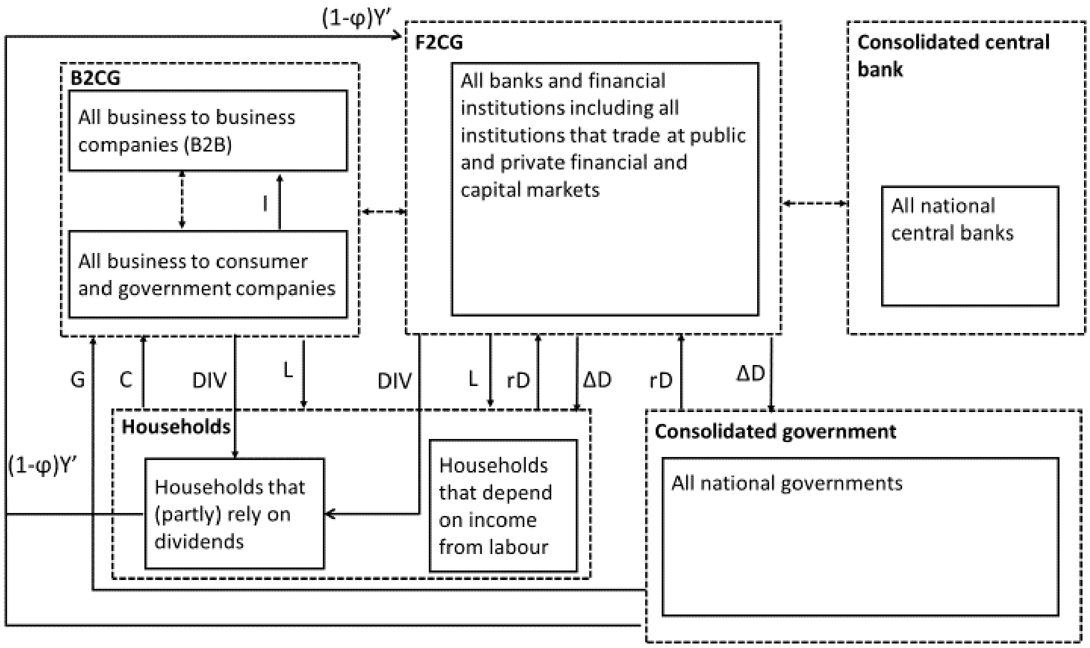
Macroeconomics

The equivalent of aggregated production in time accounting and valuation *(Y)* is the Gross Domestic Product in macroeconomics and the financial system. We should bear in mind though that there are some important differences which make them develop differently over time:

- In time accounting all human efforts should be included (like looking for a new job, housekeeping, raising children) whereas GDP only accounts for economic activity that is registered. For example, in time accounting unemployment can only be voluntary.
- In time valuation capital goods include human experience and skills, social networks, human knowledge and alike whereas in the financial system capital goods only include labour that was activated on companies' balance sheets.

1.2.3 How macroeconomics relates to financial accounting

Imagine a closed economy with a Gross Domestic Product *(Y)* which equals *C+G+I* wherein all labour is either employed by privately owned companies (jointly referred to as B2CG) or privately-owned financial institutions (jointly referred to as F2CG). In this economy governments do not employ people, but they source all their services from the private sector instead. Now assume a large global merger between all privately-owned companies (B2CG) and all banks and all other financial institutions in the economy (F2CG), which we will refer to as "the private sector". This truly capitalistic closed economy is visualised below.



If we would obtain the consolidated financial statements of the private sector we would eliminate all business-to-business transactions and positions of the closed economy, because they would all qualify as intercompany transactions and positions. This leaves us with all business-to-consumer *(C)* and business-to-government *(G)* transactions in the economy. Therefore, these financial statements represent all transactions and positions between the private sector against all households and governments (jointly referred to as the "public sector"). These financial statements are drafted below (allowing a few non-critical simplifications).

CONSOLIDATED PROFIT AND LOSS ACCOUNT OF THE PRIVATE SECTOR (B2CG AND F2CG)		
Financial accounting	**Macroeconomics**	**Operator**
Consolidated revenues	$Y_i(1-s) + r_iD_{i-1}$	=
Operational expenditures (opex)	$(1-\alpha-s)Y_i + (1-\alpha)r_iD_{i-1}$	-/-
EBITDA *EBITDA as % of revenues*	$\alpha Y_i + \alpha r_iD_{i-1}$ α	=
Depreciation *(Dep)* *Depreciation as % B2CG sales*	Depreciation (δY_i) δ	-/-
EBIT	$Y_i (\alpha-\delta)+ \alpha(r_iD_{i-1})$	=
Interest costs (eliminated)	0	-/-
Corporate income tax (CIT) *CIT as % of revenues*[5]	$\tau_{CIT} Y_i + \tau_{CIT} r_iD_{i-1}$ τ_{CIT}	-/-
NOPLAT	$Y_i (\alpha-\delta-\tau_{CIT}) + r_iD_{i-1}(\alpha-\tau_{CIT})$	=

Table 5.3 Profit and loss account of the merger of B2CG and F2CG expressed in both macroeconomics and corporate finance metrics

CONSOLIDATED CASHFLOW STATEMENT OF THE PRIVATE SECTOR (B2CG AND F2CG)		
Financial accounting	**Macroeconomics**	**Operator**
EBITDA *EBITDA as % of revenues*	$\alpha Y_i+\alpha r_iD_{i-1}$ α	=
Corporate income tax (CIT) *CIT as % of revenues*	$\tau_{CIT} Y_i + \tau_{CIT} r_iD_{i-1}$ τ_{CIT}	-/-
Working capital mutations *(0)*	Changes in intermediate goods	-
Capital expenditures (capex) *Capex as % of B2CG sales*	Investments (sY_i) s	-
Free cash flow (FCF)	$Y_i (\alpha-s-\tau_{CIT})+ r_iD_{i-1}(\alpha-\tau_{CIT})$	=

Table 5.4 Consolidated cashflow statement of the merger of B2CG and F2CG expressed in both macroeconomics and corporate finance metrics

In the financial statements, s is a constant fraction of Y that is activated (at historic costs) on the balance sheet such that corporate investments I equals sY, δ is the depreciation rate of all capital goods owned by the private sector relative to Y, τ_{CIT} is the corporate income tax rate relative to revenues (either Y or rD), α is the gross margin (added value) of the private sector relative to Y, r is the weighted average public interest rate and D is the public debt level (sum of all household debt and all government debt).

1.2.4 Financial instability

From the financial statements of a truly capitalistic closed economy we can derive the **exact public budget constraint** (formula 5.25), which expresses the public budget deficit of year $i+1$ (ΔD_{i+1}) relative to the Net Domestic Product ($Y' \equiv Y-\delta Y=C+G+sY-\delta Y\approx C+G$ if $s\approx\delta$).

$$\frac{\Delta D_{i+1}}{Y'_i} = g + \theta + r(\frac{\Delta D_i}{Y'_i} + \theta\,\frac{D_{i-1}}{Y'_i}) \tag{5.25}$$

The right side of the exact public budget constraint shows the various components that are funded by the public debt increase. The first term reflects nominal growth (g). The second term reflects the saving rate *(Θ)* of some households and part of the private sector which implies an equal fraction was borrowed (or withdrawn from their savings) by other households and governments to fund their consumption. The third term *(rΔD/Y')* represents interest payments over last year's debt increase, due to delayed income of taxes and labour income.

[5] Due to the absence of depreciation in the financial sector τ_{CIT} should be a lower fraction of revenues in case of financial institutions. This is modelled properly in the supporting spreadsheet model but disregarded in the content of the book.

The fourth term *(rΘD/Y')* represents the "net interest costs" of the existing debt, which equals the interest costs minus the fraction *(1-Θ)(r(D/Y')* that was recaptured by the public sector (taxes, labour, dividends). Disregarding defaults, the exact public budget constraint converges to an asymptotic level of debt relative to *Y'* of *(g+Θ)/(g(1-r)-r Θ(1-g))* if *rΘ(1-g)* is smaller than *g(1-r)*, which is the case for realistic values of *g, Θ* and r. We can rearrange the exact public budget constraint into the **net public budget constraint** (formula 5.37) by introducing the **net interest rate** (formula 5.36).

$$r_{net}(\frac{D_i}{Y'_i}) = \left[r\frac{D_i}{Y'_i} + (\theta - 1)r\frac{D_{i-1}}{Y'_i}\right] \tag{5.36}$$

$$\frac{\Delta D_{i+1}}{Y'_i} = g + \theta + r_{net}\frac{D_i}{Y'_i} \tag{5.37}$$

The continuous time differential equation that is the equivalent of the net public budget constraint (assuming a constant net interest rate) has the following solution with boundary condition *x(t=0)=0 and x(t)=D(t)/Y'(t)*.

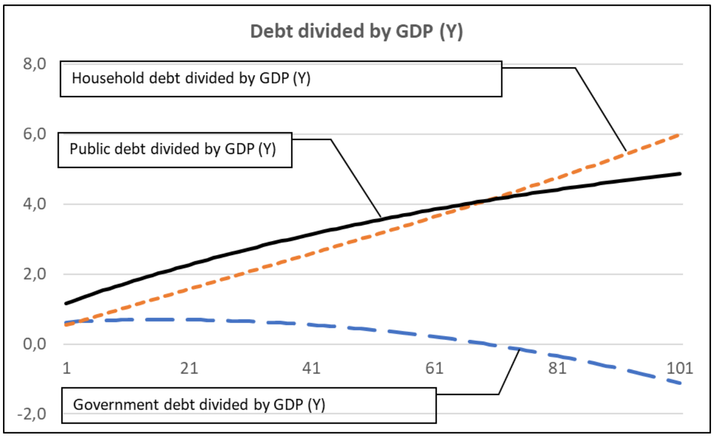
$$x(t) = \frac{D(t)}{Y'(t)} = \frac{g+\theta}{g-r_{net}}\left(1 - e^{(r_{net}-g)t}\right) \tag{5.38}$$

We can derive that if the net interest rate, the nominal growth rate, the profit margin, all tax rates, the dividend pay-out ratio and the savings rate are all constant over time, the net interest rate can be expressed as formula (5.40).

$$r_{net} = r(\alpha - \tau_{CIT})\left(1 - \frac{DIV}{FCF}\right) \tag{5.40}$$

Here τ_{CIT} is the corporate income tax rate and *DIV/FCF* is the pay-out ratio (dividend divided by free cash flow). The formula states that the net interest rate equals the public interest rate multiplied by the fraction that is withdrawn from the real economy and added to the excess cash of the aggregated financial markets. The net interest rate equals all rental income minus all payments to governments (taxes) and households (all labour costs of and all net dividends paid by the financial sector). It also confirms that under realistic conditions the net interest rate is smaller than economic growth such that the public debt level of a closed economy converges to an asymptotic value. Nonetheless, we should not conclude that the financial system of such an economy would then be fundamentally stable. This is because the aggregated public debt is a summation of all debt of individual households and governments, some of which are diverging positively (negative debt levels) and some of which are diverging negatively that jointly add up to a converging aggregated public debt.

To see this please find below a simple example using realistic variables wherein aggregated government debt and aggregated household debt diverge in opposite directions such that the aggregated public debt converges from present day debt levels for a period of a hundred years.



Although at aggregated level the financial system seems stable (converging to 5 times GDP) it is in fact unstable because it inevitably results in defaulting households. So, in order to understand financial stability we need to distinguish between various types of governments and households.

1.2.5 Financial inequality

The net government budget constraint

When decomposing the net public budget constraint, it can be shown that any governmental net budget constraint is expressed by formula (5.46).

$$\left[\frac{\Delta D_{i+1}^{G}}{Y_i}\right]_{\frac{\Delta D_{i+1}}{Y'_i}} = [\gamma g]_g + \left[\gamma - \tau_{CIT} + \tau_L(1-\alpha) + \tau_{DIV}\left(\frac{DIV}{FCF}\right)(\alpha - \tau_{CIT} - s)\right]_{(\theta)}$$

$$+\left[\left(\frac{r^G D_i^G}{Y_i}\right) - \left(\tau_{CIT}\left(\frac{r_i D_i}{Y_i}\right) + \tau_L(1-\alpha)\left(\frac{r_i D_i}{Y_i}\right) + \tau_{DIV}\left(\frac{DIV}{FCF}\right)(\alpha - \tau_{CIT})\left(\frac{r_i D_i}{Y_i}\right)\right)\right]_{r_{net}D_i/Y_i} \quad (5.46)$$

Here, the grey connotations refer to the equivalent terms of the net public budget constraint. This formula tells us that for some governments maintaining a sustainable budget is much easier than it is for other governments. The main components that make sustainable tax regimes easy for governments are (1) a net trading surplus and (2) a large and international financial sector. For governments of countries with a small financial sector and a trading deficit it is virtually impossible to maintain prudent budgeting except by inflating debt away (printing money to stimulate inflation).

The net labour-income dependent households' budget constraint

Imagine a group of all households in a closed economy that are fully dependent on income from labour and jointly spend a constant fraction c^L of the total GDP *(Y_i)* for any given year *i* such that their joint total consumption amounts to $C^L_i = c^L Y_i$ for any given year *i*. Let's also assume that their joint annual net income L^L_i is annually adjusted for inflation and real growth such that L^L_i is a constant fraction α^L of the GDP *(Y_i)*. This way the budget constraint of all the households that fully depend on income from labour in a closed economy is as follows:

$$C_{i+1}^L + rD_i^L = L_i^L + \Delta D_{i+1}^L \quad (5.47)$$

In words this means that the total consumption of the group of households that fully depend on labour income plus their joint interest payments must equal their income from the prior period plus the amount of new debt they need to borrow to fund the gap. The equivalent continuous time differential equation with $x(0)=0$ wherein $x(t)=D^L(t)/\alpha^L Y(t)$ is the amount of debt of this group of households relative to their joint net income has the following solution:

$$x(t) = \frac{D^L(t)}{\alpha^L Y(t)} = \frac{g}{g-r}\left(1 - e^{(r-g)t}\right) \quad (5.50)$$

Obviously, equation (5.50) disregards defaulting and holds true only for households that fully depend on income from labour and consistently fund nominal growth and interest obligations by borrowing money. Nonetheless it does reveal the main difference between households that fully depend on income and the rest of the public sector (households that own equity and governments). They are unexposed to financial income. Therefore, they have no feedback loop at all from their interest payments. Consequently, their net interest rate *(r_{net})* equals the interest rate they pay for their loans. So in order to maintain a sustainable financial position, the interest rate they pay must be lower than nominal growth. And we all know that this is not the case. Even interest rates on mortgage-backed securities generally exceed nominal growth, let alone all other forms of consumer credit. So even if wages of indebted households without exposure to further career opportunities would grow in line with nominal GDP growth, their growth of consumption must be lower to avoid defaulting. Equation (5.50) captures the essence of debt-financed growth; it is not sustainable unless debt is for free without repayment obligations, which would make it a gift rather than a loan.

If wage increases lag nominal economic growth (which has been the case for most western economies in the past decades) the income-dependent households budget constraint is given by equation (5.54), wherein g^L is the annual wage increase and $\alpha^L_0 Y_i$ is the total net income of these households in year *i.* The last terms on the right side between brackets express the ever-increasing additional funding requirement due to lagging wage increases.

$$\frac{\Delta D_{i+1}^L}{\alpha_0^L Y_i} = g + r\frac{D_i^L}{\alpha_0^L Y_i} + \left[1 - \left(\frac{1+g^L}{1+g}\right)^i\right] \tag{5.54}$$

Inflationary fractional reserve banking and inheritance are main drivers of instability

From the public budget constraint (5.25) we can see that there are two drivers in our current financial system that make the system fundamentally instable. Firstly, due to fractional reserve banking (money creation delegated to commercial banks by issuing loans) the creation of money to fund growth of public consumption is booked against new public debt *(gY'_i)*. This way, all real and inflationary growth of *NDP (Y')* creates an equal increase in public debt.

Secondly, since not all free cash flows are reused for consumption there is a drain of money *($\Theta Y'_i$)* out of the real economy into the financial markets. This amount is also booked against new public debt and hence further drives growth of public debt. Without central banking interference both drivers would inevitably result in deflation and negative nominal growth.

However, western central banks aim for nominal growth including inflation by stimulating borrowing (low interest rates) and injecting money into the financial markets (quantitative easing) instead of directly injecting money into the real economy where the money shortage occurs. Measures that in my view accelerate the increase of public debt and abundance of money in the financial markets. This can only end in negative interest rates and/or public defaults. The artificial growth of the financial sector driven by fractional reserve banking also yields to (1) a brain drain away from the real economy, which slows down real economic growth and (2) an ever-increasing amount of household savings and private sector excess cash, which inflates values of assets in the financial markets.

The third driver of instability in the financial system is low inheritance tax. Whereas debt is largely transferred publicly from generation to generation by government debt, equity and savings are largely inherited through bloodlines. Because return on capital is structurally higher than nominal growth *($r_{capital} > g$)* it enables rich families to live from return on capital and still transfer more wealth than they inherited to the next generation.

1.2.6 So, now what?

In order to develop a financial system that is both stable and ensures fair distribution we should reconsider the way we create money and the way we tax inheritance of capital. Central banks might want to consider annually withdrawing an amount of *$\Theta Y'$* minus a natural increase to compensate aggregated capital gain away from the financial markets by issuing riskless bonds to maintain a balanced amount of money in the financial markets relative to the aggregated value of assets. It could then estimate real growth based on labour volume and productivity increases and proportionally deposit an amount of *gY* on bank accounts of households and government as a gift to maintain price stability (preferably without inflation). Arguably, another part should be reinjected this way to cover for the drain of money from the real economy due to savings (*$\Theta Y'_i$*). This way, the public sector can grow its level of consumption in line with economic growth without borrowing from the private sector, which yields to debt markets driven by natural dynamics (i.e. size and interest rates based on the time value of time and the chances on default). Secondly, annualised inheritance tax rates on capital should be larger than the spread between capital return and nominal growth, such that inherited capital gradually transfers to public ownership over generations. Preferably, inheritance tax is paid in kind, such that the public sector is increasingly exposed to return from capital and public wealth is protected against inflation.

These measures yield dynamics that will drive the financial sector into a sustainable situation with converging inequality, whilst maintaining the incentives for entrepreneurship that currently work so well in capitalism-based economies.