Working paper

Methodology of calculating inflation targets
Sustainable growth equation and principle
Calculating equitable share of economic output
Calculating "bubble" and "contraction" in economy

Grzegorz Pytel

[Updated: 27 June 2022]

ABSTRACT

A key finding in this article is the role of rate-of-loss, ie. measure of risk, in economic system and how it links concepts of inflation, economic growth and equitable share of wealth. We show that inflation tends naturally to be equal to risk, ie. actual rate-of-loss in economic activities. This determines the value of inflation target. We propose how to measure such risk, rate-of-loss, and that it's also a condition for sustainable economic growth. We demonstrate that economic data supports this. We show that this determines what equitable share of wealth (economic output) is. We define and calculate "bubble" and "contraction" in economic system. Using a historical and ideological cliché, we demonstrate that for an economic system to be sustainable in a long-term equilibrium experiencing maximal growth rate, we need as much "Adam Smith" ("liberal") and "Karl Marx" ("socialist") thinking applied to economic policies. We show quantitatively where the balance between providers of capital and providers of labour in share of wealth is for a long-term sustainable economic development.

MOTTO

"Economics is a "right-wing" science which may give "left-wing" answers" (Prof Jon Gruber)

I. Money and time

"Monetæ cudendæ ratio", a paper on coinage written by a Polish Scientist, Nicolaus Copernicus in 1526, proposed a principle: *"bad money drives out good"*. Around half a century later, it was also noted by Sir Thomas Gresham, a financier of Tudor dynasty in Britain, who founded the Royal Exchange. Two hundred years or so earlier, French philosopher, a counsellor of King Charles V, Nicolas d'Oresme, made the same observation.

Today, this is known as Gresham Law (or Copernicus-Gresham Law, unfairly forgetting the French philosopher). It was named by Sir Thomas Gresham in 1860 and popularised by Henry Dunning Macleod. From France, through Poland to Britain, the economic thinking captured by Gresham Law has been with us for at least half a millennium. Before we consider what level of inflation is in equilibrium for optimal economic growth, let's stop and consider some aspects of Gresham Law that would help us understand the nature of inflation and how it's linked to economic growth.

Does Gresham Law talk about fundamental human economic behaviour popularly referred to as *"greed is good"*, and more elaborately described by Adam Smith: *"It is not from the benevolence of the butcher, the brewer, or the baker that we expect our dinner, but from their regard to their own interest. We address ourselves, not to their humanity but to their self-love, and never talk to them of our own necessities but of their advantages."*? To limit Gresham Law to this would be to miss another key point of the law, which is the subject of this article. Gresham Law is also about inflation. Thus, those who argue like Milton Friedman did in 1969, that – for optimal economic growth if a long-term equilibrium is to be achieved - nominal interest rate should be zero and inflation should tend to be zero too, describe an economic utopia, because this would mean that Gresham Law may no longer apply. And - as we'll demonstrate further in this article - this would be a kind of utopia, which Milton Friedman would have described himself as a *"free lunch"*, that is getting an economic benefit without any costs attached to such gain. Thus, we will not only demonstrate - based on other aspects of an economic system - that Gresham Law is true, but also why it is true.

Gresham Law is trivial to understand in the monetary context of commodity money as it was originally observed by Nicolas d'Oresme, Nicolaus Copernicus and Sir Thomas Gresham. It's obvious to see how gold or silver coins lost some of their gold or silver, whether through deliberate theft of metal or because of their usage, wear and tear. In this case, the process of debasing would be widely distributed, risk of tracing theft or loss of value would be minimised. But why should Gresham Law still hold for representative or fiat money? In both cases –

representative and fiat money - the value of money is guaranteed to hold by a trusted party, a bank, a state treasury, etc.

There is a fundamental difference between commodity money versus representative and fiat money. The former is a direct application of full reserve banking in economic activities in every exchange. In fact, it's a form of barter. The latter allows for trust to be stretched from trust in keeping money without decreasing it in its value, ie. full reserve banking, to trust in economic performance reflected in fractional reserve banking, and economically unsustainable process of depleting reserve banking (with its border form of no reserve banking).[1]

Leaving aside a form of banking by assuming full reserve banking approach in this article, any use of both commodity and representative money is a form of bartering. On the other side, fiat money, similarly to representative money, represents trust in the issuer. It's no longer linked to any commodity. Hence, fiat money can be deemed as an abstraction of representative money representing trust in value - not in an underlying commodity - in the economic value of the issuer. This may be deemed as a risk spreading mechanism: from value of a single commodity to the value of the entire economy in which such fiat money is a legal tender (hereafter called money).

The concept of legal tender is vacuous unless there is economic exchange, ie. deals which are settled using legal tender. John Sturt Mill, developed the ideas of David Hume, which Irving Fisher presented as a formula in 1911:

$$MV = PQ \text{ (Fisher's Equation)}$$

This equation captures for a given period:

- M is an average amount of money in economy,
- V which may be described as velocity of circulation of money, is frequency with which a unit of money is exchanged for goods or services,
- P is a price level, and
- Q is quantity of goods or services for which money is exchanged.

We may immediately observe two aspects of money, which are the key in our considerations. Firstly, money is a medium of exchange. As a medium of exchange, it creates

[1] More details:
https://gregpytel.blogspot.com/2010/03/computational-complexity-analysis-of.html
https://publications.parliament.uk/pa/cm200809/cmselect/cmtreasy/144/144w254.htm
https://ethz.ch/content/dam/ethz/special-interest/mtec/chair-of-entrepreneurial-risks-dam/documents/dissertation/master%20thesis/MAS_Thesis_Marina_Stoop_2010_final.pdf

intrinsic costs such as costs of printing banknotes, storing them, distributing them or of performing economic transactions. Whilst for the purpose of our considerations in the article we will ignore such costs, we can observe that such costs are a loss. Eg. there is very little value in having a physical paper as such, and even less value in storing a digital unit of money, unless it may be used. We note this as the fact that there are elements in economic exchange, which inevitably generate loss. Secondly, money especially when stored in a safe and inexpensive (to store) way, may be hoarded to preserve wealth.

At this point we may ask ourselves a question: how much money is needed for efficient economic exchange? We may say that it's easier said than done. The Fisher's Equation gives a static answer. Thus, in this sense, there is always the right quantity of money. Let's take a time factor into account. We still may expect inflation to be zero. If we assume that there is no economic growth, ie. the quantity of goods and services doesn't grow over time, then assume a fixed velocity of exchange (which typically monetarist do, and this argument doesn't limit the considerations in this article), the quantity of money may remain constant. However, if we assume that there is economic growth, ie. people produce increasingly more and/or new goods and services per money unit, and we also assume a fixed velocity of exchange, then the increase in money supply should reflect the increase of quantity of goods and services available for exchange. This leads us to a conclusion that economic growth with zero inflation, is not possible without supplying ("printing") new money for additional exchange. However, maybe it's possible to have economic growth without printing new money? If it is, Fisher's Equation tells us that economic growth with no new money would lead to deflation.

The above also leads us to key observations for our further considerations. If we don't use money as a part of economic exchange – we hoard it instead – we kill economic growth, as there is no money in circulation to pay for newly created goods and services. Or there would be deflation. Taking this argument to extreme, this would mean that economy would become a bartering economy, and – possibly – a new money would be introduced. And if we use less and less money in circulation to pay for more and more goods and services produced, we will have a deflationary effect. And there would be an economic incentive, for those who currently hold money not to spend them on goods and services, as money would keep appreciating just by the virtue of hoarding it. Doesn't it sound like a Friedman's "free lunch"? And there is also a natural phenomenon of loss and waste in economy, least of all costs of exchange like printing and using money, or electronic transactions. How are such costs covered in the process of economic exchange?

Noting this, we move to consider whether inflation is a natural phenomenon needed for economic growth, at what level of inflation the economy would be in a long-term equilibrium. Perhaps Gresham Law didn't only note the greed of human nature is necessary for economic activities, as rationalised by Adam Smith, but it might have a deeper meaning? Maybe it also has a meaning that inflation, a continued depreciation of a medium of economic exchange – money - is also a precondition for sustainable economic growth, balancing incentives of those who provide capital, with those who provide labour and making sure that all costs of production and economic exchange are reconciled in transactions/deals?

II. Inflation

Milton Friedan once said: *"Inflation is the only form of taxation that can be levied without any legislation"*. Some called it more bluntly a *"theft"*[2]. This clearly goes back to the basic meaning of Gresham Law that money loses its value over time. Let's see who is a loser, how much is lost and why?

To analyse this, let's compare three simple scenarios in, say, one year period. The first one is a zero-inflation scenario. The second one, 10% inflation. The third one, 10% deflation.

In the first scenario nobody is worse off or better off. Those who have any disposable income may hoard money with no loss.

In the second scenario, if wages increase in line with inflation (eg. inflation is caused by growing wages, and there is no economic and productivity growth) those who have no disposable income are not worse off or better off. Those who have disposable income face 10% annual loss on their savings. They have incentive to invest money, to find a way to produce new goods or services, to earn extra money which is available due to inflation. Inflation may be indeed seen as taxation or theft. But it may also be described as a penalty for economic inactivity or unproductive use of money and decreasing risk aversion to invest.

In the third scenario, if wages decrease with deflation those who have no disposable income are no worse off or better off. Those who have disposable income are making 10% annually just by hoarding money. It sounds like a free lunch. No economic activity is needed to become richer. In any deflationary scenario – also when there is no wage decrease – free lunch is for everyone who has disposable income. Simply keeping money creates wealth.

By arguing for that and that economy can be in a long-term equilibrium having positive growth, or no growth, Milton Freedman argued that a "free lunch" was possible: keep your

[2] https://fee.org/articles/inflation-is-theft/

money, do nothing and you'll become richer anyway. There is no such a thing as a risk-free investment. It's also accepted that humans are risk averse. Thus, in all the situations inflation creates economic incentives to take a risk and invest. Inflation is a penalty for economic inactivity. Inflation reduces risk aversion to invest.

Let's focus on an aspect of inflation which promotes economic growth. When facing an investment decision, a provider of capital faces risk of losing all or part of invested capital. However, a provider of capital also faces risk of not investing. Inflation is such a risk, if not certainty, of not investing. On the balance, if a rate-of-loss, which measures risk, of not investing is greater than risk of investing, then a provider of capital will invest. If risk of investing is greater than of not investing, then a provider of capital won't invest. Existence of inflation is an incentive for provider of capital to invest without delay, as any delay generates loss. Time factor is critical. If there is inflation, any delay will decrease the value of their capital. It only makes economic sense to accept such decrease of value of capital if rate-of-loss of investing is greater than inflation.

Example 1 – rate-of-loss: incentive to invest:

Let's consider an investment in an economic system with 10% annual inflation rate. For a provider of a capital, rate of loss on capital keeps reducing 10% every year, since by not investing the loss on hoarded capital is 10% every year anyway. If annual inflation is 5% then such rate of loss halves to 5% every year.

Inflation is also an automatic debt reduction mechanism in the economy. It applies to individual debt. More importantly, it keeps writing off debt in the entire economic system.

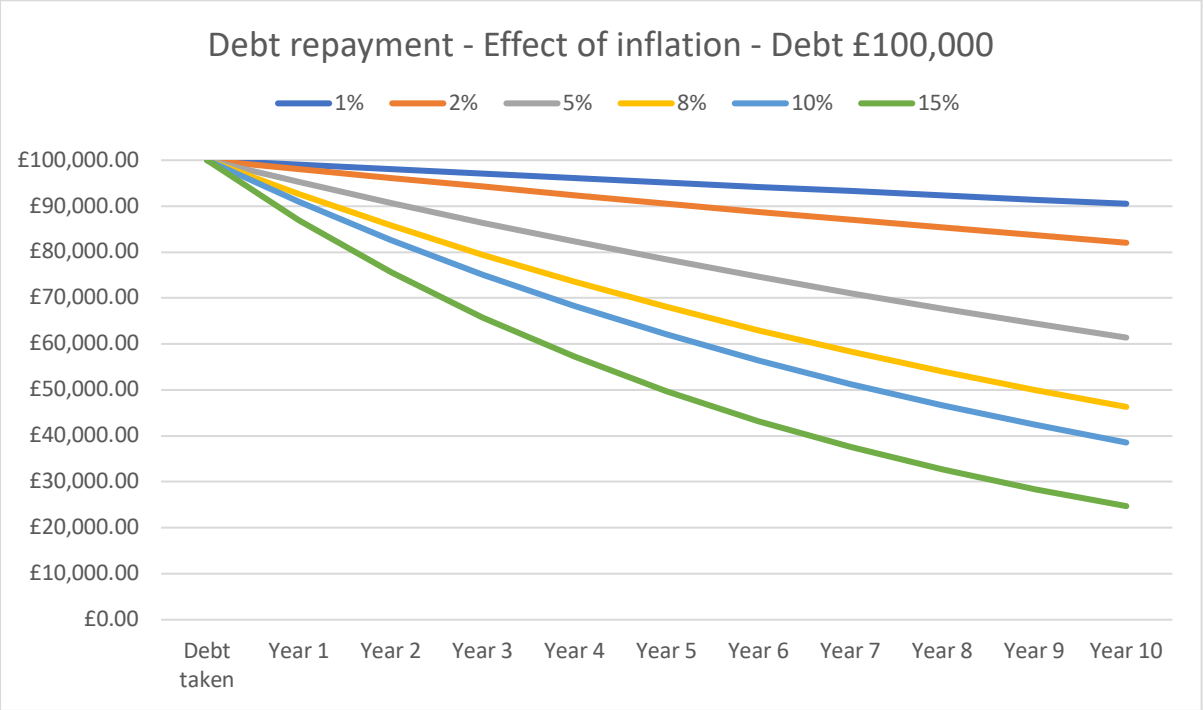
Example 2 – rate of debt reduction: incentive to borrow:

For a user of capital (a borrower), if annual inflation is 10%, any debt is being reduced by 10% every year. Thus, in just over 7 years, half of the debt is written off by inflation. With annual inflation rate of 5%, it would take around 15 years to halve the debt.

Not only does "higher" inflation write off systemic debt over time faster than "lower" inflation, "higher" inflation also limits the systemic indebtedness, and limits individuals getting into high(er) debt in the first place. The quantity of money one can borrow is linked to the ability to service the debt: creditworthiness.

The table below shows how inflation repays debt:

Table 1:



Example 3 – debt servicing, limitation of individual and systemic debt level:

With inflation of 10%, and interest rate linked to inflation, a borrower can borrow around half the amount as when inflation is running at 5%. Eg. let's assume that an individual has £10,000 disposable income. At maximum, with inflation of 10%, such individual can borrow £100,000 and be able to service the debt. (Servicing the debt means paying a provider of capital, debt, at least the quantity of money which covers the loss due to inflation.) With inflation of 5%, such individual can borrow £200,000 and service the debt. With inflation of 1% such individual can borrow £1,000,000 and service the debt. With inflation of 0%, in theory, there is no limit to indebtedness, and all could live their lives at the top standard doing nothing, by simply borrowing money. With deflation, they could use borrowed money to keep repaying the borrowed capital. Zero inflation, and especially deflation, sounds like Milton Friedman's ultimate "free lunch".

This leads us to consider a combined time effect of debt reduction over time and limitation to getting into debt at any one time.

Example 4 – spreading borrowing risk over time:

After just 7 years, with 10% inflation, half of the debt is repaid by inflation. This opens a possibility of taking new debt with ability to service it after some time. It would take twice as long with inflation at 5% to take the same quantity of debt, as with inflation of 10%.

Such a structure, in a natural way, limits indebtedness and promotes spreading it - going into debt - over time, whilst inflation "takes care of" some of the debt. Thus, a combined debt reduction and limitation of indebtedness effect is a systemic mechanism which automatically builds risk portfolios for all actors in economic system: providers of capital and capital users alike.

Furthermore, because of limiting of the indebtedness, higher inflation creates incentives for providers of capital to be equity investors rather than debt providers. This promotes their direct involvement in economic management, becoming directly economically active.

Higher inflation also helps with economic management for those who pay for labour. In real world, wage reductions and redundancies, are significant frictions for efficient management. Clearly, the higher the inflation the more scope for the dynamic management of economic incentives when paying for labour. Those who perform less economically demanded roles, or are less productive in general, get wage increases below inflation rate. So, in reality, it's a wage reduction. Those who perform highly economically demanded roles get wage increases at or above inflation rate, reflecting economic value of their roles. The real increase is that part of increase which is above the inflation rate. This facilitates dynamic self-regulation of supply of labour in different economic roles on a supply side, rather than taking actions by employers on a demand side (wage reductions, redundancies). This helps avoiding conflicts with labour providers, not a minor issue in managing businesses.

There is also a key risk spreading and portfolio building mechanism built into inflationary processes. For both providers of capital, as well as those who borrow, inflation allows them to optimise their risk portfolio not only over time, but also across different economic activities, and manage it.

Example 5 – building investment portfolio underwritten by inflation:

Let's consider investing in 10 businesses with the same risk and business profiles, with 10% rate-of-loss, during the investment cycle period. If during this period inflation is greater than 10% - and 1 business out of 10 will fail and 9 out of 10 will stay viable - then this is a profitable investment portfolio. The debt write-off due to inflation on 10 businesses will cover the failure of 1 business, which failed. The debt of the entire portfolio will stay unchanged, and 9 will be

viable businesses. A loss in such a portfolio, on average, will be covered by inflation, so there will no loss for an investor. With 5% inflation half of the debt would have been covered in the same period. Or it would have taken twice the period to cover the debt. This is a segue to the next chapter of this article by observing, that if the failure rate in this example was half (1 in 20), then 5% inflation would have had the same effect. Thus, it's economic risk, rate-of-loss, which is the key in our analysis in our aim to calculate the inflation target. Ie. it's a role of inflation to pay for rate-of-loss, risk resulting failure, in economic system. This will be at the centre of our analysis in deriving inflation target equation in the next chapter.

We can consider every economic system as a wide ongoing investment portfolio of all economic actors. Inflation discourages hoarding money, encourages investment and economic activity, penalises economic inactivity, rewards those who are innovative and productive and penalises those who are not. Inflation is also an automatic mechanism to build a risk portfolio, spreading the risk in time and across different economic activities amongst all economic actors. Deflation is a "free lunch": economic inactivity like hoarding money is rewarded.

It should be clear that inflation is conducive to economic growth. A naïve approach would suggest that the higher the inflation the better it is for economic growth. Is there no limit? Clearly, intuitively and, in reality, this can't possibly be true.

Policy makers around the world agreed that inflation of around 2% is good for promoting economic growth. Despite theories which were promoting zero inflation, or even deflation, as good for economic growth, it's been widely accepted that some inflation is good. However, there is no consistent theory, or a model, which justifies inflation targets.[3] It looks like a naïve approach to keep inflation as low as possible, without getting into a deflation. In the next chapter, we will consider how we can calculate the long-term inflation targets. They will be different for different economic systems and may be changing over time. And they have justification within economic systems: as there are risks which are realised in economic activities, such as failures, losses, market frictions, etc. inflation is a price paid for such losses. Inflation is the other side of equation of risk, ie. rate-of-loss, in economic system.

Further considerations, which are beyond the scope of this article, can lead us to demonstrate why low inflation and low interest rate create a false perception as if borrowing money is cheaper than when inflation and interest rates are high. It's also worth economic

[3] https://www.bankofengland.co.uk/-/media/boe/files/ccbs/resources/state-of-the-art-inflation-targeting.pdf?la=en&hash=313130B91A7F12BD730BCA3D553E0FF9C440DB4A page 8

incentive analysis to figure out why providers of capital don't like high(er) inflation. In a nutshell, it exposes them to higher rate of loss (by hoarding money), limits their market as there is more money on the market due to inflation. Inflation directly competes with providers of capital and, if they refuse to compete, decreases their capital. However, additional money which causes inflation is not free money. It's not a "free lunch". We will explain this in the next chapter of this article too.

III. Inflation target equation

We consider economic system as a 2-period production system whereby an economic output at t_1 is the outcome of economic processes applied to input at the start of the period at t_0.

Let's assume that economic system operates in a one-step cycle between t_1 and t_0. Ie. we look at economic system as discrete production steps between input and output, taking into account inflation between the time of input, t_0, and the time of output, t_1. We also use a representative firm model to approximate whole economic system assuming that the firms are the same in terms of their preferences, risk appetite, productivity, efficiencies, etc.[4]

In such economic system, production process starts at t_0 when a capital provider provides capital for a production process. The production process ends at t_1 when a provider of labour gets paid for provision of labour by the provider of capital. We note that at t_0 a provider of labour has an opportunity to provide capital and be a provider of capital if it's more beneficial than being a provider of labour being paid at t_1. Similarly, if it was more beneficial for a capital provider to become a provider of labour, the capital provider would become a labour provider.

In economic system with perfect competition market structure, there are no barriers of entry and no barriers of exit, and all economic actors have perfect information. Therefore, any economic actor can choose instantly whether to be a provider of capital or a provider of labour, depending which choice is more profitable. At the equilibrium both roles are equally profitable. A capital provider expects any losses to be covered (such losses are described as "rate-of-loss measure of risk") and get a (net) share of growth, ie. a share of wealth created by the production process. A provider of labour expects to get a (net) share of growth adjusted for inflation. Therefore, under perfect competition market structure, all providers of capital and labour get the same share of growth, of added value in economic activities. Otherwise, they would switch their roles.

[4] https://www.jstor.org/stable/2553302

Let's V denote the value of input into or output from economic system. After a period, when the output is produced, the value of the input is:

$$V (1 + c)$$

where c covers all costs of input. For example, an interest rate during the production, expressed as a proportion of the value of input as c. (1 is a normalising constant, if we express c in percentage.) This is what a provider of capital will get as an economic actor in money terms, with return calculated as: $V (1 + c) - V$. c may be broken down as follows: $c = l + gr_1$, where l is a rate-of-loss, ie. measure of risk, and gr_1 is a net return, ie. the real growth adjusted for inflation. The equation: $V (1 + c) – V$, represents *Return on Capital* in economic system.

At the time of output, the value of output is:

$$V (1 + r)$$

where r is the return on the input, a production output, that is the sum of inflation and net growth, net profit expressed as money: $r = i + gr_2$. The equation: $V (1 + r) – V$ represents *Return on Labour* in economic system.

We use a representative firm model to approximate the whole economy. In a perfectly competitive economy, in a long-term, at equilibrium, $gr_1 = gr_2$.[5] $gr_1 = gr_2 = gr$, where gr is the average growth in the economic system, which is the same for all economic actors. It should be noted that return of providers of capital is not limited to growth of economic system, gr. They also "benefit" from l. But under perfect competition market structure, l covers only the loss resulting from risks realised in economic system. Otherwise, it would be a part of gr.

Combining the value of the input after a period – between input and output time - the value of the output, we get:

Input = $V (1 + l + gr)$, accounting also for costs of capital, generates after a "period of time" on producer's side: Output = $V (1 + i + gr)$ expressed in money terms, that is:

$$V (1 + l + gr) \rightarrow^{inflation(\Delta t)} V (1 + i + gr)$$ where Δt is a period between t_0 and t_1.

[5] This is implied directly by free entry and exit conditions and access to perfect information under perfect competition market structure to all economic actors.

this is an input - output transition: a production process. As providers of capital must have the same value of gain as providers of labour at equilibrium (otherwise, they would switch between the roles):

$$V\,(\,1 + l + gr\,) = V\,(\,1 + i + gr\,)$$

$$1 + l + gr = 1 + i + gr$$

which we can simplify and rearrange to:

Inflation Target Equation:

$$\boldsymbol{i = l}$$

Inflation in economic system = Rate-of-loss measure of risk in economic system

ie. given market structure of perfect competition, without any external intervention, inflation in economic system offsets loss on the input in the production process, and all economic actors benefit equally from economic growth.[6] The Inflation Target Equation sets out what an *invisible hand* of perfectly competitive market would have done.

Thus, bearing in mind consideration in the previous chapter (ie. inflation prevents from capital hoarding, spreads risks in time and amongst economic actors, etc), we can conclude that inflation provides money into economic system, which reconciles economic frictions, inefficiencies and losses. *"There ain't no such thing as a free lunch."* Exactly. Any loss, costs of market frictions and inefficiencies in the system must be covered. And inflation pays for them. Thus, an inflation target in any economic system (eg. a country such as the United States) must be set to equal a risk, ie. rate-of-loss, rate of failure, in the economy. This was indicated by Example 5 in the previous chapter. We suggest revisiting this example.

There is a practical consideration related to the above statement. In the same way, as there is no perfect method to calculate inflation – what to include and in what proportion in a "basket" of goods and services, and how frequently "basket" must be re-calibrated to be representative – calculating rate-of-loss, as a measure of risk, in any economy is equally

[6] Perfect competition implies that *Return on Capital* is equal *Return on Labour*. Without costs of entry and exit economic actors would switch to activity with the highest return. Zero profit, under perfect competition, doesn't imply zero growth. It implies equitable share of growth, an issue dealt with further in the article.

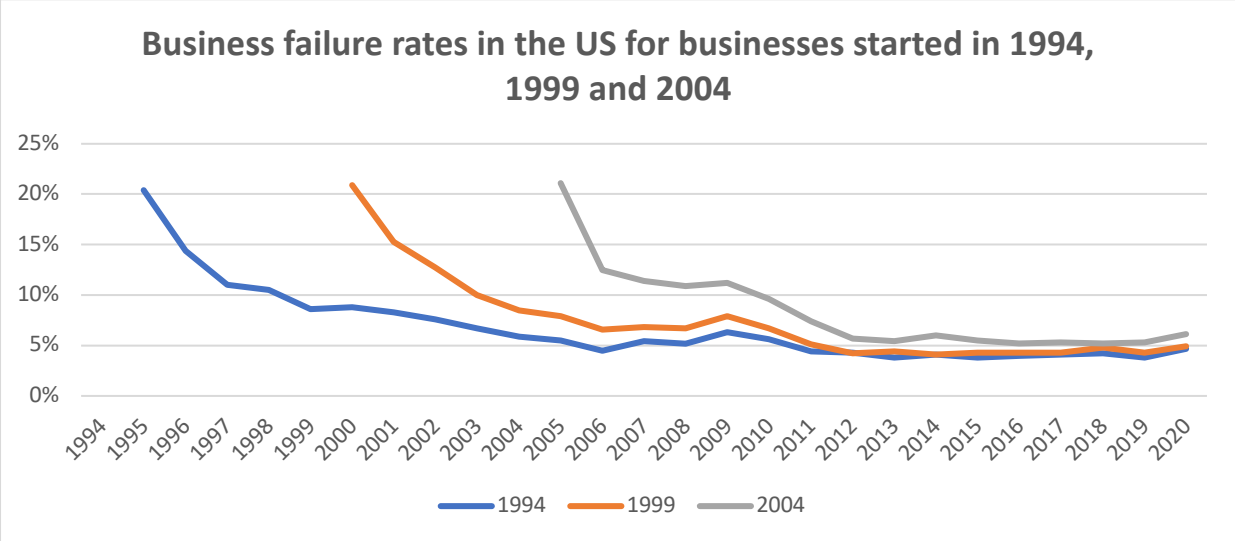
challenging. But, for practical reasons, it doesn't have to be ideal. It must be representative in the same way as calculating of inflation must be representative. The next chapter indicates that, in the US, data showing reliable rate-of-loss, as a measure of risk, in the economy already exists and is readily available.

IV. Calculating inflation target – data analysis

Below is the first shot of reliably calculating rate-of-loss as a measure of risk in the United States economy. We acknowledge that such method of calculations requires further research. Nevertheless, the method developed below appears to be credible and likely to be closely representative of risk, rate-of-loss, in the US.

Appendix 1 contains a print-out of *"Survival of private sector establishments by opening year"* from the US Bureau of Labor Statistics[7]. A basic examination of data allows us to assume that after 12 years, or even less, business failures stabilise (failure rate defined as 100% minus survival rate). This allows us to assume that further failures aren't related to initial start-up phase of business but are becoming representative of rate-of-loss, as a measure of risk, in an economic system as such. Table below shows a failure rate in the US of businesses started in 1994, 1999 and 2004:

Table 2:



There are many ways of conducting statistical analysis of the date of business failure rate. We try to keep it simple. Below, are first basic observations:

[7] https://www.bls.gov/bdm/bdmage.htm (Table 7. Survival of private sector establishments by opening year)

- The graphs indicate a nearly horizontal asymptotic stability of business failure risk after not more than 12 years since start-up.
- It looks that failure rates for business started in 1994 and 1999 converged in around 2012, whilst failure rate for businesses started in 2004 remained a bit higher. This may be a coincidence. But it may be indicative that the systemic risks started affecting businesses started in 2004 more than older businesses were affected. For example, this may be related to the types of funding and risks related to financing of companies in a long-term (for example, a shift from equity financing to debt financing?)
- It looks that since 2019 failure rates for businesses started in 1994, 1999 and 2004 all increased. This may be a blip. But the fact that it increased for all three groups suggests that it may be indicative of the increased systemic economic risk developed in the US economy.

To calculate a representative economic systemic rate-of-loss, a measure of risk, in the United States, we adopted the following methodology:

- For each year between 2011 – 2020, we calculate a geometric average of failure rates in each year for all business sets, grouped by the year of start-up, which are at least 12 years in operations (ie. as per our assumption that after 12 years, businesses achieved asymptotic stability with respect of their start-up phase, hence failure rate may be assumed to be representative of all businesses with respect to systemic and operational risks).

Table 3:

Year	Failure: risk, rate-of-loss
2011	4.73%
2012	4.23%
2013	4.09%
2014	4.21%
2015	4.26%
2016	4.36%
2017	4.47%
2018	4.83%
2019	4.55%
2020	5.47%

This analysis suggests that inflation target between 2011 and 2019 should behave been between 4% and 5% (4.4% on average) raising to above 5% in 2020. This is not that surprising. Or does it sound outlandish? In 2010, although his key argument was different, Olivier Blanchard proposed inflation target in the US of 4%[8]. Using different methods than used in this article, Phuong V. Ngo proposed the US inflation target 3.5% to 5%.[9] Both appear to be consistent with and supported by the analysis presented in this article.

The above also justifies a concept of inflating out of debt, ie. reducing debt by eroding it thanks to inflation. This would not only be by a way of debt reduction but also by readjusting response to rate-of-loss, ie. prevailing risk, in economy. However, as the next chapters will show, there is a limit to the extent inflating out of debt will lead to a long-term equilibrium, as it may lead to what's called popularly a "bubble". (We will define then what a "bubble" means in quantitative terms.) Thus, this will confirm further the assertions made in this article that the role of inflation is to balance rate-of-loss, ie. risk, in economic system. The policymakers should set an inflation target equal to rate-of-loss in economic system, so inflation may absorb the loss. From this angle, we may see the advantage of fiat money over commodity or representative money. The latter two are real goods. Therefore, they can't absorb rate-of-loss, risk, as such, because they have intrinsic value. For this reason, we may think that what Copernicus or Gresham observed - debasing a currency - may have been driven by a more fundamental, and stronger, economic force than Smithian individuals' greed. That is by the need in economic system to reconcile rate-of-loss, risk, of economic activities.

We may reflect whether the above-mentioned risk, rate-of-loss, of the US businesses between 2011 and 2018 is consistent, if not (negatively) correlated, with decrease of the US GDP (whilst inflation was decreasing too). Ie. as the increased rate of failure wasn't balanced by increased inflation, GDP growth rate kept falling.

We may also consider using equity risk premiums as representative of rate-of-loss measure of risk. Aswath Damodaran developed a methodology[10] and calculated such premiums for a number of countries[11].

Such an approach has certain intrinsic weaknesses. In the past, credit rating agencies were not necessarily the best source of estimate of risks. The same applies to accuracy of using CDS' as a measure of risk, especially that CDS' have a built in economically perverse

[8] https://voxeu.org/article/rethinking-macro-policy
[9] https://class.csuohio.edu/sites/csuohio.edu.class/files/32.pdf
[10] https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3825823
[11] https://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/ctryprem.html

mechanism of allowing to insure a risk above its value (thereby creating an objective economic perverse incentive for such a risk to materialise, especially if there is a way of influencing this by those who insure such risk above its value). However, due to the global character of financial markets, with all their arbitrage mechanisms, this approach has its intrinsic consistency and is complete, underpinned by well-founded methodology. This is its strength.

The results of using Damodaran's approach give us the rate-of-loss measure of risk in the US at 4.24% for 2022. This compares to the average 4.41% for the years 2011 - 2020 calculated in this article using the previous method based on the rate of survival of private businesses in the US. Whilst the former reflects the markets perception *ex-ante*, the latter is its *ex-post* verification. It's encouraging to see such close results obtained using these two methods for close, albeit different, time periods.

Damodaran's approach also allows us to calculate the rate-of-loss measure of risk for different countries using country default spreads. This is in the column "Equity Risk Premium" of the table "Country Default Spreads and Risk Premiums" in Appendix 2. The data in this column passes a basic sense check. We would normally expect the rate-of-loss measure of risk between 5% - 10%. This means that inflation should match this to compensate for such rate of loss / risk. If the rate-of-loss measure of risk is above 10% clearly the economy is not healthy. Indeed, the table shows that this is the case with countries regarded as having less than healthy economies. And if the rate-of-loss measure of risk is above 15%, and more, such countries are in trouble. This makes our inflation – rate-of-loss measure of risk model look consistent.

V. Further analysis of inflation targets

Appendix 3 contains graphs generated using GDP growth rate and inflation rate data for up to more than 50 years obtained from World Bank[12] for many countries in the world, for developed economies and several other countries. They show 5 year moving averages of GDP growth rate and inflation rate. (The choice of countries was random. The only bias was towards subjectively "better known" countries by their names and for having all major economies.)

After basic (visual) analysis, some conclusions appear to be inescapable:

- For the last 40 years or more, nearly all developed economies, and many other economies, have inflation rate decreasing and GDP growth rate decreasing too. At least for the last decade the inflation rate in the United States is below 4% - 5% rate, below what would reflect risk, rate-of-loss. (We assume that generally rate-of-loss in

[12] Eg. https://www.macrotrends.net/countries/NOR/norway/inflation-rate-cpi

other developed economies shouldn't be lower, or much different than in the US.) Shouldn't inflation rate, hence inflation targets, in these countries be higher than the actual inflation targets?

- Poland and Ireland seem to be an exception from this trend. However, it's easy to identify exogenous developmental factors which would explain why these countries don't follow the general trend.
- Switzerland also appears to be an exception. However, considering the position of Swiss currency, and being a very low risk economy, it appears that data for Switzerland example may be considered to confirm the analysis.
- Turkey and Nigeria are a good example how high inflation may be associated with stable economic long-term growth. In fact, Turkey and Nigeria examples may be considered to confirm the analysis as they are assessed as high-risk countries for investors. And this high risk appears to be well reflected in high inflation rate. The data in Appendix 2 for Turkey and Nigeria appear to confirm this analysis, bearing in mind that this is an estimate at a point in time of January 2022.
- India and Pakistan are also interesting examples. In India, the inflation trend of around 8%, slightly downward, is associated with a steady growth rate. This may be explained, and there are arguments to justify it, that risk / loss rate in India keeps going down, whilst inflation is in territory, based on the US example, which reflects such risk / loss rate. On the other side, Pakistan average inflation rate (if we compare with Turkey) may still be too low for risk / loss rate there. Hence, there is a GDP growth downward trend in Pakistan. The data in Appendix 2 for India and Pakistan appear to confirm this analysis, bearing in mind that this is an estimate at a point in time of January 2022.
- We conducted the same analysis on different time windows for GDP growth rate and inflation rate data for these countries. It led to the same preliminary results.
- This is a complex system with spill overs and feedbacks, like general equilibrium. For example, inflation rate volatility is likely to increase risk, rate-of-loss, in economic system. Thus, stabilising inflation at a certain level, leads to the inflation level being reduced, because lower volatility decreases risk, rate-of-loss and, therefore, needs to be balanced with reduced inflation rate.
- The overriding conclusion from analysing the graphs in Appendix 3 seems to confirm that to achieve stable economic growth, we should expect higher inflation rate in more risky economies than in lower risk economies. As it looks, we are unlikely to expect

extraordinarily high levels of inflation targets. It looks we may expect a very low inflation target in exceptional cases like Switzerland, with inflation target c.4% - 6% for the US which can't be regarded as high inflation, similarly for the UK, with somewhat higher interest rates for developing and emerging economies, c.8% - 14%, again not historically unusually high. It doesn't look like a dramatic change. However, due to compounding effect of exponential processes, which we will deal with in the next chapter – "bubble" and "contraction" - it will make a huge difference for economic development over time. Each country, each economy, must be analysed taking her own circumstances into account. And let's not forget, the precise method for calculating rate-of-loss as a measure of risk – like calculating inflation rate - must be developed and empirically tested. The above analysis is indicative. But we can note that data for the US provided encouraging results.

The above is a very sketchy analysis. It alludes to various countries, and their economic circumstances, and different time periods, and a way how to calculate what inflation targets should be in different countries to facilitate economic growth. The analysis in this article seems to be confirmed in the Bank of England document prepared by Gill Hammond:
"[…] Balassa-Samuelson effects imply that optimal inflation in [developing and emerging] countries should be a little higher than in industrialised countries."[13]

VI. Sustainable growth principle

Now we aim to show that arguments presented in the previous chapters let us analyse economic system and its stability from both growth mechanism and wealth distribution perspective.

It's commonly accepted by economists and policymakers that low inflation promotes economic growth. That's why - we can say - practically all economic policies try to promote low inflation. However - agreeing that what's commonly regarded as good economic growth must be associated with low inflation - this approach is not entirely correct and in fact it may be misleading in understanding the underlying phenomena. As we discussed in the previous chapter, low risk in economic system will lead to low inflation. It's low risk which promotes economic growth by encouraging economic activities for the following reasons: the greater the risk the more diverse risk portfolio and capital needed to absorb any adverse events. Thus, the

[13] https://www.bankofengland.co.uk/-/media/boe/files/ccbs/resources/state-of-the-art-inflation-targeting.pdf?la=en&hash=313130B91A7F12BD730BCA3D553E0FF9C440DB4A page 8

barrier of being economically active as a provider of capital keeps increasing as risk keeps increasing (and vice versa). Consequently, the higher the risk the lower the economic activities, and competition amongst economic actors. And this negatively affects growth.

There is also a feedback loop between risk in economic system and inflation itself. If risk is low economic actors are prepared to invest due to low risk. They don't need high(er) inflation to push them to invest. However, if risk is high(er) then increased inflation is needed to push economic actors to take such risk and invest because inflation is worse of the two evils. However, for a rational provider of capital, the greater the risk the more diverse risk portfolio is needed. Some economic actors with little capital to absorb any loss, won't invest, thereby lowering the growth. Thus, lowering the risk, which will manifest itself in lower inflation, will increase activities of economic actors leading to economic growth. However, using inflation control mechanism to promote economic growth, such as setting interest rate by central banks, is one element of risk control in economic system.

Thus, we conclude that risk should be lowered in economic system as it will lead to increased growth with lower inflation as a result. Such thinking typically leads to promoting more business-friendly policies, more favourable to providers of capital (than providers of labour). The sustainable growth equation let us understand quantitatively the limits of being business-friendly and identify the point when being too business-friendly starts backfiring.

Let's consider *Base* as the current value of economic system, the current output. We will also call it in the analysis later *Initial endowment*. From capital provider's perspective, we can calculate the present value of *Base* expected after time *n*:

$$Base(n) = Base\frac{1}{(1+r)^n}$$

For a capital provider a return rate *r* equals: *l*, rate-of-loss measure of risk, plus *gr*, expected growth. The future expected value is however affected by the output delivered by providers of labour, those who employ this capital and "make it work" to generate output, create wealth:

$$Base(n) = Base\frac{(1+r)^n}{(1+l+gr)^n}$$

For a provider of labour, a return rate *r* equals: *i*, that is inflation after period *n*, plus expected growth, value added by a labour provider:

$$Base(n) = Base\left(\frac{1+i+gr}{1+l+gr}\right)^n$$

Sustainable[14] Growth Principle:

for economic growth to be sustainable, far all *n* defined as number of time periods then *i* = *l* (Inflation = Rate-of-loss measure of risk) and:

$$\boldsymbol{Base(n) = Base}$$

If this condition isn't satisfied this means that for an endogenous perfectly circular economic system the net present value of the economic system in the future (after period *n*, with *n* going to infinity) would either race to infinity (which would be a "bubble" effect) or would race to zero (a "contraction" effect, economic activities keep dying, which is possible, but it's not sustainable either), in both cases at exponential pace.

This means that whilst there may be growth in economic system (growth in output generated from input), expressed as *gr*, the value of *Base* must remain unchanged. *Base* can also be considered as *Initial endowment*, gross domestic product in economic system (first input at the start of measuring the process), which can't change as a result of economic activities as it is fixed at a starting point. In our analysis, *Base* looks like "*Index = 100*" assumed as the starting value to measure inflation in base year.

The above model is based on assumption of economic system being endogenous satisfying perfect competition market structure assumptions. Let's now extend this model to take exogenous effects into account. Referring to the *Base* period, let's call our starting value of the economy, initial *Base*, *Initial endowment*, gross domestic product, at year 0.

$$EV_0 = EV_0^+ = Initial\ endowment\ /\ Gross\ Domestic\ Product$$

The current value of economic system taking into account any subsequent periods - after a period number *n* – may be considered as a new endowment for the next period, say period *n*:

[14] The notion of "sustainable" in this article is a counterpart of a concept of "tractable" in complexity and computability theory.

EV_n. We don't assume that there is the same rate-of-loss measure of risk, growth or inflation rate in every period. EV_n can be calculated using the following recursive equation:

$$EV_n = (EV_{n-1} + EV_n^+)\left(\frac{1 + i_n + gr_n}{1 + l_n + gr_n}\right)$$

EV_{n-1} is endowment, gross domestic product, inherited, from the period preceding period *n*.

$EV_n^+$is an additional endowment that was added into economic system during period *n*. This may be a result of, such things as:

- Innovation
- Productivity improvements
- New resources

The fact that $EV_k^+ < 0$ has the same effect on the current value of economic system as $\left(\frac{1+i_k+gr_k}{1+l_k+gr_k}\right) < 1$ shows us that negative additional endowment during a given period has the same effect as the share of output by providers of capital was greater than providers of labour. Ie. if providers of the capital have too big a share of the output, they are subtracting wealth from economic system. And if providers of labour were to have too big a share, this would be a bogus value: empty money added to the inflation rate.

General Sustainable Growth Principle:

extending Sustainable Growth Principle for economic system with exogenous effects:

$$\left(\frac{1 + i_k + gr_k}{1 + l_k + gr_k}\right) = 1$$

is a condition for optimal growth. If not and this condition isn't satisfied, it has an exponential, compounding effect on the economic base – overinflating or contracting it - over time periods. The numerator in this equation expresses the share of the output by providers of labour and the denominator expresses the share of the output by providers of capital in period *k*. It should be noted that under perfect competition assumptions, with no barriers of entry or exit, perfect information, etc, every economic actor may freely choose to a provider of labour or provider of capital.

The General Sustainable Growth Principle let us consider present value of economic system, after *n* periods, further:

$$EV_0 = EV_0^+ = Initial\ endowment$$

$$EV_n = (EV_{n-1} + EV_n^+)\left(\frac{1 + i_n + gr_n}{1 + l_n + gr_n}\right)$$

This recursive formula has the form of a non-deterministic, pseudo random (quasi) Fibonacci Sequence with EV_{n-1} known at the outset of period *n*, and with other variables having pseudo random characteristics.

There is a catch in this formula, also for politicians and policy makers. It doesn't seem immediately obvious when $EV_n > EV_{n-1}$ whether this is a result of positive EV_n^+, ie. a genuine growth factor, or is a result of $\left(\frac{1+i_n+gr_n}{1+l_n+gr_n}\right) > 0$, ie. a "bubble" effect, or both. Similarly, when $EV_n < EV_{n-1}$, it's not immediately obvious either whether this is a result of negative EV_n^+, ie. a genuine negative impact factor or is a result of $\left(\frac{1+i_n+gr_n}{1+l_n+gr_n}\right) < 0$, ie. a "contraction" effect, or both. In the next chapter, we will see how to calculate both "bubble" / "contraction" effect for economic system, and how gr relates to measurable gross domestic product, GDP, growth (called MGr).

General Sustainable Growth Principle shows us that sustainability is about avoiding the present value - calculated in a form of pseudo random (quasi) Fibonacci Sequence - being exponentially divergent to infinity or exponentially convergent to 0 (zero) – ie. having runaway, exponential, compounding properties – and present value having a linear characteristic of the sum of all new endowment inputs into economic system in *n* periods:

$$EV_n = \sum_{k=0}^{n} EV_k^+$$

that is present value of *n* periods of economic system.

The General Sustainable Growth Principle extends the Inflation Target Equation:

$$i = l$$

Inflation in economic system = Rate-of-loss measure of risk in economic system

making it valid in economic systems with exogenous effects, as period may be arbitrarily short or long, depending in what unit of time we want to measure economic processes. It also shows consistency between conditions for sustainable short-term economic growth and sustainable long-term economic growth.

Equitable share, fair share of economic output

If we assume that the intrinsic aim of economic system is to maximise its growth, Sustainable Growth Principle may be regarded as a definition, with justification, what fair share, or equitable share, must be in economic system between providers of labour and providers of capital.

VII. "Bubble" and "contraction" of economic base

Now we define, by a way of equation, a concept of "overinflation", which is also called a "bubble", and show how to calculate it. When overinflation is below *0*, zero, we will refer to such overinflation as "contraction" (of the economic base).

When we empirically calculate economic growth, growth of gross domestic product, we do it based on the output which we can observe and measure. That is:

$$MGr = \frac{EV' - EV}{EV}$$

where:

- MGr is the measured economic growth rate, rate of increase of gross domestic product: GDP growth rate,
- EV' is the measured endowment value, it's a gross domestic product, GDP, or value of the economic base, at the end of the period (of growth measurement),
- EV is the measured endowment value, it's a gross domestic product, GDP, or value of the economic base, at the start of the period (of growth measurement).

We note that as EV' can't be less than *0*, zero, then MGr can't be less than -*1* (less than -100%). Ie. in any given period, the economic base may disappear, but it can't be negative. This will be important characteristic in our further analysis.

Next, we define:

$$EV' = EV^*(1 + gr)$$

EV^* is the adjusted initial economic base at the start of the period of growth measurement, compensated for a bubble or contraction effect when $\left(\frac{1+gr+i}{1+gr+l}\right) \neq 1$. gr is the economic growth resulting from applied production methods such use of new resources, use of new innovative tools, etc. New, or additional endowment, EV^+, is a new resource added. Economic growth gr measures how it is used, applied as a part of production process, and it also measures the effect of EV^+on growth, gr.

$$EV' = EV\left(\frac{1 + gr + i}{1 + gr + l}\right)(1 + gr)$$

Thus,

$$MGr = \frac{EV\left(\frac{1 + gr + i}{1 + gr + l}\right)(1 + gr) - EV}{EV}$$

$$MGr = \left(\frac{1 + gr + i}{1 + gr + l}\right)(1 + gr) - 1$$

We note that if $\left(\frac{1+gr+i}{1+gr+l}\right) = 1$ then $MGr = 1 \cdot (1 + gr) - 1$ that is $MGr = gr$

Let's denote:

$$Gr = 1 + gr$$

$$MGr = \left(\frac{Gr + i}{Gr + l}\right)Gr - 1$$

$$MGr = \frac{(Gr + i)Gr - (Gr + l)}{(Gr + l)}$$

Thus, we can calculate Gr and as $gr = Gr - 1$

$$Gr^2 + (i - MGr - 1)Gr - l(MGr + 1) = 0$$

$$Gr = \frac{-(i - MGr - 1) \pm \sqrt{(i - MGr - 1)^2 + 4l(MGr + 1)}}{2}$$

$$gr = \frac{-(i - MGr - 1) \pm \sqrt{(i - MGr - 1)^2 + 4l(MGr + 1)}}{2} - 1$$

$4l(MGr + 1)$ is always greater than *0*, zero, then $-(i - MGr - 1) + \sqrt{(i - MGr - 1)^2 + 4l(MGr + 1)} > 0$. The only valid solution is:

$$gr = \frac{-(i - MGr - 1) + \sqrt{(i - MGr - 1)^2 + 4l(MGr + 1)}}{2} - 1$$

as otherwise EV' would have contracted by more than 100%, since $EV' = EV^*(1 + gr)$, which is not possible, ie. an economic system with negative *Initial endowment* value, gross domestic product, is not possible to exist.

A Bubble, overinflation greater than *0*, zero, ie. $MGr > gr$:

We may define and calculate a bubble in economic system as follows:

$$Bubble = MGr - gr = MGr - \left[\frac{-(i - MGr - 1) + \sqrt{(i - MGr - 1)^2 + 4l(MGr + 1)}}{2} - 1\right]$$

$Value_{of_{Bubble}} = Bubble \cdot EV$, ie. $Value_{of_{Bubble}} = Bubble \cdot GDP$

A Contraction, or cooling, overinflation less than *0*, zero, ie. $MGr < gr$:

We may define a contraction, cooling off, of economic system as follows:

$$Contraction = gr - MGr = \left[\frac{-(i - MGr - 1) + \sqrt{(i - MGr - 1)^2 + 4l(MGr + 1)}}{2} - 1\right] - MGr$$

$$Value_{of_{Contraction}} = Contraction \cdot EV \text{ or } Value_{of_{Contraction}} = Contraction \cdot GDP$$[15]

We note that if $\left(\frac{1+gr+i}{1+gr+l}\right) = 1$, that is General Sustainable Growth Principle condition is met, then $MGr = gr$ and $Bubble = Contraction = 0$ and $Value_{of_{Bubble}} = Value_{of_{Contraction}} = 0$

Thus, as we can empirically measure:

- economic growth, gross domestic product growth, MGr,
- endowment value, ie. gross domestic product,
- inflation, i, and
- rate-of-loss measure of risk, l

we can also measure and monitor any bubble or contraction, and their values in the system.

A bubble is a fake value in economic system. It doesn't exist. But it's perceived to exist. Since it's growing with exponential characteristics, a bubble must burst. A contraction is a loss. It's an outcome of not maximally using the economic base: the endowment, the resources available to economic actors. Both phenomena are a result of suboptimal, inequitable, share of the economic output against by General Sustainable Growth Principle condition. Bubble and contraction are a measure of inequity in economic system.

Example:

Based on the data referred to in this article and available at the World Bank[16], the table below shows the value of contraction of economic base in the United States between 2011 and 2020, due to inequitable share of gross domestic product (GDP data for a preceding year).

Table 4:

Year	*Risk, rate-of-loss (l)*	*Inflation (i)*	*GDP Growth Rate (MGr)*	*EV = GDP (in billions)*	*Bubble / Contraction (%)*	*Value of Bubble / Contraction (in billions)*
2011	4.73%	3.16%	1.55%	$14,992.05	1.50%	$224.69
2012	4.23%	2.07%	2.25%	$15,542.58	2.07%	$321.91
2013	4.09%	1.46%	1.84%	$16,197.01	2.53%	$410.38
2014	4.21%	1.62%	2.53%	$16,784.85	2.49%	$417.90
2015	4.26%	0.12%	3.08%	$17,527.16	3.98%	$697.11
2016	4.36%	1.26%	1.71%	$18,238.30	2.98%	$542.59
2017	4.47%	2.13%	2.33%	$18,745.08	2.25%	$421.09
2018	4.83%	2.44%	3.00%	$19,542.98	2.29%	$447.40
2019	4.55%	1.81%	2.16%	$20,611.86	2.62%	$541.01
2020	5.47%	1.23%	-3.49%	$21,433.22	4.03%	$862.75

[15] GDP is gross domestic product, endowment value, ie. $GDP = EV$

[16] https://www.macrotrends.net/countries/USA/united-states/gdp-gross-domestic-product and Chapter IV of this article explains "rate-of-loss measure of risk". Legend for the terms in the header of the Table 4 is on page 21.

The table below shows the actual GDP growth in the US between 2011 and 2020, and what would have been the maximum optimal growth – ie. without "bubble" / "contraction" effect – if, *ceteris paribus*, there was equitable share of wealth in economic system in the US in those years. This looks like a significant, but realistic, lost opportunity, systemic loss of wealth.

Table 5:

Year	***Growth (MGr)***	***Inflation (i)***	***Risk, rate-of-loss (l) / optimal inflation (i) / equitable share of wealth***	***Optimal growth if there was equitable share of wealth***
2011	1.55%	3.16%	4.73%	3.05%
2012	2.25%	2.07%	4.23%	4.32%
2013	1.84%	1.46%	4.09%	4.37%
2014	2.53%	1.62%	4.21%	5.02%
2015	3.08%	0.12%	4.26%	7.06%
2016	1.71%	1.26%	4.36%	4.69%
2017	2.33%	2.13%	4.47%	4.58%
2018	3.00%	2.44%	4.83%	5.29%
2019	2.16%	1.81%	4.55%	4.78%
2020	-3.49%	1.23%	5.47%	0.54%
Average	***1.70%***	***1.73%***	***4.52%***	***4.37%***

The optimal growth in the table above may look (to some) a bit too high. Thus, we may compare optimal growth results above to a different 10 years in the US economy.

Table 6:

Year	***Growth (MGr)***	***Inflation***
1983	4.58%	3.21%
1984	7.24%	4.30%
1985	4.17%	3.55%
1986	3.46%	1.90%
1987	3.46%	3.66%
1988	4.18%	4.08%
1989	3.67%	4.83%
1990	1.89%	5.40%
1991	-0.11%	4.24%
1992	3.52%	3.03%
Average	***3.61%***	***3.82%***

Between 2011 and 2020, the average Growth was 1.7%, the average Inflation was 1.73% and, according to our model if inflation was equal rate-of-loss, ie. risk, Optimal average growth would have been 4.37%. Between 1983 and 1992 the average Growth was 3.61% and Inflation was 3.82%.

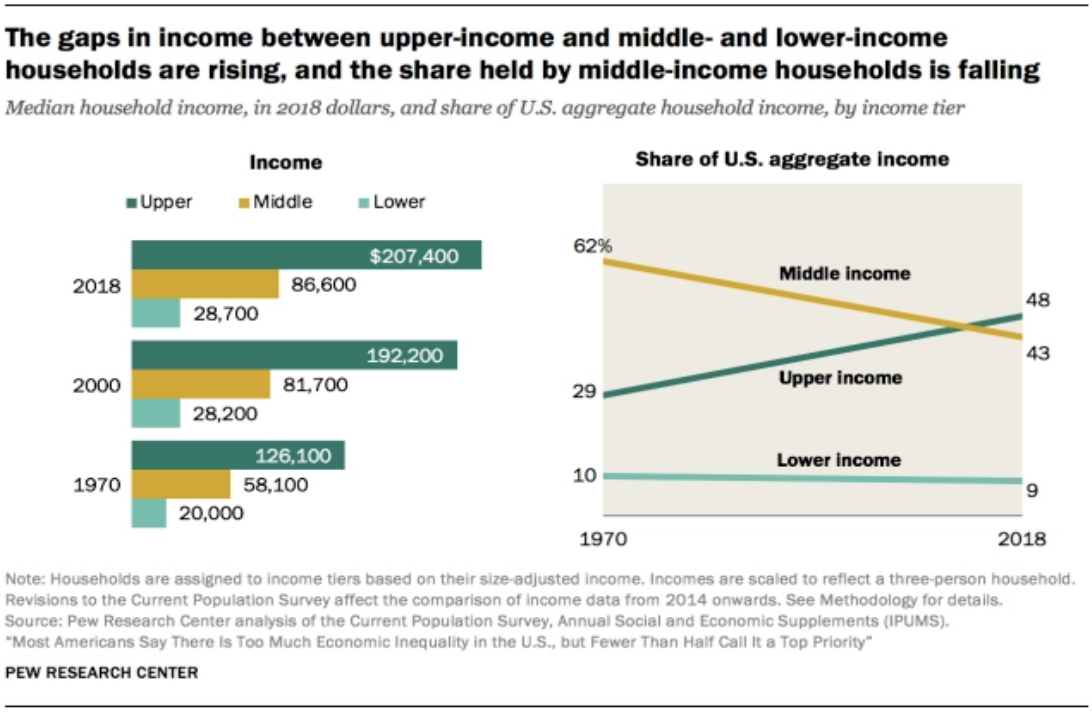
Optimal Growth results in Table 5 don't look unusual compared to Growth figures in Table 6. Whilst this is still to be verified, it's a plausible assumption that rate-of-loss as a measure of risk in the US between 1983 and 1992 was not much different than between 2011 and 2020. Inflation between 1983 and 1992 was higher than between 2011 and 2020, and closer to a level of inflation implicitly postulated by the model presented in this article. We invite the reader to compare Growth figures for two periods and Optimal growth for years between 2011 and 2020. We may suggest that according to our model and assuming that the rate-of-loss as a measure

of risk in the US between 1983 and 1992 was the same as between 2011 and 2020 – ie. 4.4% on average - it appears there was still a small room for greater Optimal growth of around 0.5% between 1983 and 1992.

Between 1981 and 1990 average Growth was 3.34% and average Inflation was 4.74%. In this case, according to our model, inflation could have been too high by 0.3% - 0.7%. It looks there could have been a room for greater Optimal growth of between 0.5% - 1%. However, these 10 years require more detailed analysis due to unusually high inflation in 1981 of 10.33% followed by anti-inflationary measures, and negative growth of -1.8% in 1982.[17]

Whilst such analysis is beyond the scope of this article, we observe that continued contraction of economic base due to inequity as presented in the Table 4 above appears to be consistent with continued growth of inequality gap of income and wealth between richer and poorer households, which may also be regarded as a measure of inequity in economic system. Ie. providers of capital had too high a share of wealth than providers of labour. See the graph below. It looks the share of economic wealth between 1983 and 1992 was different than from 2011 onwards. Intuitively, we may regard share of wealth between 1983 and 1992 as more equitable.[18] We note the higher inflation between 1983 and 1992 than between 2011 and 2020.

Graph 1:



[17] We note that the accuracy of results of our analysis is limited by the quality of data about rate-of-loss measure of risk and also by the fact that our model assumes perfect competition market structure.

[18] https://www.pewresearch.org/social-trends/2020/01/09/trends-in-income-and-wealth-inequality/

A key finding in this article is the role of rate-of-loss measure of risk in economic activities and how it links concepts of inflation, economic growth and equitable share of wealth. We also determined two aspects of inflation: one, which balances risk, rate-of-loss, and the other a monetary phenomenon.

The arguments above indicate consistency and completeness of the model presented in this article. We demonstrated in a form of measurable characteristics and equations a relationship between:

- **Inflation,**
- **Rate-of-loss measure of risk,**
- **Economic growth,**
- **Equitable share of wealth.**

We also concluded that if inflation matches the risk, rate-of-loss in the economic system, this assures an equitable share of wealth amongst economic actors and leads to optimal (ie. without a "bubble" of "contraction" effects) maximal growth in economic system. Thus, we postulate, in real economy inflation target be set as equal to rate-of-loss, ie. risk, in economic system. Chapter IV of this article presents two approaches – *ex-post and ex-ante* - on how to measure risk, rate-of-loss, in economic system.

VIII. Historical reflection on economics and economic systems developments

The Sustainable Growth Principle tells us how output of economic growth should be shared between providers of capital and providers of labour in economic system. Using historical and ideological cliché by calling providers of capital "Adam Smith" and providers of labour "Karl Marx", we can capture the sustainable economic growth principle as follows:

$\forall \boldsymbol{n}$:

$$\left(\frac{Karl\ Marx}{Adam\ Smith}\right)^{n} = 1$$

That is, in any sustainable economic system:

"*Karl Marx*" = "*Adam Smith*"

According to our model presented in this article, a share of wealth in economic system as equitable, ie. it makes the system sustainable, if the above condition "*Karl Marx*" = "*Adam Smith*" holds, and this means that: Inflation must equal risk / ratio of loss.

Let's consider situations when "*Karl Marx*" > "*Adam Smith*". According to our analysis as:

$$\lim_{n\to\infty}\left(\frac{Karl\ Marx}{Adam\ Smith}\right)^{n} \to \infty$$

will be increasing with *n* to infinity at exponential rate, ie. there will be a strong compounding effect[19]. This clearly looks like what economists call a **"bubble"**. **In our analysis, a bubble looks like as if we tried to increase an initial *Base*, an endowment, which is not possible.** A bubble creates a perception of existence of value, wealth, which doesn't exist. That's why a bubble must burst. Thus, when "*Karl Marx*" > "*Adam Smith*" economic system is not stable in a long-term (or even in a much shorter-term). We may consider this analysis as an informal proof why a communism system was bound to fail.

Now let's consider situations when "*Karl Marx*" < "*Adam Smith*". According to our analysis as:

$$\lim_{n\to\infty}\left(\frac{Karl\ Marx}{Adam\ Smith}\right)^{n} \to 0$$

will be decreasing to 0 (zero) at exponential rate. There will be a strong compounding effect, with increasing *n*, this clearly look like a **"contracting"** of economic system[20]. In our analysis contracting of economic system is as if we don't use parts of initial *Base*, an endowment. And such a decrease is reducing the use of the initial *Base* to 0 (zero) at exponential rate, ie. with a compounding effect. This may be an accurate description of a mechanism of gradual reduction of growth of nearly all major western economies in the last 40 – 50 years, whilst at the same time, or because of that, inflation was going down too. This also seems to capture well a mechanism how the rich (providers of capital) are becoming even richer, above the rate of economic growth, and why the economic growth has a decreasing trend at the same time. Ie.

[19] To show this, either assume that "Karl Marx" to "Adam Smith" ratio is constant or take the infimum in the series of this ratio.
[20] To show this, either assume that "Karl Marx" to "Adam Smith" ratio is constant or take the supremum in the series of this ratio.

such an inequitable share of wealth when "*Karl Marx*" < "*Adam Smith*" results in contracting the *Base* in a long-term, ie. a lot of initial endowment is not used to generate output.

It appears that this analysis and model may be quite useful in general. For example, according to this analysis, stagflation is a result of, or a reaction to, a high risk, rate-of-loss. As explained earlier, after some time, high risk, rate-of-loss decreases economic activities. This leads to low growth rate. At the same time high risk ultimately leads to high inflation rate in economic system (needed to balance high risk, rate-of-loss, as presented earlier). Thus, in case of stagflation, the policy focus should be on identifying the sources of high risk, rate-of-loss and eliminating them, and as a result eliminating high risk, rate-of-loss. As a result, growth rate will start increasing and inflation rate will start going down. According to our analysis, stagflation is a natural phenomenon resulting from pushing inflation too much down below the level of rate-of-loss. The hard part is to determine how in different countries different risk, rate-of-loss may have different effects on growth rate. For example, it appears that the risk, rate-of-loss such as in Turkey or Nigeria will have different effects on growth rate there than it would be the case in Switzerland or the United States (see graphs in Appendix 3 and also refer to analysis in Chapter V of this article). We suggest such an exemplification how risk, rate-of-loss affects rate of growth to be subject of empirical research. There is an important human factor in perceiving risk and calculating it as a rate-of-loss, verified later by the empirical data,[21] and then reacting to this by changing, or not, a level of economic activities, which affects growth rate.

Concluding remark: *"The greatest shortcoming of the human race is our inability to understand the exponential function."* – Albert Bartlett.

IX. (Preliminary) conclusions

The above is a theoretical model. In real life, there is no perfect competition, and no long-term stable equilibrium. However, whilst $i = l$ is also a model, it looks it may be practically applicable to manage the economy.

This analysis tells us that providers of capital and provider of labour are "frenemies", friends and enemies at the same time. Whilst they compete for wealth, output, in economic system, if this share is not equitable (as defined in this article), they will be acting against their own interests. For this reason, a balance between business/capital-friendly policies and labour-

[21] Clearly an approach initiated by Gary Becker will be helpful: https://www.nobelprize.org/uploads/2018/06/becker-lecture.pdf

friendly policies is critical for sustainable growth. This paper indicates how this model can be verified: ie. by measuring risk, rate-of-loss and inflation in economic system, and how monetary policy (interest rate) must respond to it.

The aim of these policies should be focused on reducing risk, rate-of-loss (for example, as measured by the US Bureau of Labor as used in the analysis in this article) and on ensuring using monetary policy (assuming that currencies are controlled by central banks) that inflation rate is equal to rate-of-loss measure of risk.

Similarly, in the same way how methodology to measure inflation was developed, a methodology to measure risk, rate-of-loss, must also be developed and tested and be consistent with inflation measuring methodology. The one used in this article appears to be theoretically consistent and promising for practical purposes.

Setting up interest rate is a potent but quite crude mechanism of controlling inflation. This analysis and model show that inflation target should be set to reflect rate-of-loss measure of risk in economic system and setting up interest rate is a tool to achieve this.

It would be interesting to model events from economic history - like communism and its collapse, various crises in western economies in the last 100 years – using the model and approach presented in this article. Ie. that for any economic system to be stable, inflation must equal rate-of-loss measure of risk, in order to avoid “bubbles” growing, or “contracting” happening.

It also looks from our analysis that it’s not a human, good old Smithian greed, which is behind human economic behaviour, but it’s risk aversion, which seems to be driving people to become richer. Greed is an outside manifestation of a more primitive and instinctive avoidance of becoming destitute.

Making a far-fetched but quite explanatory statement, we may compare the relationship between inflation and rate-of-loss measure of risk in economy to relationship between energy and mass in physics. And that this equivalence appears to be quite fundamental. In a perfectly competitive economy, higher inflation results in higher risk, rate-of-loss. Higher risk, rate-of-loss results in higher inflation needed to absorb the rate-of-loss, ie. risk in economic system.

APPENDIX 1

Annual openings Year ended: March		Surviving Establishments	Total Employment of Survivors	Survival Rates Since Birth	Survival Rates of Previous Year's Survivors	Average Employment of Survivors		Business failure rate		
1994							**1994**	**Graph in the Graphs Tab**		
March	**1994**	569,419	4,132,450	100.0	_	7.3	**1994**			
March	**1995**	453,134	4,140,239	79.6	79.6	9.1	**1995**	20.40%		
March	**1996**	387,868	4,012,051	68.1	85.6	10.3	**1996**	14.40%		
March	**1997**	345,155	3,947,376	60.6	89.0	11.4	**1997**	11.00%		
March	**1998**	309,084	3,862,645	54.3	89.5	12.5	**1998**	10.50%		
March	**1999**	282,484	3,721,580	49.6	91.4	13.2	**1999**	8.60%		
March	**2000**	257,488	3,655,305	45.2	91.2	14.2	**2000**	8.80%	20.90%	
March	**2001**	236,094	3,506,596	41.5	91.7	14.9	**2001**	8.30%	15.30%	
March	**2002**	218,171	3,276,821	38.3	92.4	15.0	**2002**	7.60%	12.70%	
March	**2003**	203,484	3,117,464	35.7	93.3	15.3	**2003**	6.70%	10.00%	
March	**2004**	191,428	3,025,551	33.6	94.1	15.8	**2004**	5.90%	8.50%	
March	**2005**	180,909	2,962,831	31.8	94.5	16.4	**2005**	5.50%	7.90%	21.10%
March	**2006**	172,805	2,914,145	30.3	95.5	16.9	**2006**	**4.50%**	6.60%	12.50%
March	**2007**	163,477	2,856,566	28.7	94.6	17.5	**2007**	**5.40%**	6.80%	11.40%
March	**2008**	154,939	2,772,210	27.2	94.8	17.9	**2008**	**5.20%**	6.70%	10.90%
March	**2009**	145,109	2,535,759	25.5	93.7	17.5	**2009**	**6.30%**	7.90%	11.20%
March	**2010**	136,978	2,421,364	24.1	94.4	17.7	**2010**	**5.60%**	6.70%	9.60%
March	**2011**	130,986	2,403,881	23.0	95.6	18.4	**2011**	**4.40%**	5.10%	7.40%
March	**2012**	125,354	2,399,386	22.0	95.7	19.1	**2012**	**4.30%**	4.20%	5.70%
March	**2013**	120,593	2,383,994	21.2	96.2	19.8	**2013**	**3.80%**	4.40%	5.40%
March	**2014**	115,619	2,372,009	20.3	95.9	20.5	**2014**	**4.10%**	4.10%	6.00%
March	**2015**	111,183	2,355,817	19.5	96.2	21.2	**2015**	**3.80%**	4.30%	5.50%
March	**2016**	106,785	2,339,019	18.8	96.0	21.9	**2016**	**4.00%**	4.30%	5.20%
March	**2017**	102,384	2,323,824	18.0	95.9	22.7	**2017**	**4.10%**	4.30%	5.30%
March	**2018**	98,046	2,299,788	17.2	95.8	23.5	**2018**	**4.20%**	4.80%	5.20%
March	**2019**	94,357	2,254,351	16.6	96.2	23.9	**2019**	**3.80%**	4.30%	5.30%
March	**2020**	89,876	2,195,534	15.8	95.3	24.4	**2020**	**4.70%**	4.90%	6.10%
Annual openings										
Year ended: March	**1995**						**1995**			
March	**1995**	604,415	4,372,481	100.0	_	7.2	**1995**			
March	**1996**	476,551	4,318,303	78.8	78.8	9.1	**1996**	21.20%		
March	**1997**	410,336	4,269,975	67.9	86.1	10.4	**1997**	13.90%		
March	**1998**	361,618	4,178,731	59.8	88.1	11.6	**1998**	11.90%		
March	**1999**	326,825	4,078,358	54.1	90.4	12.5	**1999**	9.60%		
March	**2000**	295,171	4,003,473	48.8	90.3	13.6	**2000**	9.70%		
March	**2001**	268,146	3,836,718	44.4	90.8	14.3	**2001**	9.20%		
March	**2002**	246,242	3,541,478	40.7	91.8	14.4	**2002**	8.20%		
March	**2003**	229,526	3,361,657	38.0	93.2	14.6	**2003**	6.80%		
March	**2004**	215,477	3,274,763	35.7	93.9	15.2	**2004**	6.10%		
March	**2005**	201,976	3,199,890	33.4	93.7	15.8	**2005**	6.30%		
March	**2006**	191,065	3,162,982	31.6	94.6	16.6	**2006**	5.40%		
March	**2007**	180,774	3,088,012	29.9	94.6	17.1	**2007**	5.40%		
March	**2008**	171,477	2,994,604	28.4	94.9	17.5	**2008**	5.10%		
March	**2009**	160,618	2,741,490	26.6	93.7	17.1	**2009**	6.30%		
March	**2010**	151,822	2,618,042	25.1	94.5	17.2	**2010**	5.50%		
March	**2011**	145,015	2,602,835	24.0	95.5	17.9	**2011**	4.50%		
March	**2012**	139,196	2,583,414	23.0	96.0	18.6	**2012**	4.00%		
March	**2013**	133,907	2,567,440	22.2	96.2	19.2	**2013**	3.80%		
March	**2014**	128,768	2,521,791	21.3	96.2	19.6	**2014**	3.80%		
March	**2015**	123,537	2,504,036	20.4	95.9	20.3	**2015**	4.10%		
March	**2016**	118,660	2,480,841	19.6	96.1	20.9	**2016**	3.90%		
March	**2017**	113,860	2,437,727	18.8	96.0	21.4	**2017**	4.00%		
March	**2018**	109,128	2,411,960	18.1	95.8	22.1	**2018**	4.20%		

March	**2019**	104,719	2,378,546	17.3	96.0	22.7	**2019**	4.00%
March	**2020**	99,930	2,308,447	16.5	95.4	23.1	**2020**	4.60%

Annual openings Year ended: March

	1996						**1996**	
March	**1996**	609,638	4,376,545	100.0	_	7.2	**1996**	
March	**1997**	476,797	4,329,770	78.2	78.2	9.1	**1997**	21.80%
March	**1998**	408,018	4,248,705	66.9	85.6	10.4	**1998**	14.40%
March	**1999**	363,990	4,173,926	59.7	89.2	11.5	**1999**	10.80%
March	**2000**	325,701	4,115,688	53.4	89.5	12.6	**2000**	10.50%
March	**2001**	293,298	3,940,353	48.1	90.1	13.4	**2001**	9.90%
March	**2002**	267,339	3,635,089	43.9	91.1	13.6	**2002**	8.90%
March	**2003**	246,995	3,456,646	40.5	92.4	14.0	**2003**	7.60%
March	**2004**	230,620	3,363,765	37.8	93.4	14.6	**2004**	6.60%
March	**2005**	215,725	3,316,437	35.4	93.5	15.4	**2005**	6.50%
March	**2006**	203,390	3,283,078	33.4	94.3	16.1	**2006**	5.70%
March	**2007**	191,924	3,210,634	31.5	94.4	16.7	**2007**	5.60%
March	**2008**	181,330	3,106,853	29.7	94.5	17.1	**2008**	5.50%
March	**2009**	170,442	2,829,779	28.0	94.0	16.6	**2009**	6.00%
March	**2010**	160,473	2,710,277	26.3	94.2	16.9	**2010**	5.80%
March	**2011**	153,003	2,686,149	25.1	95.3	17.6	**2011**	4.70%
March	**2012**	146,723	2,676,883	24.1	95.9	18.2	**2012**	4.10%
March	**2013**	140,708	2,660,300	23.1	95.9	18.9	**2013**	4.10%
March	**2014**	135,496	2,631,076	22.2	96.3	19.4	**2014**	3.70%
March	**2015**	129,930	2,618,420	21.3	95.9	20.2	**2015**	4.10%
March	**2016**	124,433	2,597,697	20.4	95.8	20.9	**2016**	4.20%
March	**2017**	119,546	2,551,100	19.6	96.1	21.3	**2017**	3.90%
March	**2018**	114,335	2,521,416	18.8	95.6	22.1	**2018**	4.40%
March	**2019**	109,579	2,486,935	18.0	95.8	22.7	**2019**	4.20%
March	**2020**	104,407	2,432,392	17.1	95.3	23.3	**2020**	4.70%

Annual openings Year ended: March

	1997						**1997**	
March	**1997**	639,114	4,653,407	100.0	_	7.3	**1997**	
March	**1998**	501,944	4,698,852	78.5	78.5	9.4	**1998**	21.50%
March	**1999**	436,505	4,610,718	68.3	87.0	10.6	**1999**	13.00%
March	**2000**	384,435	4,559,669	60.2	88.1	11.9	**2000**	11.90%
March	**2001**	338,998	4,333,345	53.0	88.2	12.8	**2001**	11.80%
March	**2002**	304,458	3,959,256	47.6	89.8	13.0	**2002**	10.20%
March	**2003**	279,205	3,709,345	43.7	91.7	13.3	**2003**	8.30%
March	**2004**	258,919	3,604,854	40.5	92.7	13.9	**2004**	7.30%
March	**2005**	240,821	3,536,477	37.7	93.0	14.7	**2005**	7.00%
March	**2006**	227,776	3,499,870	35.6	94.6	15.4	**2006**	5.40%
March	**2007**	213,968	3,426,520	33.5	93.9	16.0	**2007**	6.10%
March	**2008**	201,591	3,311,770	31.5	94.2	16.4	**2008**	5.80%
March	**2009**	187,304	3,004,789	29.3	92.9	16.0	**2009**	7.10%
March	**2010**	176,231	2,850,131	27.6	94.1	16.2	**2010**	5.90%
March	**2011**	167,587	2,827,369	26.2	95.1	16.9	**2011**	4.90%
March	**2012**	160,498	2,819,352	25.1	95.8	17.6	**2012**	4.20%
March	**2013**	154,081	2,806,671	24.1	96.0	18.2	**2013**	4.00%
March	**2014**	148,017	2,788,382	23.2	96.1	18.8	**2014**	3.90%
March	**2015**	141,865	2,761,084	22.2	95.8	19.5	**2015**	4.20%
March	**2016**	136,289	2,733,154	21.3	96.1	20.1	**2016**	3.90%
March	**2017**	130,158	2,689,393	20.4	95.5	20.7	**2017**	4.50%
March	**2018**	124,308	2,644,595	19.5	95.5	21.3	**2018**	4.50%
March	**2019**	119,317	2,593,849	18.7	96.0	21.7	**2019**	4.00%
March	**2020**	113,501	2,529,758	17.8	95.1	22.3	**2020**	4.90%

Annual openings Year ended: March

	1998						**1998**	

March	**1998**	643,070	4,728,570	100.0	_	7.4	**1998**	
March	**1999**	515,330	4,722,697	80.1	80.1	9.2	**1999**	19.90%
March	**2000**	440,788	4,718,220	68.5	85.5	10.7	**2000**	14.50%
March	**2001**	383,515	4,513,905	59.6	87.0	11.8	**2001**	13.00%
March	**2002**	340,826	4,142,552	53.0	88.9	12.2	**2002**	11.10%
March	**2003**	309,183	3,904,056	48.1	90.7	12.6	**2003**	9.30%
March	**2004**	285,445	3,796,984	44.4	92.3	13.3	**2004**	7.70%
March	**2005**	264,980	3,737,229	41.2	92.8	14.1	**2005**	7.20%
March	**2006**	248,721	3,707,664	38.7	93.9	14.9	**2006**	6.10%
March	**2007**	233,012	3,640,698	36.2	93.7	15.6	**2007**	6.30%
March	**2008**	218,611	3,511,430	34.0	93.8	16.1	**2008**	6.20%
March	**2009**	202,644	3,231,210	31.5	92.7	15.9	**2009**	7.30%
March	**2010**	189,933	3,073,305	29.5	93.7	16.2	**2010**	6.30%
March	**2011**	180,855	3,053,866	28.1	95.2	16.9	**2011**	4.80%
March	**2012**	172,719	3,046,553	26.9	95.5	17.6	**2012**	4.50%
March	**2013**	165,417	3,037,780	25.7	95.8	18.4	**2013**	4.20%
March	**2014**	158,591	3,001,512	24.7	95.9	18.9	**2014**	4.10%
March	**2015**	151,953	2,991,023	23.6	95.8	19.7	**2015**	4.20%
March	**2016**	145,945	2,966,332	22.7	96.0	20.3	**2016**	4.00%
March	**2017**	140,253	2,932,637	21.8	96.1	20.9	**2017**	3.90%
March	**2018**	133,741	2,882,416	20.8	95.4	21.6	**2018**	4.60%
March	**2019**	128,151	2,836,963	19.9	95.8	22.1	**2019**	4.20%
March	**2020**	122,249	2,747,940	19.0	95.4	22.5	**2020**	4.60%
								10000.00%

Annual openings Year ended: March

	1999						**1999**	
March	**1999**	650,730	4,736,499	100.0	_	7.3	**1999**	
March	**2000**	514,914	4,764,054	79.1	79.1	9.3	**2000**	20.90%
March	**2001**	436,181	4,578,837	67.0	84.7	10.5	**2001**	15.30%
March	**2002**	380,967	4,217,372	58.5	87.3	11.1	**2002**	12.70%
March	**2003**	342,763	3,982,345	52.7	90.0	11.6	**2003**	10.00%
March	**2004**	313,589	3,866,204	48.2	91.5	12.3	**2004**	8.50%
March	**2005**	288,762	3,778,972	44.4	92.1	13.1	**2005**	7.90%
March	**2006**	269,710	3,751,614	41.4	93.4	13.9	**2006**	6.60%
March	**2007**	251,399	3,670,789	38.6	93.2	14.6	**2007**	6.80%
March	**2008**	234,614	3,548,588	36.1	93.3	15.1	**2008**	6.70%
March	**2009**	216,177	3,254,444	33.2	92.1	15.1	**2009**	7.90%
March	**2010**	201,749	3,084,030	31.0	93.3	15.3	**2010**	6.70%
March	**2011**	191,474	3,062,699	29.4	94.9	16.0	**2011**	**5.10%**
March	**2012**	183,486	3,060,314	28.2	95.8	16.7	**2012**	**4.20%**
March	**2013**	175,427	3,033,792	27.0	95.6	17.3	**2013**	**4.40%**
March	**2014**	168,151	3,014,462	25.8	95.9	17.9	**2014**	**4.10%**
March	**2015**	160,952	2,995,664	24.7	95.7	18.6	**2015**	**4.30%**
March	**2016**	153,968	2,971,017	23.7	95.7	19.3	**2016**	**4.30%**
March	**2017**	147,397	2,942,087	22.7	95.7	20.0	**2017**	**4.30%**
March	**2018**	140,327	2,892,269	21.6	95.2	20.6	**2018**	**4.80%**
March	**2019**	134,279	2,835,599	20.6	95.7	21.1	**2019**	**4.30%**
March	**2020**	127,646	2,757,443	19.6	95.1	21.6	**2020**	**4.90%**

Annual openings Year ended: March

	2000						**2000**	
March	**2000**	674,644	4,678,689	100.0	_	6.9	**2000**	
March	**2001**	528,894	4,656,268	78.4	78.4	8.8	**2001**	21.60%
March	**2002**	445,193	4,253,751	66.0	84.2	9.6	**2002**	15.80%
March	**2003**	392,621	4,065,722	58.2	88.2	10.4	**2003**	11.80%
March	**2004**	356,118	3,953,830	52.8	90.7	11.1	**2004**	9.30%
March	**2005**	325,423	3,871,332	48.2	91.4	11.9	**2005**	8.60%
March	**2006**	301,684	3,861,952	44.7	92.7	12.8	**2006**	7.30%
March	**2007**	280,436	3,791,627	41.6	93.0	13.5	**2007**	7.00%
March	**2008**	260,349	3,655,074	38.6	92.8	14.0	**2008**	7.20%

March	**2009**	239,407	3,349,380	35.5	92.0	14.0	**2009**	8.00%
March	**2010**	221,708	3,194,876	32.9	92.6	14.4	**2010**	7.40%
March	**2011**	210,503	3,169,050	31.2	94.9	15.1	**2011**	5.10%
March	**2012**	200,746	3,153,890	29.8	95.4	15.7	**2012**	4.60%
March	**2013**	192,750	3,134,327	28.6	96.0	16.3	**2013**	4.00%
March	**2014**	184,355	3,124,582	27.3	95.6	16.9	**2014**	4.40%
March	**2015**	177,268	3,121,362	26.3	96.2	17.6	**2015**	3.80%
March	**2016**	169,451	3,092,747	25.1	95.6	18.3	**2016**	4.40%
March	**2017**	162,353	3,068,464	24.1	95.8	18.9	**2017**	4.20%
March	**2018**	154,461	3,027,407	22.9	95.1	19.6	**2018**	4.90%
March	**2019**	147,461	2,968,230	21.9	95.5	20.1	**2019**	4.50%
March	**2020**	140,302	2,896,963	20.8	95.1	20.6	**2020**	4.90%

Annual openings Year ended: March

	2001						**2001**	
March	**2001**	671,383	4,313,710	100.0	_	6.4	**2001**	
March	**2002**	508,376	4,001,028	75.7	75.7	7.9	**2002**	24.30%
March	**2003**	434,349	3,817,146	64.7	85.4	8.8	**2003**	14.60%
March	**2004**	386,793	3,751,867	57.6	89.1	9.7	**2004**	10.90%
March	**2005**	351,455	3,699,116	52.3	90.9	10.5	**2005**	9.10%
March	**2006**	322,909	3,664,248	48.1	91.9	11.3	**2006**	8.10%
March	**2007**	297,034	3,568,005	44.2	92.0	12.0	**2007**	8.00%
March	**2008**	274,484	3,420,089	40.9	92.4	12.5	**2008**	7.60%
March	**2009**	250,787	3,109,889	37.4	91.4	12.4	**2009**	8.60%
March	**2010**	231,551	2,950,829	34.5	92.3	12.7	**2010**	7.70%
March	**2011**	217,340	2,920,669	32.4	93.9	13.4	**2011**	6.10%
March	**2012**	207,292	2,901,611	30.9	95.4	14.0	**2012**	4.60%
March	**2013**	198,021	2,865,182	29.5	95.5	14.5	**2013**	4.50%
March	**2014**	188,498	2,840,720	28.1	95.2	15.1	**2014**	4.80%
March	**2015**	180,045	2,820,839	26.8	95.5	15.7	**2015**	4.50%
March	**2016**	171,356	2,794,360	25.5	95.2	16.3	**2016**	4.80%
March	**2017**	163,593	2,748,711	24.4	95.5	16.8	**2017**	4.50%
March	**2018**	155,100	2,696,859	23.1	94.8	17.4	**2018**	5.20%
March	**2019**	148,097	2,649,441	22.1	95.5	17.9	**2019**	4.50%
March	**2020**	139,974	2,567,788	20.8	94.5	18.3	**2020**	5.50%

Annual openings Year ended: March

	2002						**2002**	
March	**2002**	659,236	4,200,561	100.0	_	6.4	**2002**	
March	**2003**	516,525	3,978,225	78.4	78.4	7.7	**2003**	21.60%
March	**2004**	444,555	3,870,838	67.4	86.1	8.7	**2004**	13.90%
March	**2005**	395,685	3,831,940	60.0	89.0	9.7	**2005**	11.00%
March	**2006**	360,997	3,824,120	54.8	91.2	10.6	**2006**	8.80%
March	**2007**	330,348	3,725,942	50.1	91.5	11.3	**2007**	8.50%
March	**2008**	302,780	3,558,910	45.9	91.7	11.8	**2008**	8.30%
March	**2009**	275,267	3,261,835	41.8	90.9	11.8	**2009**	9.10%
March	**2010**	253,255	3,070,962	38.4	92.0	12.1	**2010**	8.00%
March	**2011**	237,710	3,041,589	36.1	93.9	12.8	**2011**	6.10%
March	**2012**	225,244	3,017,064	34.2	94.8	13.4	**2012**	5.20%
March	**2013**	214,273	2,982,077	32.5	95.1	13.9	**2013**	4.90%
March	**2014**	203,175	2,944,528	30.8	94.8	14.5	**2014**	5.20%
March	**2015**	193,637	2,929,857	29.4	95.3	15.1	**2015**	4.70%
March	**2016**	185,336	2,887,595	28.1	95.7	15.6	**2016**	4.30%
March	**2017**	176,097	2,832,518	26.7	95.0	16.1	**2017**	5.00%
March	**2018**	167,159	2,792,492	25.4	94.9	16.7	**2018**	5.10%
March	**2019**	160,204	2,743,154	24.3	95.8	17.1	**2019**	4.20%
March	**2020**	151,035	2,649,698	22.9	94.3	17.5	**2020**	5.70%

Annual openings Year ended: March

	2003						**2003**	

March	**2003**	662,543	3,891,084	100.0	_	5.9	**2003**	
March	**2004**	525,244	3,804,733	79.3	79.3	7.2	**2004**	20.70%
March	**2005**	453,130	3,752,400	68.4	86.3	8.3	**2005**	13.70%
March	**2006**	406,991	3,718,365	61.4	89.8	9.1	**2006**	10.20%
March	**2007**	366,143	3,644,988	55.3	90.0	10.0	**2007**	10.00%
March	**2008**	330,963	3,491,112	50.0	90.4	10.5	**2008**	9.60%
March	**2009**	296,904	3,174,969	44.8	89.7	10.7	**2009**	10.30%
March	**2010**	271,042	2,997,006	40.9	91.3	11.1	**2010**	8.70%
March	**2011**	252,322	2,964,296	38.1	93.1	11.7	**2011**	6.90%
March	**2012**	238,688	2,949,752	36.0	94.6	12.4	**2012**	5.40%
March	**2013**	226,559	2,920,974	34.2	94.9	12.9	**2013**	5.10%
March	**2014**	214,060	2,899,140	32.3	94.5	13.5	**2014**	5.50%
March	**2015**	203,464	2,878,763	30.7	95.0	14.1	**2015**	5.00%
March	**2016**	192,827	2,854,938	29.1	94.8	14.8	**2016**	5.20%
March	**2017**	183,224	2,816,408	27.7	95.0	15.4	**2017**	5.00%
March	**2018**	173,983	2,773,581	26.3	95.0	15.9	**2018**	5.00%
March	**2019**	165,872	2,728,907	25.0	95.3	16.5	**2019**	4.70%
March	**2020**	156,307	2,657,641	23.6	94.2	17.0	**2020**	5.80%

Annual openings Year ended: March

	2004						**2004**	
March	**2004**	653,887	3,639,709	100.0	_	5.6	**2004**	
March	**2005**	516,225	3,598,159	78.9	78.9	7.0	**2005**	21.10%
March	**2006**	451,591	3,594,256	69.1	87.5	8.0	**2006**	12.50%
March	**2007**	400,022	3,500,519	61.2	88.6	8.8	**2007**	11.40%
March	**2008**	356,540	3,337,328	54.5	89.1	9.4	**2008**	10.90%
March	**2009**	316,548	3,029,119	48.4	88.8	9.6	**2009**	11.20%
March	**2010**	286,061	2,857,481	43.7	90.4	10.0	**2010**	9.60%
March	**2011**	265,011	2,830,596	40.5	92.6	10.7	**2011**	7.40%
March	**2012**	249,901	2,814,907	38.2	94.3	11.3	**2012**	5.70%
March	**2013**	236,285	2,798,135	36.1	94.6	11.8	**2013**	5.40%
March	**2014**	222,163	2,782,037	34.0	94.0	12.5	**2014**	6.00%
March	**2015**	209,874	2,760,782	32.1	94.5	13.2	**2015**	5.50%
March	**2016**	199,005	2,723,985	30.4	94.8	13.7	**2016**	5.20%
March	**2017**	188,518	2,691,362	28.8	94.7	14.3	**2017**	5.30%
March	**2018**	178,709	2,661,978	27.3	94.8	14.9	**2018**	5.20%
March	**2019**	169,223	2,624,669	25.9	94.7	15.5	**2019**	5.30%
March	**2020**	158,897	2,549,224	24.3	93.9	16.0	**2020**	6.10%

Annual openings Year ended: March

	2005						**2005**	
March	**2005**	679,925	3,623,137	100.0	_	5.3	**2005**	
March	**2006**	544,317	3,658,558	80.1	80.1	6.7	**2006**	19.90%
March	**2007**	467,307	3,575,214	68.7	85.9	7.7	**2007**	14.10%
March	**2008**	409,023	3,414,579	60.2	87.5	8.3	**2008**	12.50%
March	**2009**	357,373	3,068,818	52.6	87.4	8.6	**2009**	12.60%
March	**2010**	318,534	2,898,237	46.8	89.1	9.1	**2010**	10.90%
March	**2011**	293,767	2,877,515	43.2	92.2	9.8	**2011**	7.80%
March	**2012**	275,621	2,872,790	40.5	93.8	10.4	**2012**	6.20%
March	**2013**	259,986	2,847,458	38.2	94.3	11.0	**2013**	5.70%
March	**2014**	243,856	2,833,151	35.9	93.8	11.6	**2014**	6.20%
March	**2015**	229,707	2,817,773	33.8	94.2	12.3	**2015**	5.80%
March	**2016**	216,894	2,799,606	31.9	94.4	12.9	**2016**	5.60%
March	**2017**	205,301	2,762,321	30.2	94.7	13.5	**2017**	5.30%
March	**2018**	194,313	2,749,606	28.6	94.6	14.2	**2018**	5.40%
March	**2019**	183,944	2,701,963	27.1	94.7	14.7	**2019**	5.30%
March	**2020**	172,383	2,623,794	25.4	93.7	15.2	**2020**	6.30%

Annual openings Year ended: March

	2006						**2006**	

March	**2006**	715,734	3,606,833	100.0	_	5.0	**2006**					
March	**2007**	560,199	3,552,590	78.3	78.3	6.3	**2007**	21.70%				
March	**2008**	474,184	3,375,430	66.3	84.6	7.1	**2008**	15.40%				
March	**2009**	405,474	3,026,473	56.7	85.5	7.5	**2009**	14.50%				
March	**2010**	356,437	2,840,541	49.8	87.9	8.0	**2010**	12.10%				
March	**2011**	325,123	2,818,930	45.4	91.2	8.7	**2011**	8.80%				
March	**2012**	302,968	2,818,584	42.3	93.2	9.3	**2012**	6.80%				
March	**2013**	283,623	2,789,385	39.6	93.6	9.8	**2013**	6.40%				
March	**2014**	265,596	2,779,157	37.1	93.6	10.5	**2014**	6.40%				
March	**2015**	249,101	2,767,302	34.8	93.8	11.1	**2015**	6.20%				
March	**2016**	234,472	2,747,561	32.8	94.1	11.7	**2016**	5.90%				
March	**2017**	221,911	2,712,219	31.0	94.6	12.2	**2017**	5.40%				
March	**2018**	209,397	2,687,395	29.3	94.4	12.8	**2018**	5.60%				
March	**2019**	197,927	2,642,950	27.7	94.5	13.4	**2019**	5.50%				
March	**2020**	185,109	2,583,044	25.9	93.5	14.0	**2020**	6.50%				

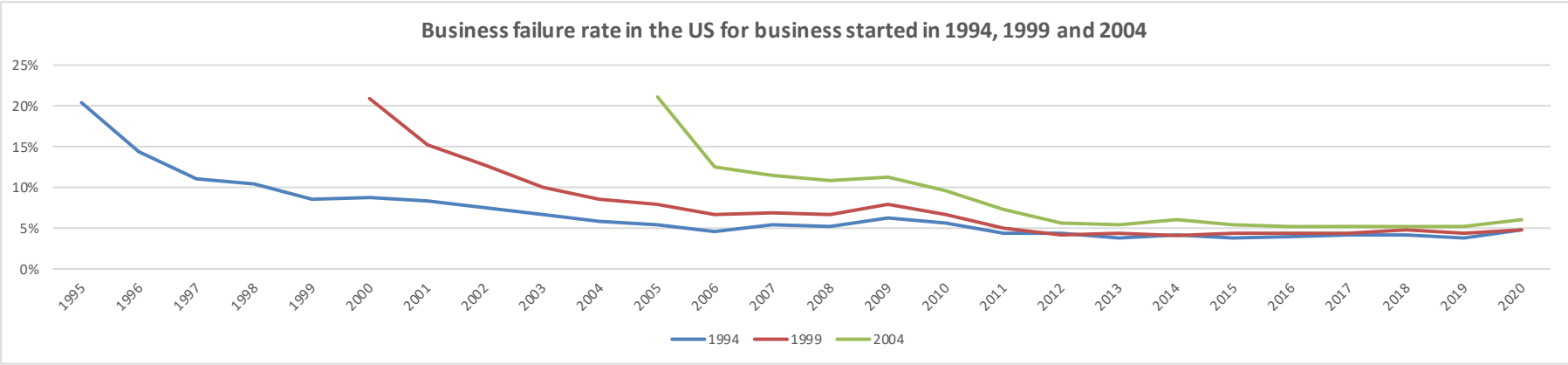
Annual openings Year ended: March												
	2007						**2007**					
March	**2007**	703,834	3,507,309	100.0	_	5.0	**2007**					
March	**2008**	544,014	3,382,980	77.3	77.3	6.2	**2008**	22.70%				
March	**2009**	450,670	3,047,819	64.0	82.8	6.8	**2009**	17.20%				
March	**2010**	390,550	2,873,967	55.5	86.7	7.4	**2010**	13.30%				
March	**2011**	353,443	2,844,598	50.2	90.5	8.0	**2011**	9.50%				
March	**2012**	326,364	2,832,460	46.4	92.3	8.7	**2012**	7.70%				
March	**2013**	303,237	2,803,835	43.1	92.9	9.2	**2013**	7.10%				
March	**2014**	282,373	2,797,607	40.1	93.1	9.9	**2014**	6.90%				
March	**2015**	263,441	2,785,122	37.4	93.3	10.6	**2015**	6.70%				
March	**2016**	247,023	2,762,326	35.1	93.8	11.2	**2016**	6.20%				
March	**2017**	232,179	2,724,027	33.0	94.0	11.7	**2017**	6.00%				
March	**2018**	218,228	2,693,302	31.0	94.0	12.3	**2018**	6.00%				
March	**2019**	205,890	2,652,393	29.3	94.3	12.9	**2019**	5.70%				
March	**2020**	191,824	2,580,888	27.3	93.2	13.5	**2020**	6.80%				

Annual openings Year ended: March												
	2008						**2008**					
March	**2008**	678,095	3,333,421	100.0	_	4.9	**2008**					
March	**2009**	510,240	2,991,800	75.2	75.2	5.9	**2009**	24.80%		**Graph in the Graphs Tab**		
March	**2010**	428,956	2,802,374	63.3	84.1	6.5	**2010**	15.90%		**Year**	**Failure: risk / rate of loss**	
March	**2011**	382,843	2,782,400	56.5	89.2	7.3	**2011**	10.80%	**4.73%**	2011	4.73%	**4.73%**
March	**2012**	350,653	2,801,721	51.7	91.6	8.0	**2012**	8.40%	**4.23%**	2012	4.23%	**4.23%**
March	**2013**	324,092	2,782,441	47.8	92.4	8.6	**2013**	7.60%	**4.09%**	2013	4.09%	**4.09%**
March	**2014**	299,467	2,759,736	44.2	92.4	9.2	**2014**	7.60%	**4.21%**	2014	4.21%	**4.21%**
March	**2015**	277,982	2,745,721	41.0	92.8	9.9	**2015**	7.20%	**4.26%**	2015	4.26%	**4.26%**
March	**2016**	259,619	2,726,494	38.3	93.4	10.5	**2016**	6.60%	**4.36%**	2016	4.36%	**4.36%**
March	**2017**	243,531	2,688,888	35.9	93.8	11.0	**2017**	6.20%	**4.47%**	2017	4.47%	**4.47%**
March	**2018**	227,991	2,659,209	33.6	93.6	11.7	**2018**	6.40%	**4.83%**	2018	4.83%	**4.83%**
March	**2019**	214,969	2,614,028	31.7	94.3	12.2	**2019**	5.70%	**4.55%**	2019	4.55%	**4.55%** 4.41%
March	**2020**	199,857	2,526,280	29.5	93.0	12.6	**2020**	7.00%	**5.47%**	2020	5.47%	**5.47%** 4.41%

Annual openings Year ended: March												
	2009						**2009**					
March	**2009**	608,769	2,802,403	100.0	_	4.6	**2009**					
March	**2010**	466,678	2,596,990	76.7	76.7	5.6	**2010**	23.30%				
March	**2011**	404,363	2,592,091	66.4	86.6	6.4	**2011**	13.40%				
March	**2012**	364,658	2,597,683	59.9	90.2	7.1	**2012**	9.80%				
March	**2013**	333,536	2,569,653	54.8	91.5	7.7	**2013**	8.50%				
March	**2014**	305,186	2,551,315	50.1	91.5	8.4	**2014**	8.50%				
March	**2015**	280,858	2,538,948	46.1	92.0	9.0	**2015**	8.00%				
March	**2016**	260,219	2,509,636	42.7	92.7	9.6	**2016**	7.30%				
March	**2017**	241,940	2,484,040	39.7	93.0	10.3	**2017**	7.00%				

March	**2018**	226,584	2,457,720	37.2	93.7	10.8	**2018**	6.30%
March	**2019**	212,646	2,403,159	34.9	93.8	11.3	**2019**	6.20%
March	**2020**	195,927	2,336,566	32.2	92.1	11.9	**2020**	7.90%
Annual openings Year ended: March								
	2010						**2010**	
March	**2010**	560,588	2,515,246	100.0	_	4.5	**2010**	
March	**2011**	440,431	2,483,787	78.6	78.6	5.6	**2011**	21.40%
March	**2012**	384,642	2,491,052	68.6	87.3	6.5	**2012**	12.70%
March	**2013**	345,504	2,474,299	61.6	89.8	7.2	**2013**	10.20%
March	**2014**	313,915	2,461,884	56.0	90.9	7.8	**2014**	9.10%
March	**2015**	286,201	2,438,705	51.1	91.2	8.5	**2015**	8.80%
March	**2016**	263,309	2,415,456	47.0	92.0	9.2	**2016**	8.00%
March	**2017**	240,948	2,385,147	43.0	91.5	9.9	**2017**	8.50%
March	**2018**	226,812	2,352,910	40.5	94.1	10.4	**2018**	5.90%
March	**2019**	212,624	2,314,880	37.9	93.7	10.9	**2019**	6.30%
March	**2020**	192,239	2,235,414	34.3	90.4	11.6	**2020**	9.60%
Annual openings Year ended: March								
	2011						**2011**	
March	**2011**	582,569	2,570,850	100.0	_	4.4	**2011**	
March	**2012**	462,749	2,583,981	79.4	79.4	5.6	**2012**	
March	**2013**	403,725	2,568,705	69.3	87.2	6.4	**2013**	
March	**2014**	360,707	2,564,035	61.9	89.3	7.1	**2014**	
March	**2015**	326,173	2,557,506	56.0	90.4	7.8	**2015**	
March	**2016**	296,601	2,528,685	50.9	90.9	8.5	**2016**	
March	**2017**	271,166	2,503,450	46.5	91.4	9.2	**2017**	
March	**2018**	252,242	2,465,810	43.3	93.0	9.8	**2018**	
March	**2019**	235,407	2,428,603	40.4	93.3	10.3	**2019**	
March	**2020**	214,164	2,353,942	36.8	91.0	11.0	**2020**	
Annual openings								
Year ended: March	**2012**						**2012**	
March	**2012**	631,817	2,793,113	100.0	_	4.4	**2012**	
March	**2013**	500,642	2,770,201	79.2	79.2	5.5	**2013**	
March	**2014**	433,844	2,776,679	68.7	86.7	6.4	**2014**	
March	**2015**	386,701	2,779,989	61.2	89.1	7.2	**2015**	
March	**2016**	349,688	2,764,396	55.3	90.4	7.9	**2016**	
March	**2017**	316,769	2,731,024	50.1	90.6	8.6	**2017**	
March	**2018**	292,852	2,695,619	46.4	92.4	9.2	**2018**	
March	**2019**	271,212	2,643,652	42.9	92.6	9.7	**2019**	
March	**2020**	246,618	2,566,695	39.0	90.9	10.4	**2020**	
Annual openings Year ended: March	**2013**						**2013**	
March	**2013**	629,078	2,804,566	100.0	_	4.5	**2013**	
March	**2014**	500,620	2,833,786	79.6	79.6	5.7	**2014**	
March	**2015**	433,681	2,870,898	68.9	86.6	6.6	**2015**	
March	**2016**	386,033	2,858,300	61.4	89.0	7.4	**2016**	
March	**2017**	347,789	2,821,281	55.3	90.1	8.1	**2017**	
March	**2018**	318,384	2,798,409	50.6	91.5	8.8	**2018**	
March	**2019**	293,419	2,758,036	46.6	92.2	9.4	**2019**	
March	**2020**	265,834	2,695,059	42.3	90.6	10.1	**2020**	
Annual openings Year ended: March	**2014**						**2014**	
March	**2014**	652,780	2,885,614	100.0	_	4.4	**2014**	
March	**2015**	520,294	2,919,878	79.7	79.7	5.6	**2015**	
March	**2016**	451,988	2,942,696	69.2	86.9	6.5	**2016**	
March	**2017**	403,418	2,918,394	61.8	89.3	7.2	**2017**	

March	**2018**	364,335	2,895,590	55.8	90.3	7.9	**2018**
March	**2019**	331,393	2,866,621	50.8	91.0	8.7	**2019**
March	**2020**	302,651	2,787,134	46.4	91.3	9.2	**2020**
Annual openings Year ended: March	**2015**						**2015**
March	**2015**	678,135	3,018,287	100.0	_	4.5	**2015**
March	**2016**	539,885	3,080,396	79.6	79.6	5.7	**2016**
March	**2017**	468,409	3,087,836	69.1	86.8	6.6	**2017**
March	**2018**	416,505	3,079,853	61.4	88.9	7.4	**2018**
March	**2019**	375,875	3,045,501	55.4	90.2	8.1	**2019**
March	**2020**	339,136	2,992,643	50.0	90.2	8.8	**2020**
Annual openings Year ended: March	**2016**						**2016**
March	**2016**	733,085	3,135,574	100.0	_	4.3	**2016**
March	**2017**	583,804	3,180,955	79.6	79.6	5.4	**2017**
March	**2018**	504,459	3,183,508	68.8	86.4	6.3	**2018**
March	**2019**	448,782	3,157,327	61.2	89.0	7.0	**2019**
March	**2020**	398,366	3,081,653	54.3	88.8	7.7	**2020**
Annual openings Year ended: March	**2017**						**2017**
March	**2017**	733,490	3,117,255	100.0	_	4.2	**2017**
March	**2018**	580,180	3,155,073	79.1	79.1	5.4	**2018**
March	**2019**	502,898	3,150,418	68.6	86.7	6.3	**2019**
March	**2020**	442,252	3,096,339	60.3	87.9	7.0	**2020**
Annual openings Year ended: March	**2018**						**2018**
March	**2018**	733,825	3,092,530	100.0	_	4.2	**2018**
March	**2019**	582,882	3,148,631	79.4	79.4	5.4	**2019**
March	**2020**	500,325	3,107,968	68.2	85.8	6.2	**2020**
Annual openings Year ended: March	**2019**						**2019**
March	**2019**	770,609	3,120,486	100.0	_	4.0	**2019**
March	**2020**	601,739	3,103,992	78.1	78.1	5.2	**2020**
Annual openings Year ended: March	**2020**						**2020**
March	**2020**	804,398	3,114,111	100.0	_	3.9	**2020**


Business failure rate in the US for business started in 1994, 1999 and 2004
25%
20%
15%
10%
5%
0%
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
1994
1999
2004


Failure: risk / rate of loss between 2011 and 2020
6.00%
5.00%
4.00%
3.00%
2.00%
1.00%
0.00%
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
Failure: risk / rate of loss

Appendix 2 Country Default Spreads and Risk Premiums

Last updated: January 5, 2022

This table summarizes the latest bond ratings and appropriate default spreads for different countries. While you can use these numbers as rough estimates of country risk premiums, you may want to modify the premia to reflect the additonal risk of equity markets. To estimate the long term country equity risk premium, I start with a default spread, which I obtain in one of two ways:
(1) I use the local currency sovereign rating (from Moody's: www.moodys.com) and estimate the default spread for that rating (based upon traded country bonds) over a default free government bond rate. For countries without a Moody's rating but with an S&P rating, I use the Moody's equivalent of the S&P rating. To get the default spreads by sovereign rating, I use the CDS spreads and compute the average CDS spread by rating. Using that number as a basis, I extrapolate for those ratings for which I have no CDS spreads.
(2) I start with the CDS spread for the country, if one is available and subtract out the US CDS spread, since my mature market premium is derived from the US market. That difference becomes the country spread. For the few countries that have CDS spreads that are lower than the US, I will get a negative number.
You can add just this default spread to the mature market premium to arrive at the total equity risk premium. I add an additional step. In the short term especially, the equity country risk premium is likely to be greater than the country's default spread. You can estimate an adjusted country risk premium by multiplying the default spread by the relative equity market volatility for that market (Std dev in country equity market/Std dev in country bond). Sicnce government bonds are not available or traded in most countries, I approximate the relative equity market volatility by estimating the standard deviations in two indices, the S&P emerging market equity index (for equities) and the S&P emerging market government bond index (for government bonds), and using that ratio for all countries to estimate the additional country risk premium. Finally, I add that country risk premium to my estimate of a mature market equity risk premium, for which I use the implied equity ris premium of the S&P 500.

Country	Moody's rating	*Adj. Default Spread*	*Country Risk Premium*	*Equity Risk Premium*	*Country Risk Premium*
Abu Dhabi	Aa2	0.42%	0.49%	4.73%	0.49%
Albania	B1	3.83%	4.45%	8.69%	4.45%
Algeria	NR	5.53%	6.43%	10.67%	6.43%
Andorra (Principality of)	Baa2	1.62%	1.88%	6.12%	1.88%
Angola	B3	5.53%	6.43%	10.67%	6.43%
Anguilla	NR	5.88%	6.83%	11.07%	6.83%
Antigua & Barbuda	NR	5.88%	6.83%	11.07%	6.83%
Argentina	Ca	10.21%	11.87%	16.11%	11.87%
Armenia	Ba3	3.06%	3.56%	7.80%	3.56%
Aruba	Baa2	1.62%	1.88%	6.12%	1.88%
Australia	Aaa	0.00%	0.00%	4.24%	0.00%
Austria	Aa1	0.34%	0.39%	4.63%	0.39%
Azerbaijan	Ba2	2.56%	2.97%	7.21%	2.97%
Bahamas	Ba3	3.06%	3.56%	7.80%	3.56%
Bahrain	B2	4.68%	5.44%	9.68%	5.44%
Bangladesh	Ba3	3.06%	3.56%	7.80%	3.56%
Barbados	Caa1	6.38%	7.41%	11.65%	7.41%
Belarus	B3	5.53%	6.43%	10.67%	6.43%
Belgium	Aa3	0.51%	0.60%	4.84%	0.60%
Belize	Caa3	8.51%	9.89%	14.13%	9.89%
Benin	B1	3.83%	4.45%	8.69%	4.45%
Bermuda	A2	0.72%	0.84%	5.08%	0.84%
Bolivia	B2	4.68%	5.44%	9.68%	5.44%
Bosnia and Herzegovina	B3	5.53%	6.43%	10.67%	6.43%
Botswana	A3	1.02%	1.19%	5.43%	1.19%
Brazil	Ba2	2.56%	2.97%	7.21%	2.97%
British Virgin Islands	NR	5.88%	6.83%	11.07%	6.83%
Brunei	NR	0.72%	0.84%	5.08%	0.84%
Bulgaria	Baa1	1.36%	1.58%	5.82%	1.58%
Burkina Faso	B2	4.68%	5.44%	9.68%	5.44%
Cambodia	B2	4.68%	5.44%	9.68%	5.44%
Cameroon	B2	4.68%	5.44%	9.68%	5.44%
Canada	Aaa	0.00%	0.00%	4.24%	0.00%
Cape Verde	B3	5.53%	6.43%	10.67%	6.43%
Cayman Islands	Aa3	0.51%	0.60%	4.84%	0.60%
Channel Islands	NR	0.72%	0.83%	5.07%	0.83%
Chile	A1	0.60%	0.70%	4.94%	0.70%
China	A1	0.60%	0.70%	4.94%	0.70%
Colombia	Baa2	1.62%	1.88%	6.12%	1.88%
Congo (Democratic Republic	Caa1	6.38%	7.41%	11.65%	7.41%
Congo (Republic of)	Caa2	7.66%	8.90%	13.14%	8.90%
Cook Islands	B1	3.83%	4.45%	8.69%	4.45%
Costa Rica	B2	4.68%	5.44%	9.68%	5.44%
Croatia	Ba1	2.13%	2.47%	6.71%	2.47%
Cuba	Ca	10.21%	11.87%	16.11%	11.87%
Curacao	Baa2	1.62%	1.88%	6.12%	1.88%
Cyprus	Ba1	2.13%	2.47%	6.71%	2.47%
Czech Republic	Aa3	0.51%	0.60%	4.84%	0.60%
Denmark	Aaa	0.00%	0.00%	4.24%	0.00%
Dominican Republic	Ba3	3.06%	3.56%	7.80%	3.56%
Ecuador	Caa3	8.51%	9.89%	14.13%	9.89%
Egypt	B2	4.68%	5.44%	9.68%	5.44%
El Salvador	Caa1	6.38%	7.41%	11.65%	7.41%

Estonia	A1	0.60%	0.70%	4.94%	0.70%
Ethiopia	Caa2	7.66%	8.90%	13.14%	8.90%
Falkland Islands	NR	5.88%	6.83%	11.07%	6.83%
Fiji	B1	3.83%	4.45%	8.69%	4.45%
Finland	Aa1	0.34%	0.39%	4.63%	0.39%
France	Aa2	0.42%	0.49%	4.73%	0.49%
French Guiana	NR	3.26%	3.79%	8.03%	3.79%
Gabon	Caa1	6.38%	7.41%	11.65%	7.41%
Gambia	NR	4.68%	5.44%	9.68%	5.44%
Georgia	Ba2	2.56%	2.97%	7.21%	2.97%
Germany	Aaa	0.00%	0.00%	4.24%	0.00%
Ghana	B3	5.53%	6.43%	10.67%	6.43%
Gibraltar	NR	0.72%	0.83%	5.07%	0.83%
Greece	Ba3	3.06%	3.56%	7.80%	3.56%
Greenland	NR	0.72%	0.83%	5.07%	0.83%
Guatemala	Ba1	2.13%	2.47%	6.71%	2.47%
Guernsey	Aa3	0.51%	0.60%	4.84%	0.60%
Guinea	NR	7.66%	8.90%	13.14%	8.90%
Guinea-Bissau	NR	5.53%	6.43%	10.67%	6.43%
Guyana	NR	3.83%	4.45%	8.69%	4.45%
Haiti	NR	8.51%	9.89%	14.13%	9.89%
Honduras	B1	3.83%	4.45%	8.69%	4.45%
Hong Kong	Aa3	0.51%	0.60%	4.84%	0.60%
Hungary	Baa2	1.62%	1.88%	6.12%	1.88%
Iceland	A2	0.72%	0.84%	5.08%	0.84%
India	Baa3	1.87%	2.18%	6.42%	2.18%
Indonesia	Baa2	1.62%	1.88%	6.12%	1.88%
Iran	NR	5.53%	6.43%	10.67%	6.43%
Iraq	Caa1	6.38%	7.41%	11.65%	7.41%
Ireland	A2	0.72%	0.84%	5.08%	0.84%
Isle of Man	Aa3	0.51%	0.60%	4.84%	0.60%
Israel	A1	0.60%	0.70%	4.94%	0.70%
Italy	Baa3	1.87%	2.18%	6.42%	2.18%
Ivory Coast	Ba3	3.06%	3.56%	7.80%	3.56%
Jamaica	B2	4.68%	5.44%	9.68%	5.44%
Japan	A1	0.60%	0.70%	4.94%	0.70%
Jersey	Aaa	0.00%	0.00%	4.24%	0.00%
Jordan	B1	3.83%	4.45%	8.69%	4.45%
Kazakhstan	Baa2	1.62%	1.88%	6.12%	1.88%
Kenya	B2	4.68%	5.44%	9.68%	5.44%
Korea, D.P.R.	NR	10.21%	11.87%	16.11%	11.87%
Kuwait	A1	0.60%	0.70%	4.94%	0.70%
Kyrgyzstan	B2	4.68%	5.44%	9.68%	5.44%
Laos	Caa2	7.66%	8.90%	13.14%	8.90%
Latvia	A3	1.02%	1.19%	5.43%	1.19%
Lebanon	C	17.50%	20.34%	24.58%	20.34%
Liberia	NR	7.66%	8.90%	13.14%	8.90%
Libya	NR	3.83%	4.45%	8.69%	4.45%
Liechtenstein	Aaa	0.00%	0.00%	4.24%	0.00%
Lithuania	A2	0.72%	0.84%	5.08%	0.84%
Luxembourg	Aaa	0.00%	0.00%	4.24%	0.00%
Macao	Aa3	0.51%	0.60%	4.84%	0.60%
Macedonia	Ba3	3.06%	3.56%	7.80%	3.56%
Madagascar	NR	5.53%	6.43%	10.67%	6.43%
Malawi	NR	7.66%	8.90%	13.14%	8.90%
Malaysia	A3	1.02%	1.19%	5.43%	1.19%
Maldives	Caa1	6.38%	7.41%	11.65%	7.41%
Mali	Caa1	6.38%	7.41%	11.65%	7.41%
Malta	A2	0.72%	0.84%	5.08%	0.84%
Martinique	NR	3.26%	3.79%	8.03%	3.79%
Mauritius	Baa2	1.62%	1.88%	6.12%	1.88%
Mexico	Baa1	1.36%	1.58%	5.82%	1.58%
Moldova	B3	5.53%	6.43%	10.67%	6.43%
Mongolia	B3	5.53%	6.43%	10.67%	6.43%
Montenegro	B1	3.83%	4.45%	8.69%	4.45%
Montserrat	Baa3	1.87%	2.18%	6.42%	2.18%
Morocco	Ba1	2.13%	2.47%	6.71%	2.47%
Mozambique	Caa2	7.66%	8.90%	13.14%	8.90%
Myanmar	NR	10.21%	11.87%	16.11%	11.87%
Namibia	Ba3	3.06%	3.56%	7.80%	3.56%
Netherlands	Aaa	0.00%	0.00%	4.24%	0.00%
Netherlands Antilles	NR	5.88%	6.83%	11.07%	6.83%
New Zealand	Aaa	0.00%	0.00%	4.24%	0.00%

Nicaragua	B3	5.53%	6.43%	10.67%	6.43%
Niger	B3	5.53%	6.43%	10.67%	6.43%
Nigeria	B2	4.68%	5.44%	9.68%	5.44%
Norway	Aaa	0.00%	0.00%	4.24%	0.00%
Oman	Ba3	3.06%	3.56%	7.80%	3.56%
Pakistan	B3	5.53%	6.43%	10.67%	6.43%
Palestinian Authority	NR	1.38%	1.60%	5.84%	1.60%
Panama	Baa2	1.62%	1.88%	6.12%	1.88%
Papua New Guinea	B2	4.68%	5.44%	9.68%	5.44%
Paraguay	Ba1	2.13%	2.47%	6.71%	2.47%
Peru	Baa1	1.36%	1.58%	5.82%	1.58%
Philippines	Baa2	1.62%	1.88%	6.12%	1.88%
Poland	A2	0.72%	0.84%	5.08%	0.84%
Portugal	Baa2	1.62%	1.88%	6.12%	1.88%
Qatar	Aa3	0.51%	0.60%	4.84%	0.60%
Ras Al Khaimah (Emirate of)	A3	1.02%	1.19%	5.43%	1.19%
Reunion	NR	4.51%	5.25%	9.49%	5.25%
Romania	Baa3	1.87%	2.18%	6.42%	2.18%
Russia	Baa3	1.87%	2.18%	6.42%	2.18%
Rwanda	B2	4.68%	5.44%	9.68%	5.44%
Saint Lucia	NR	5.88%	6.83%	11.07%	6.83%
Saudi Arabia	A1	0.60%	0.70%	4.94%	0.70%
Senegal	Ba3	3.06%	3.56%	7.80%	3.56%
Serbia	Ba2	2.56%	2.97%	7.21%	2.97%
Sharjah	Baa3	1.87%	2.18%	6.42%	2.18%
Sierra Leone	NR	8.51%	9.89%	14.13%	9.89%
Singapore	Aaa	0.00%	0.00%	4.24%	0.00%
Slovakia	A2	0.72%	0.84%	5.08%	0.84%
Slovenia	A3	1.02%	1.19%	5.43%	1.19%
Solomon Islands	Caa1	6.38%	7.41%	11.65%	7.41%
Somalia	NR	10.21%	11.87%	16.11%	11.87%
South Africa	Ba2	2.56%	2.97%	7.21%	2.97%
South Korea	Aa2	0.42%	0.49%	4.73%	0.49%
Spain	Baa1	1.36%	1.58%	5.82%	1.58%
Sri Lanka	Caa2	7.66%	8.90%	13.14%	8.90%
St. Maarten	Ba2	2.56%	2.97%	7.21%	2.97%
St. Vincent & the Grenadines	B3	5.53%	6.43%	10.67%	6.43%
Sudan	NR	17.50%	20.34%	24.58%	20.34%
Suriname	Caa3	8.51%	9.89%	14.13%	9.89%
Swaziland	B3	5.53%	6.43%	10.67%	6.43%
Sweden	Aaa	0.00%	0.00%	4.24%	0.00%
Switzerland	Aaa	0.00%	0.00%	4.24%	0.00%
Syria	NR	17.50%	20.34%	24.58%	20.34%
Taiwan	Aa3	0.51%	0.60%	4.84%	0.60%
Tajikistan	B3	5.53%	6.43%	10.67%	6.43%
Tanzania	B2	4.68%	5.44%	9.68%	5.44%
Thailand	Baa1	1.36%	1.58%	5.82%	1.58%
Togo	B3	5.53%	6.43%	10.67%	6.43%
Trinidad and Tobago	Ba2	2.56%	2.97%	7.21%	2.97%
Tunisia	Caa1	6.38%	7.41%	11.65%	7.41%
Turkey	B2	4.68%	5.44%	9.68%	5.44%
Turks and Caicos Islands	Baa1	1.36%	1.58%	5.82%	1.58%
Uganda	B2	4.68%	5.44%	9.68%	5.44%
Ukraine	B3	5.53%	6.43%	10.67%	6.43%
United Arab Emirates	Aa2	0.42%	0.49%	4.73%	0.49%
United Kingdom	Aa3	0.51%	0.60%	4.84%	0.60%
United States	Aaa	0.00%	0.00%	4.24%	0.00%
Uruguay	Baa2	1.62%	1.88%	6.12%	1.88%
Uzbekistan	B1	3.83%	4.45%	8.69%	4.45%
Venezuela	C	17.50%	20.34%	24.58%	20.34%
Vietnam	Ba3	3.06%	3.56%	7.80%	3.56%
Yemen	NR	10.21%	11.87%	16.11%	11.87%
Zambia	Ca	10.21%	11.87%	16.11%	11.87%
Zimbabwe	NR	6.38%	7.41%	11.65%	7.41%

For more details, download the excel spreadsheet that contains this data on my website: https://www.stern.nyu.edu/~adamodar/pc/datasets/ctryprem.xlsx
If you are interested in my approach to computing the equity risk premium, download my magnum opus (just kidding):
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3825823

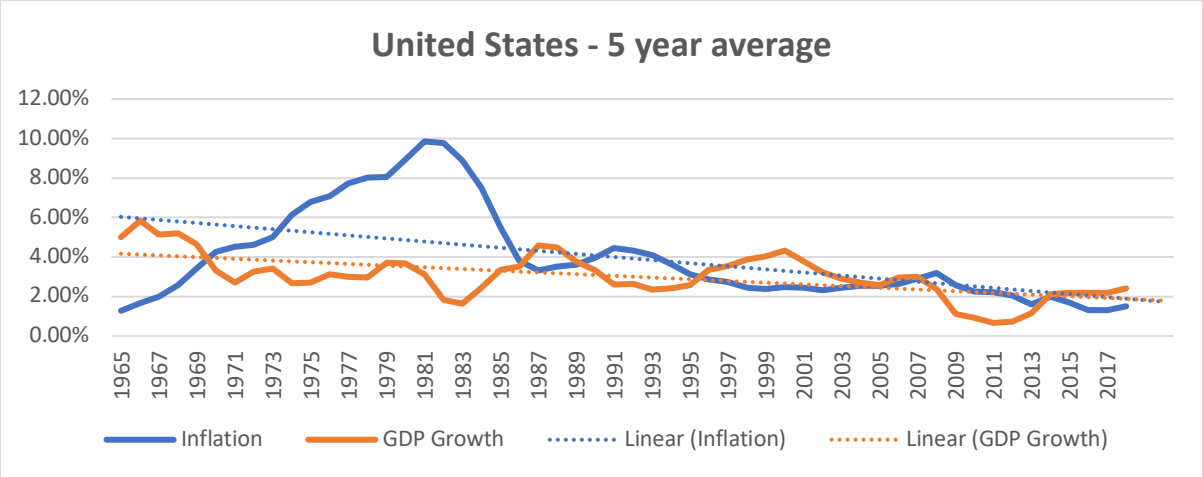
And my paper on measuring country risk
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3879109

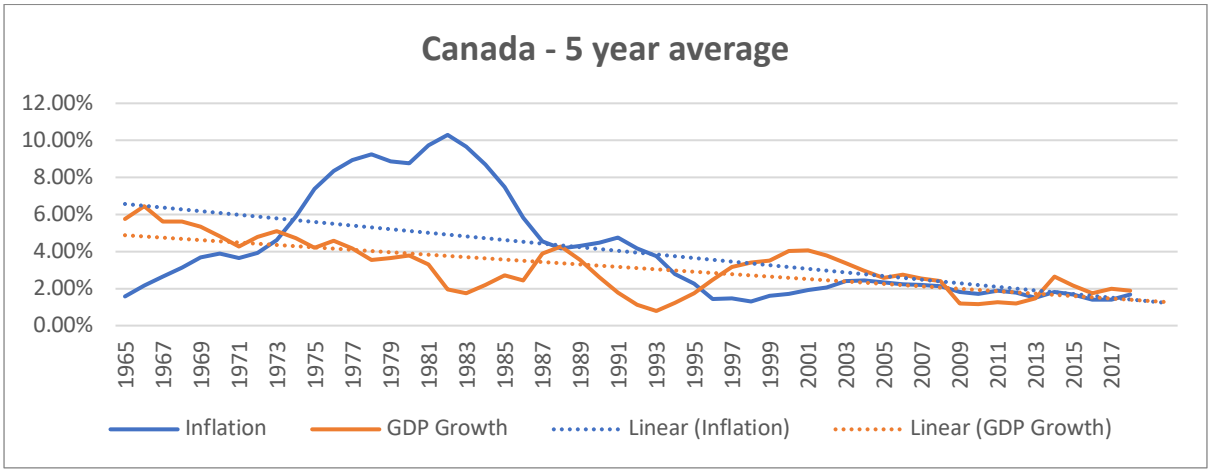
Last updated: January 2022

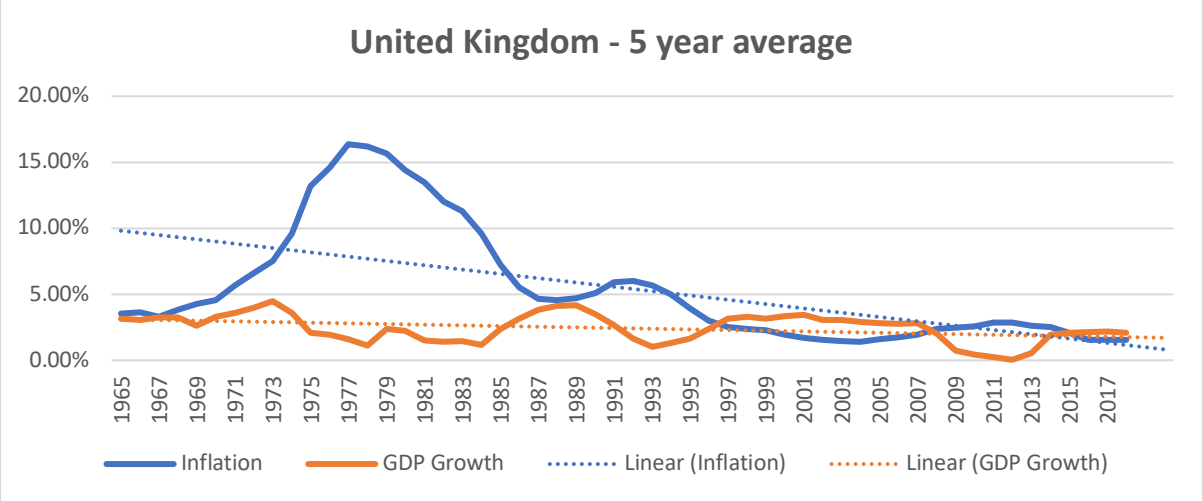
Aswath Damodaran

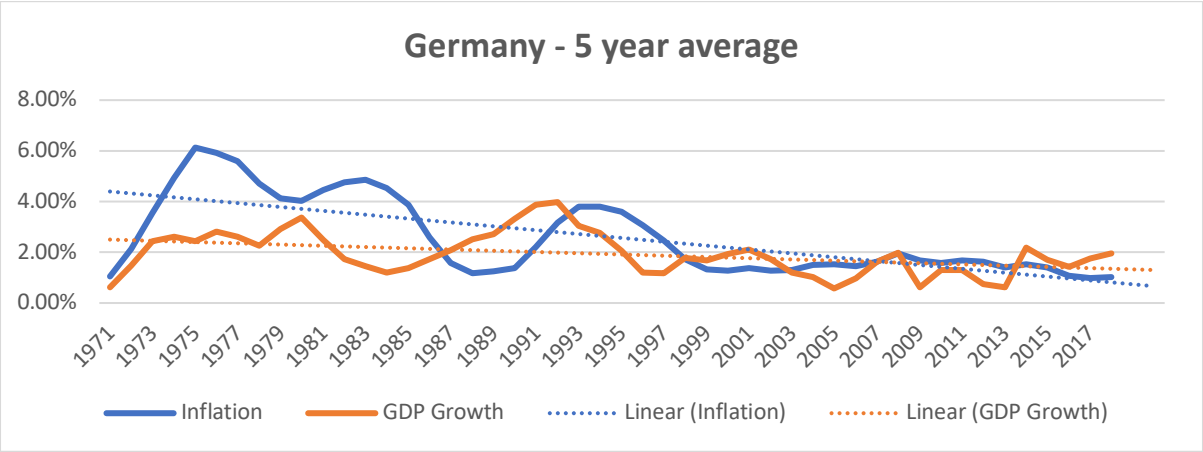
APPENDIX 3

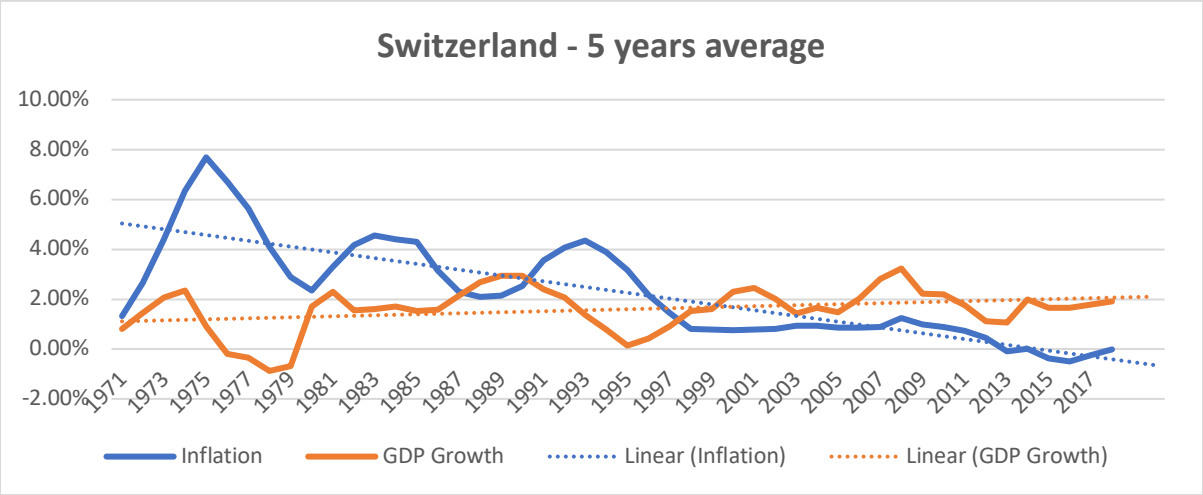
World Bank data: extracted from:
https://www.macrotrends.net/countries/NOR/norway/inflation-rate-cpi
5 year moving averages with linear trendlines

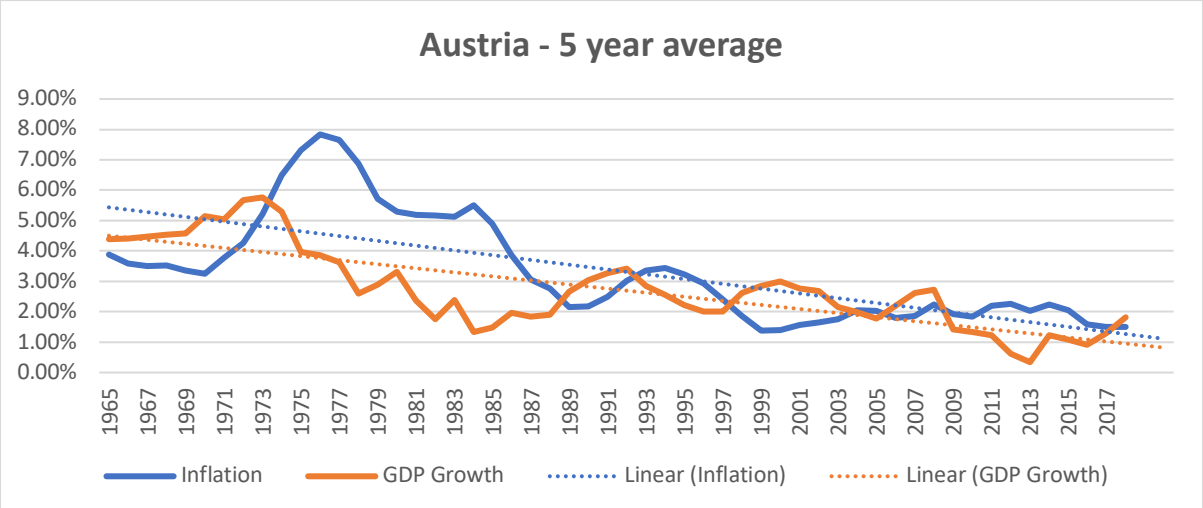


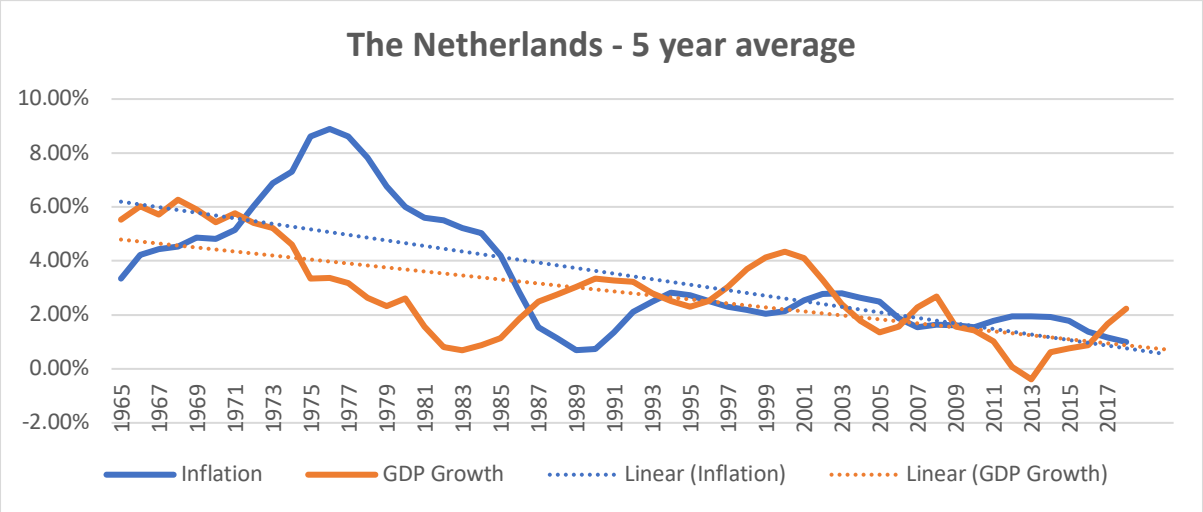


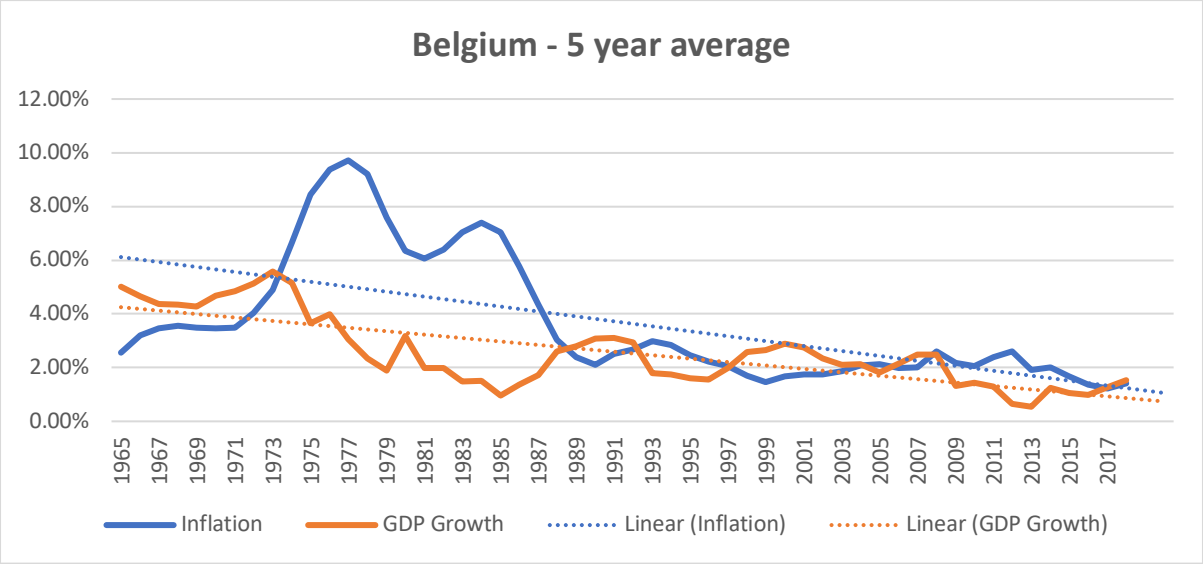


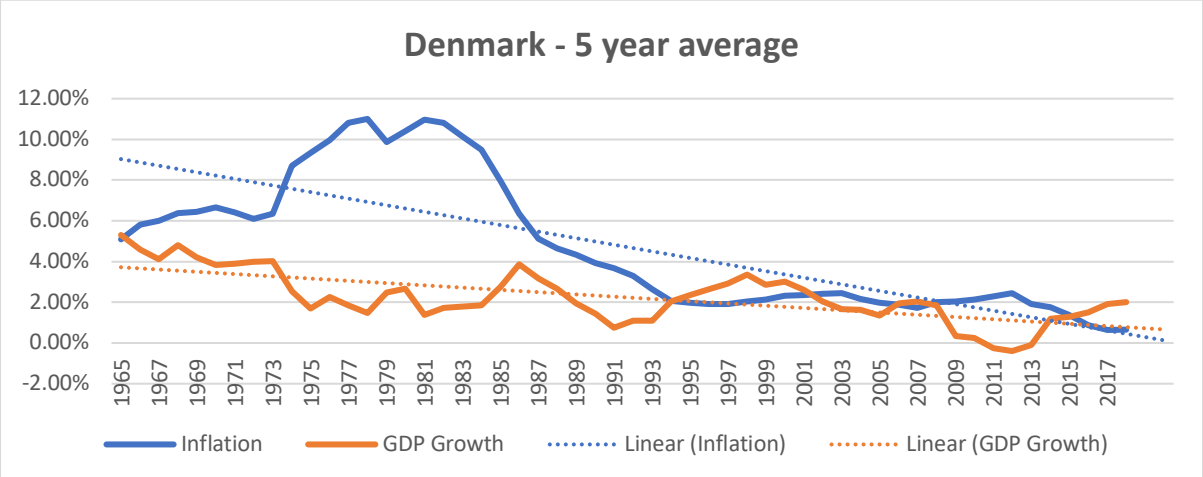

Germany - 5 year average
8.00%
6.00%
4.00%
2.00%
0.00%
1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)

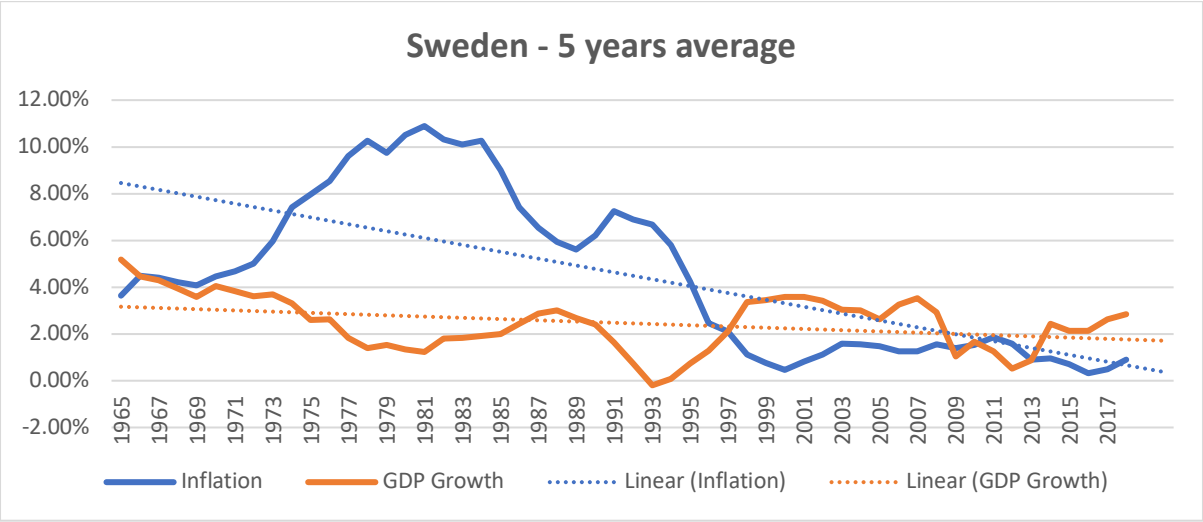

Switzerland - 5 years average
10.00%
8.00%
6.00%
4.00%
2.00%
0.00%
-2.00%
1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)

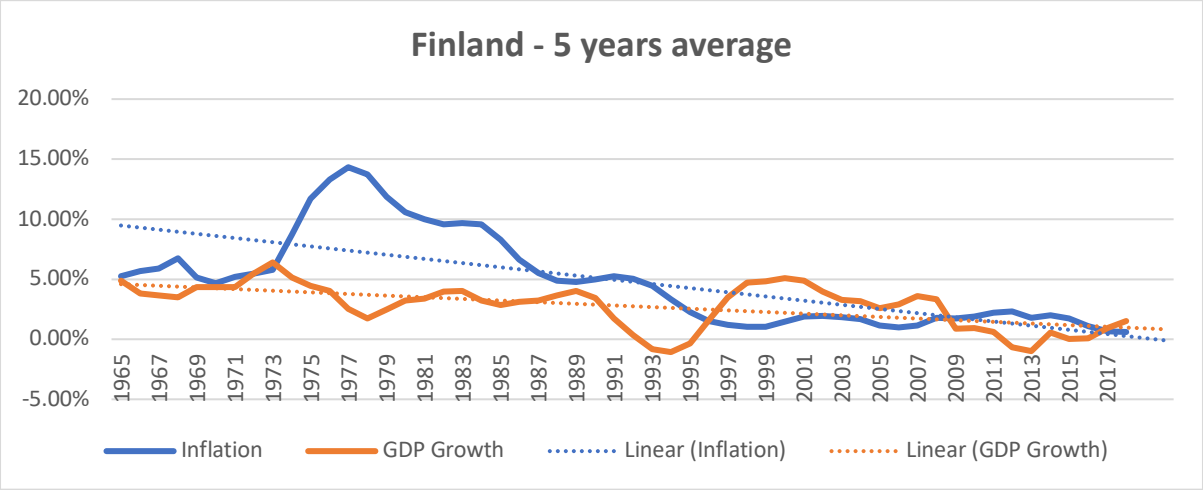

Austria - 5 year average
9.00%
8.00%
7.00%
6.00%
5.00%
4.00%
3.00%
2.00%
1.00%
0.00%
1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)

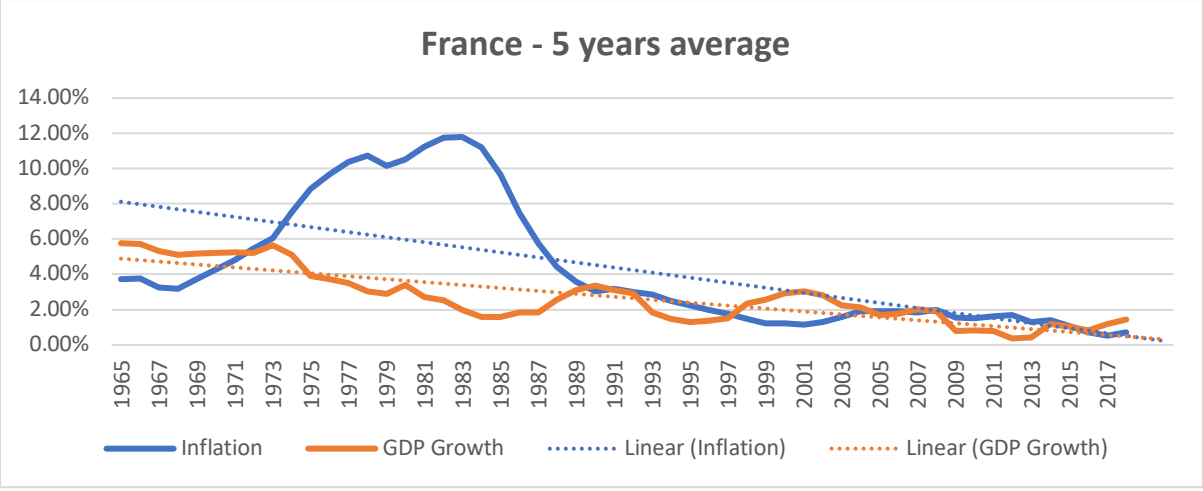

The Netherlands - 5 year average
10.00%
8.00%
6.00%
4.00%
2.00%
0.00%
-2.00%
1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)

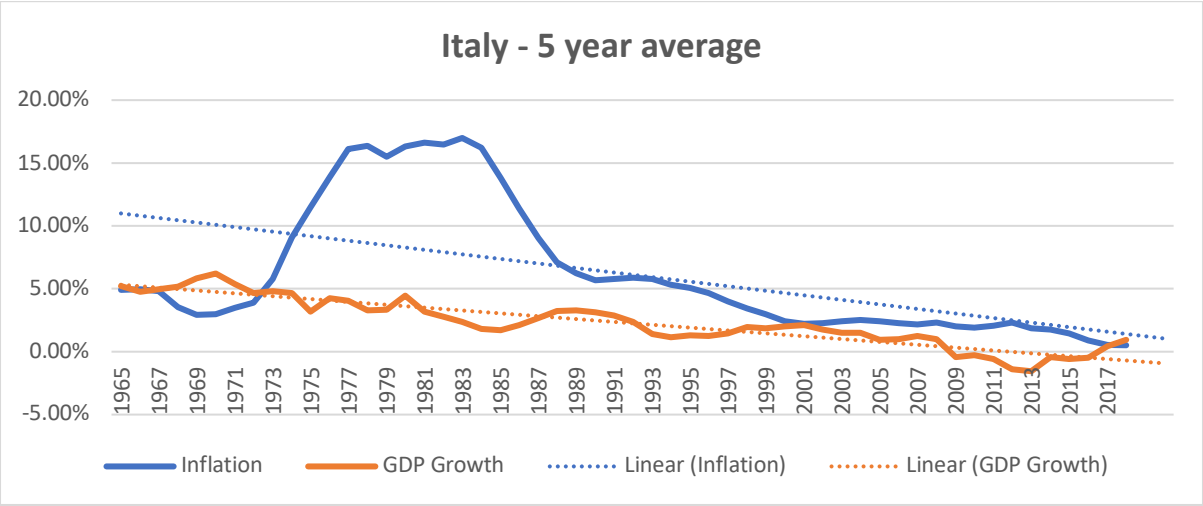

Belgium - 5 year average
12.00%
10.00%
8.00%
6.00%
4.00%
2.00%
0.00%
1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)

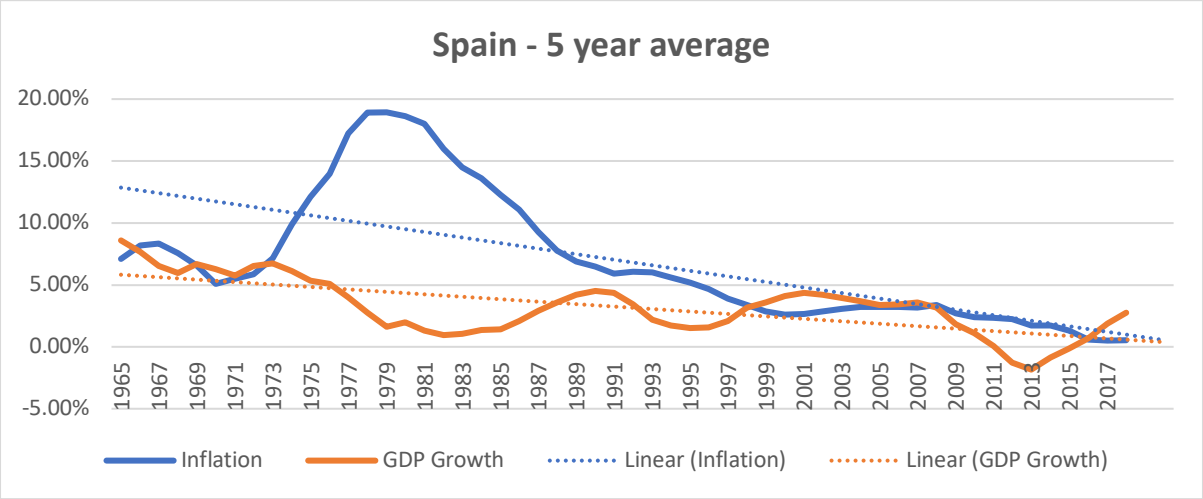

Denmark - 5 year average
12.00%
10.00%
8.00%
6.00%
4.00%
2.00%
0.00%
-2.00%
1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)

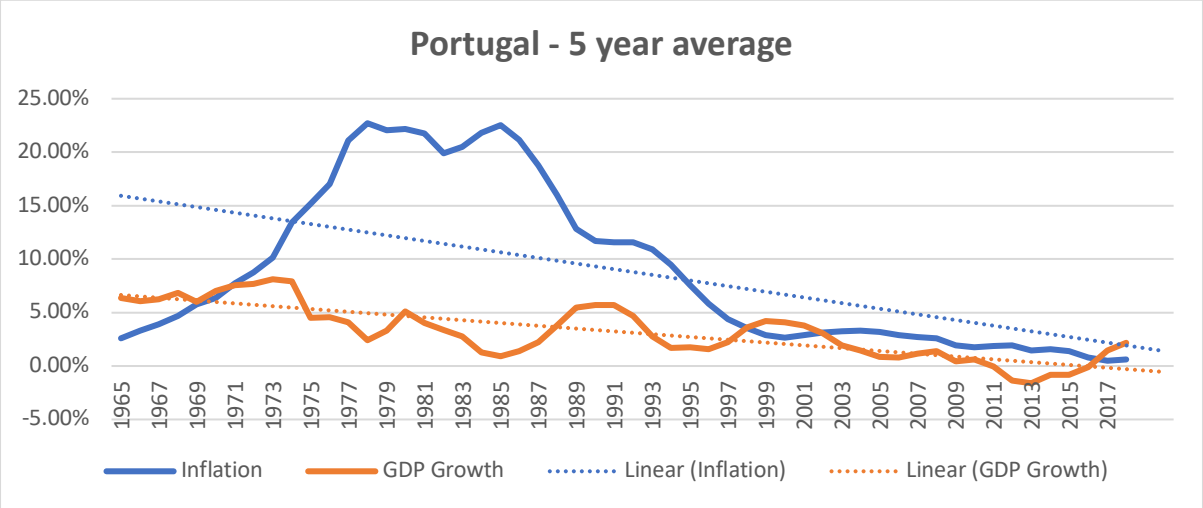

Sweden - 5 years average
12.00%
10.00%
8.00%
6.00%
4.00%
2.00%
0.00%
-2.00%
1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)

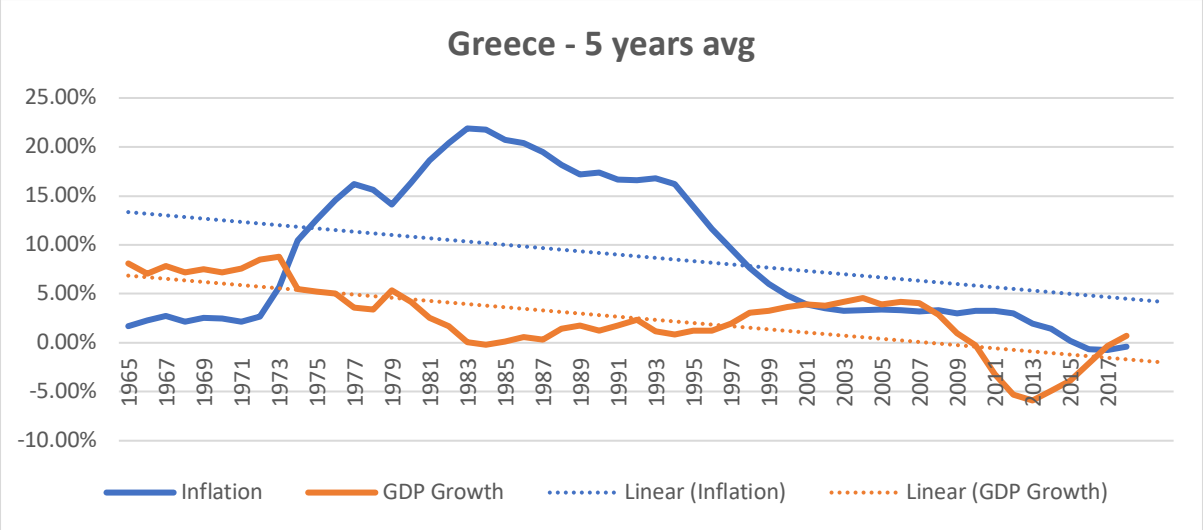

Finland - 5 years average
20.00%
15.00%
10.00%
5.00%
0.00%
-5.00%
1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)

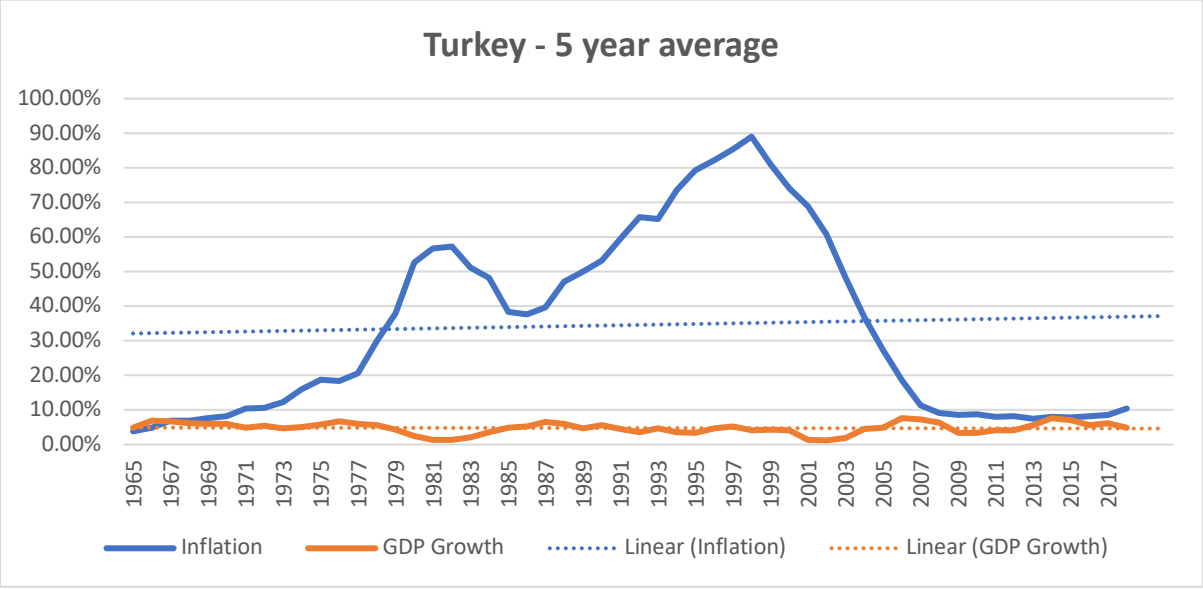

France - 5 years average
14.00%
12.00%
10.00%
8.00%
6.00%
4.00%
2.00%
0.00%
1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)

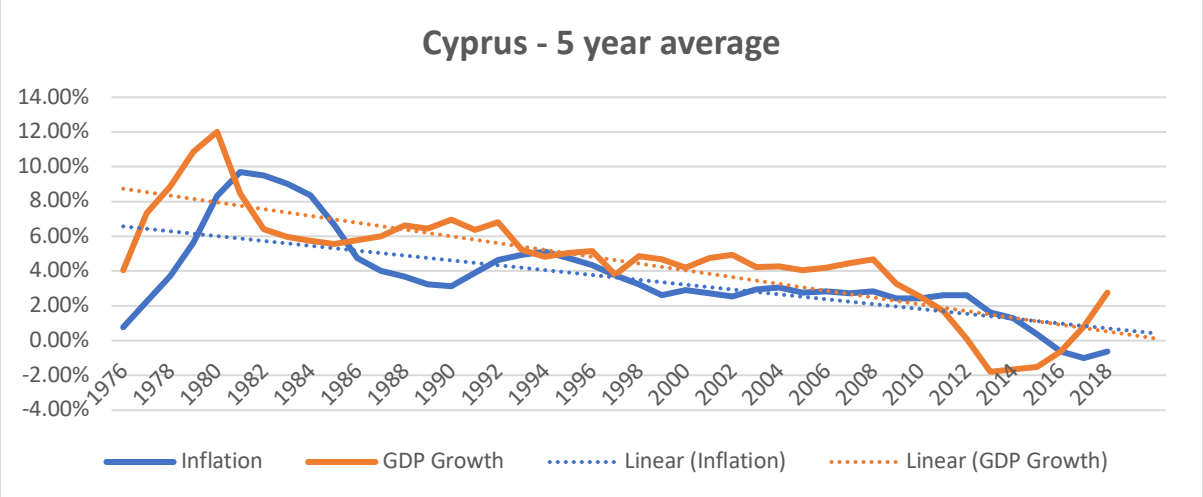

Italy - 5 year average
20.00%
15.00%
10.00%
5.00%
0.00%
-5.00%
1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)

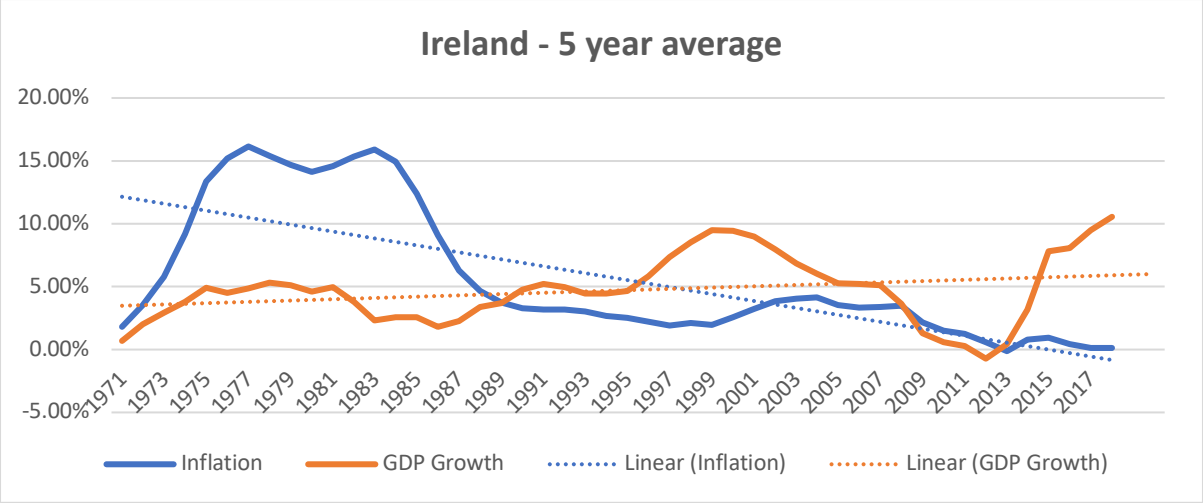

Spain - 5 year average
20.00%
15.00%
10.00%
5.00%
0.00%
-5.00%
1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)

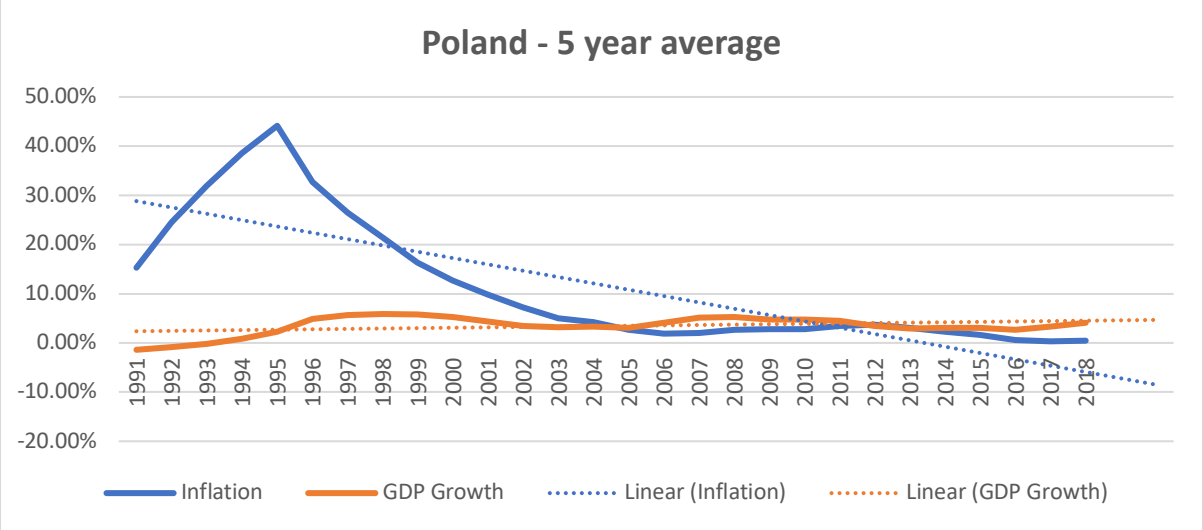

Portugal - 5 year average
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
-5.00%
1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)

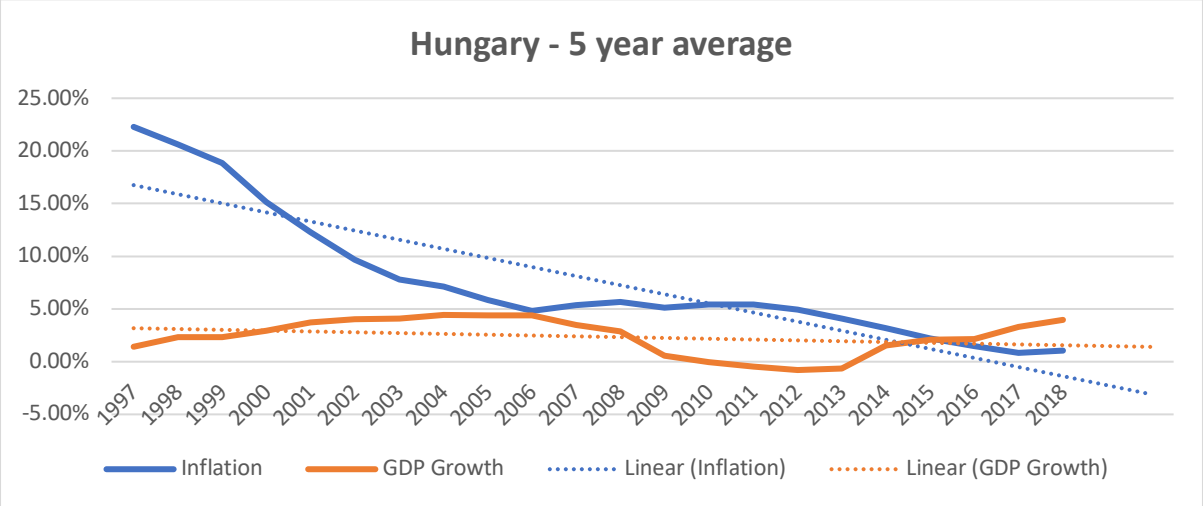

Greece - 5 years avg
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
-5.00%
-10.00%
1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)

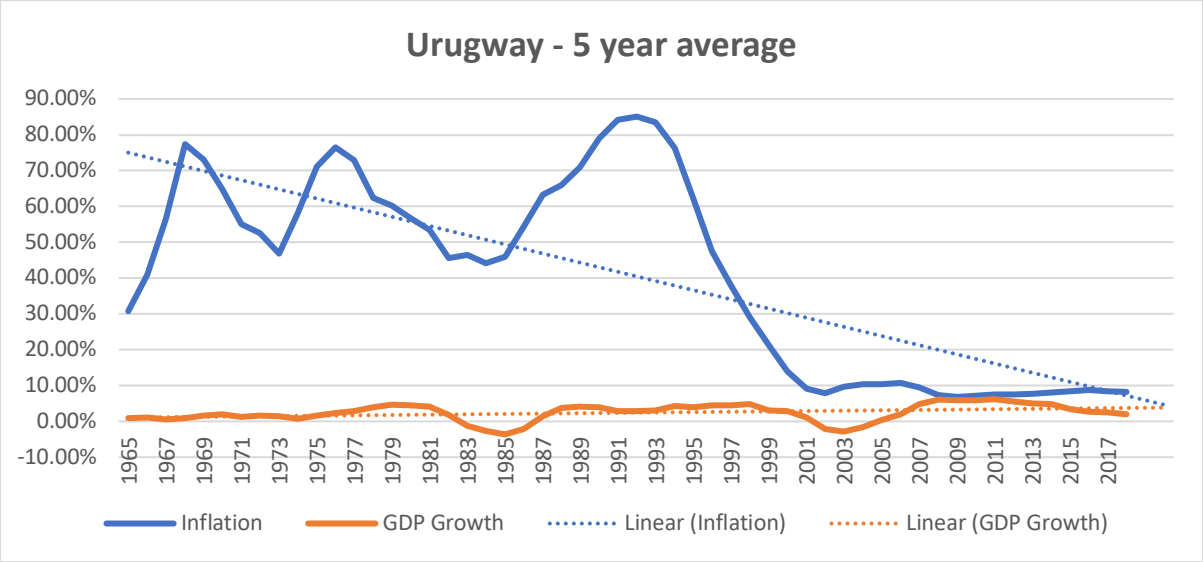

Turkey - 5 year average
100.00%
90.00%
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)

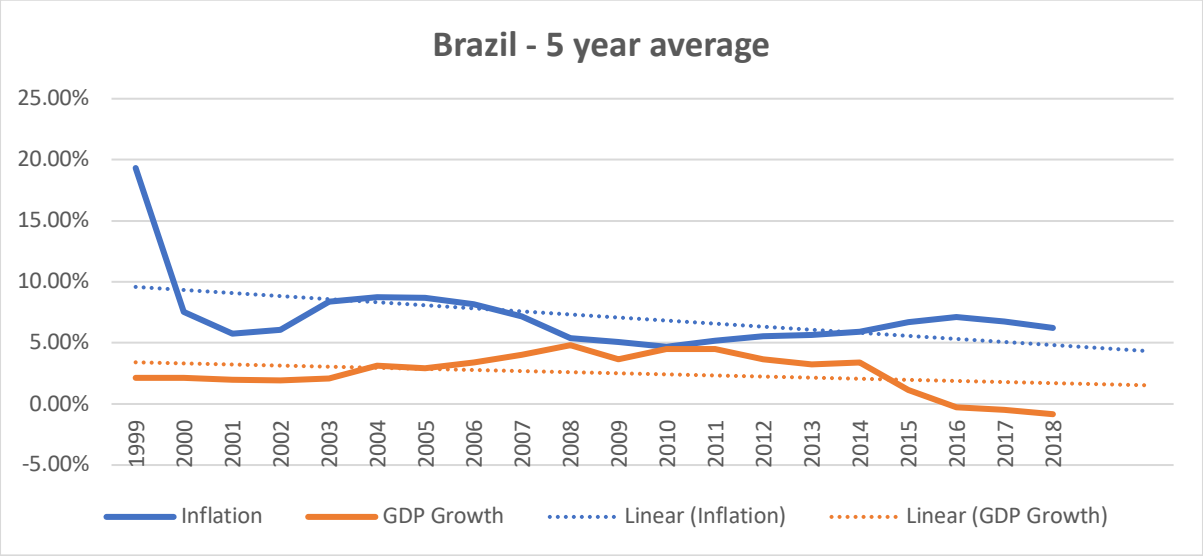

Cyprus - 5 year average
14.00%
12.00%
10.00%
8.00%
6.00%
4.00%
2.00%
0.00%
-2.00%
-4.00%
1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)

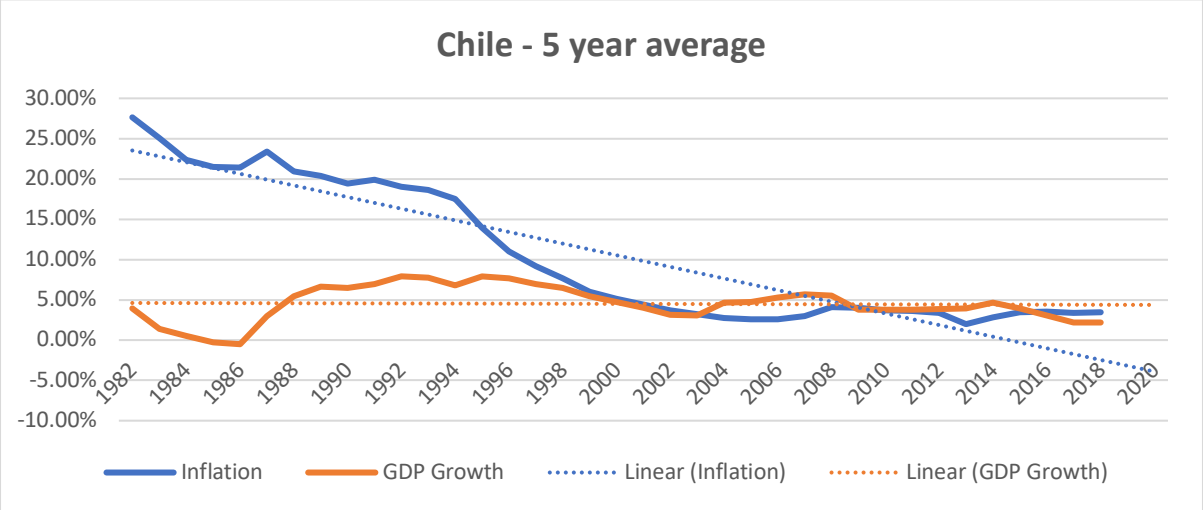

Ireland - 5 year average
20.00%
15.00%
10.00%
5.00%
0.00%
-5.00%
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
2017
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)

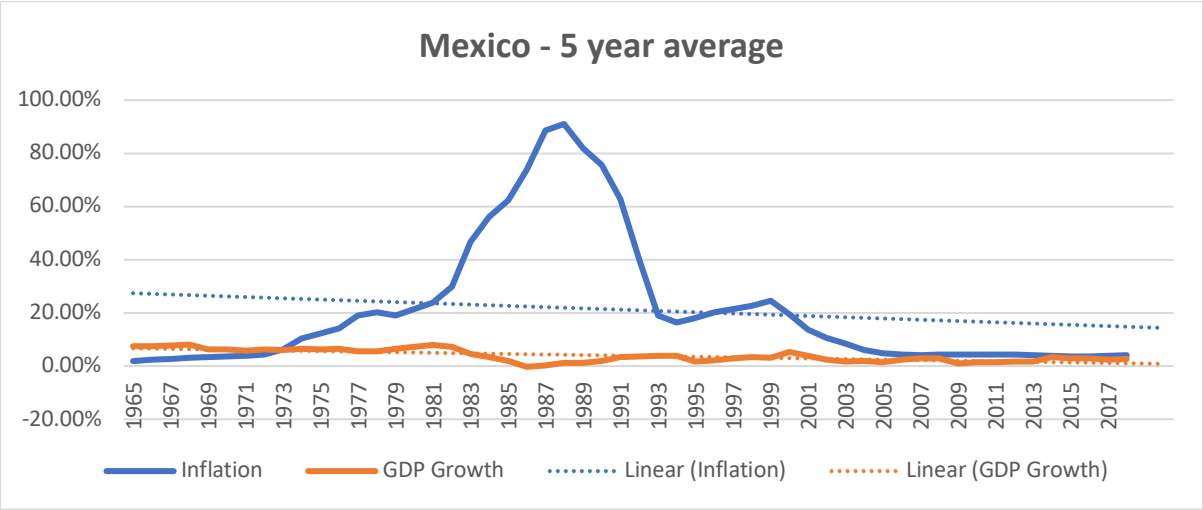

Poland - 5 year average
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
-10.00%
-20.00%
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)

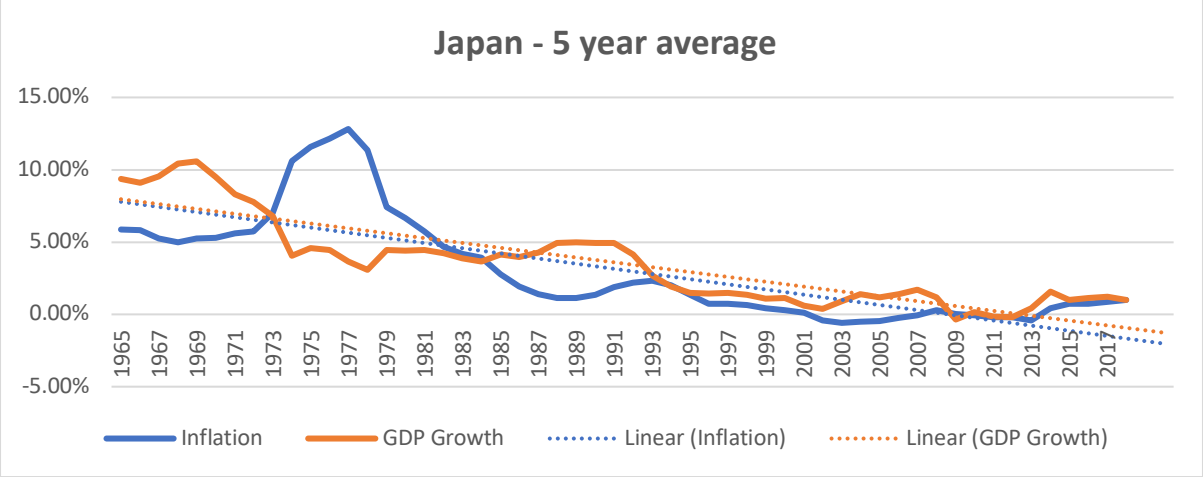

Hungary - 5 year average
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
-5.00%
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)

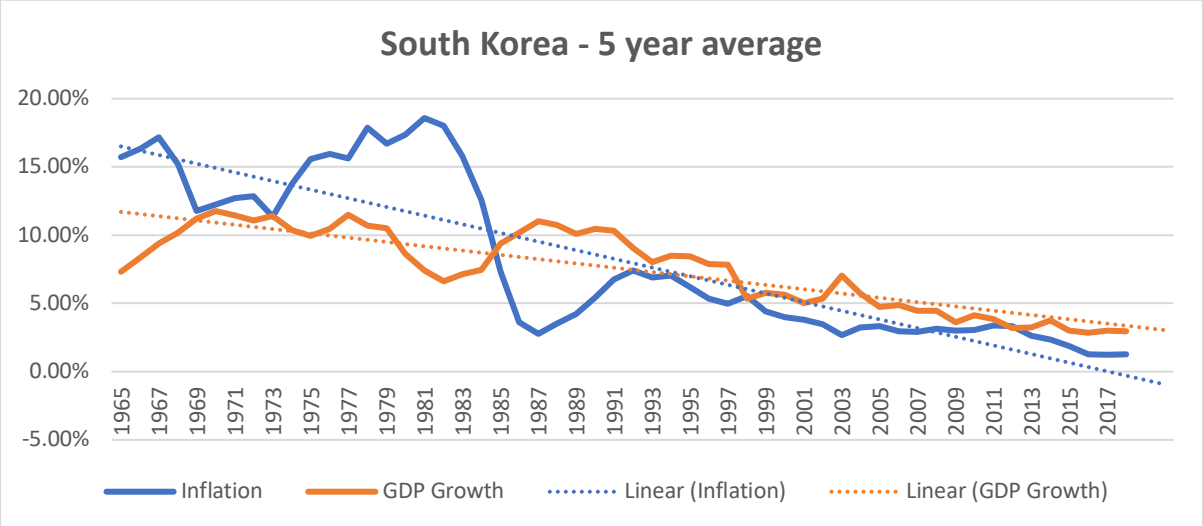

Urugway - 5 year average
90.00%
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
-10.00%
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
2017
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)

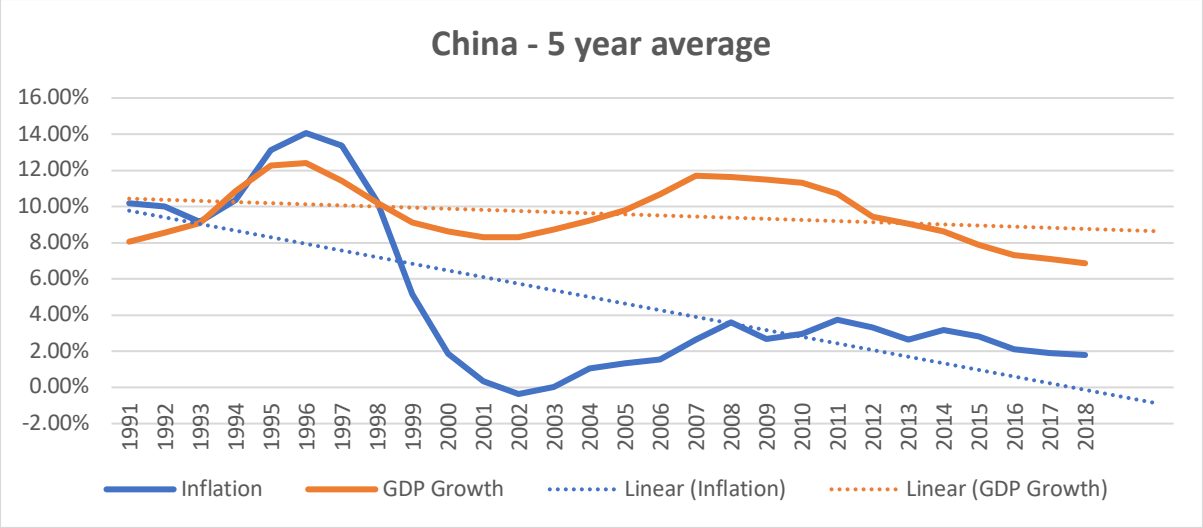

Brazil - 5 year average
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
-5.00%
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)

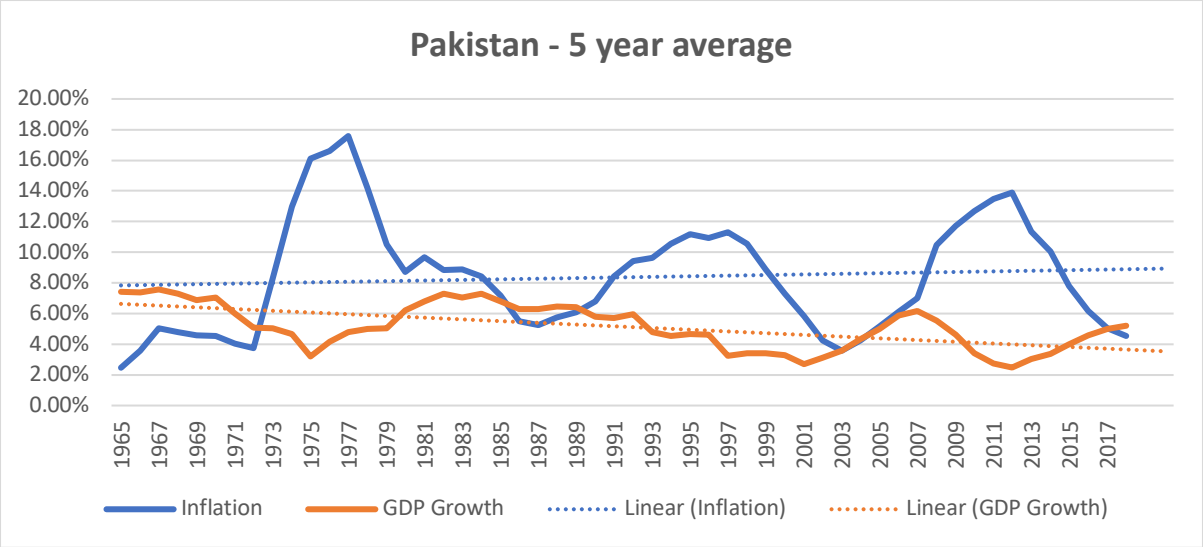

Chile - 5 year average
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
-5.00%
-10.00%
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)

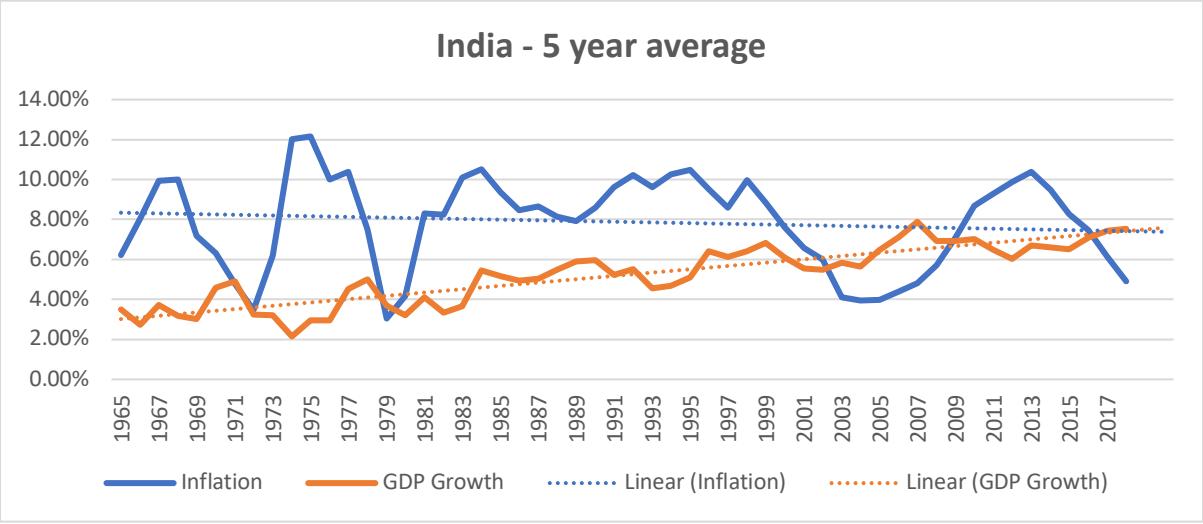

Mexico - 5 year average
100.00%
80.00%
60.00%
40.00%
20.00%
0.00%
-20.00%
1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)

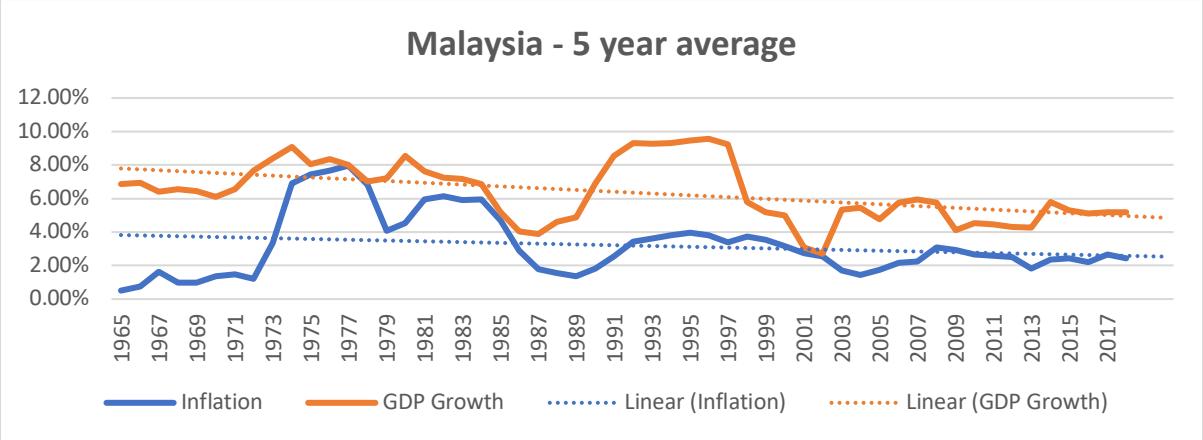

Japan - 5 year average
15.00%
10.00%
5.00%
0.00%
-5.00%
1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)

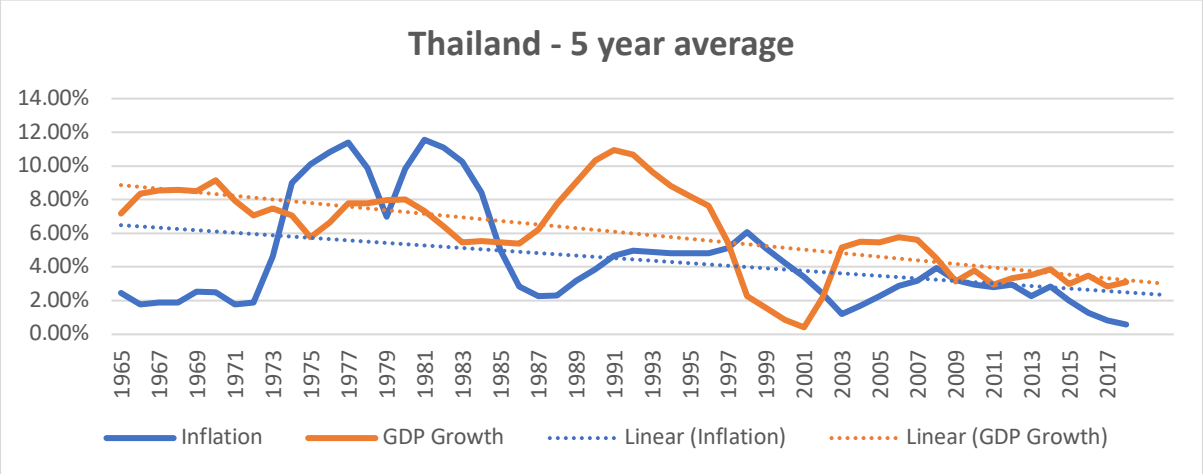

South Korea - 5 year average
20.00%
15.00%
10.00%
5.00%
0.00%
-5.00%
1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)


China - 5 year average
16.00%
14.00%
12.00%
10.00%
8.00%
6.00%
4.00%
2.00%
0.00%
-2.00%
1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)

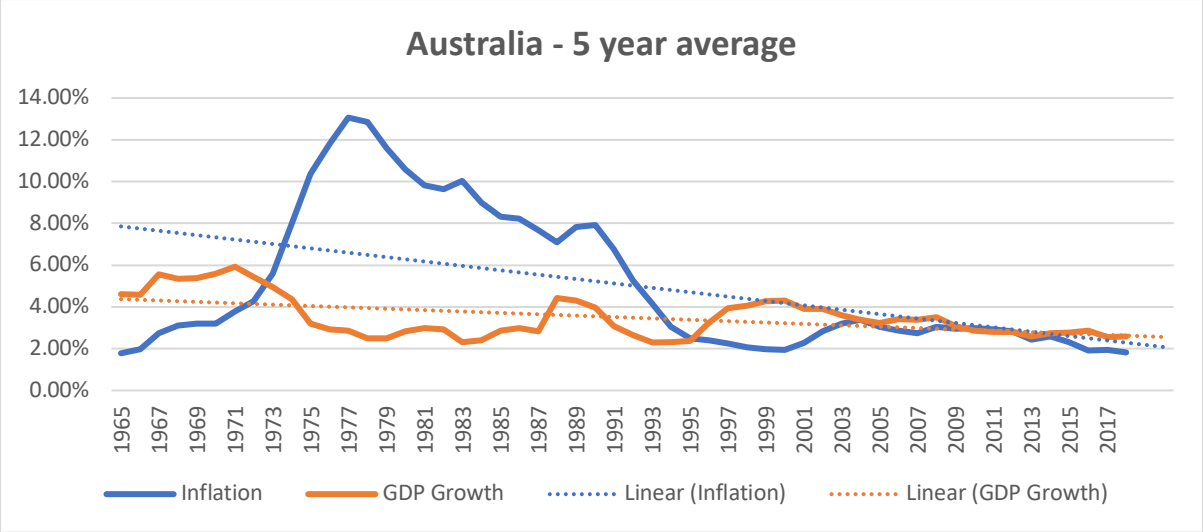

Pakistan - 5 year average
20.00%
18.00%
16.00%
14.00%
12.00%
10.00%
8.00%
6.00%
4.00%
2.00%
0.00%
1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)

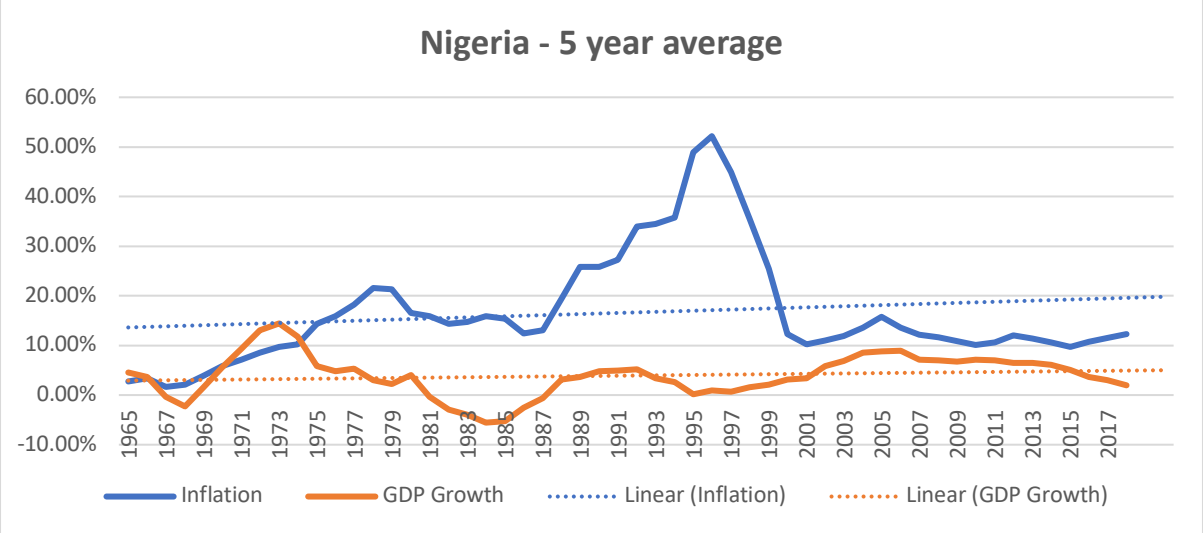

India - 5 year average
14.00%
12.00%
10.00%
8.00%
6.00%
4.00%
2.00%
0.00%
1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)

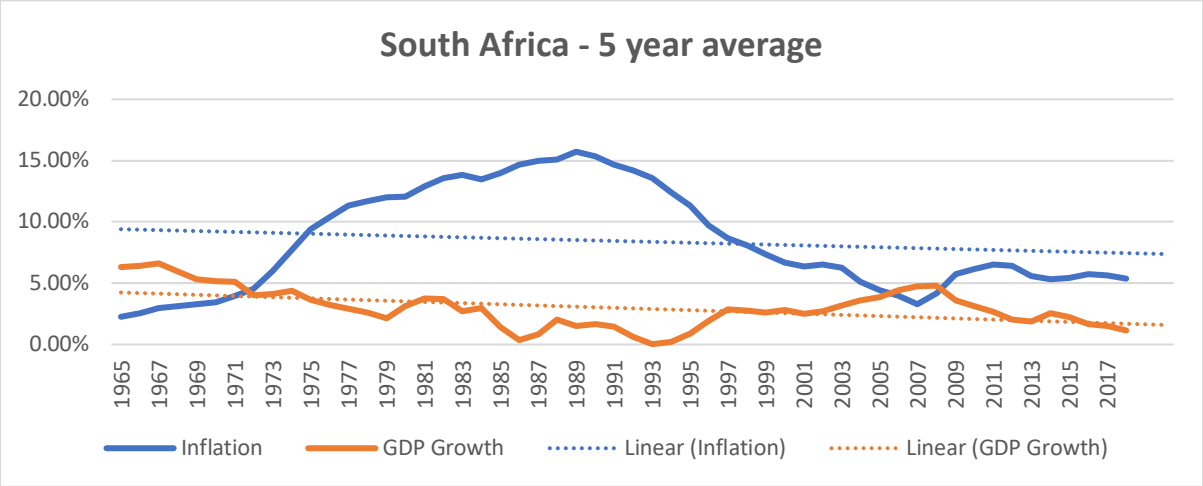

Malaysia - 5 year average
12.00%
10.00%
8.00%
6.00%
4.00%
2.00%
0.00%
1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)

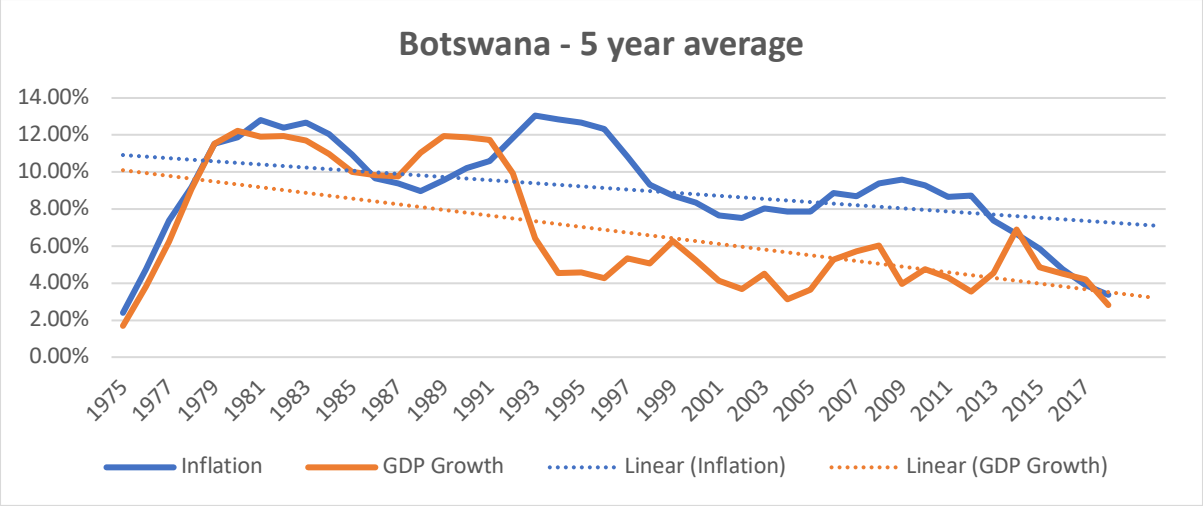

Thailand - 5 year average
14.00%
12.00%
10.00%
8.00%
6.00%
4.00%
2.00%
0.00%
1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)


Indonesia - 5 year average
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)


Australia - 5 year average
14.00%
12.00%
10.00%
8.00%
6.00%
4.00%
2.00%
0.00%
1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)


Nigeria - 5 year average
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
-10.00%
1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)


South Africa - 5 year average
20.00%
15.00%
10.00%
5.00%
0.00%
1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015 2017
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)


Botswana - 5 year average
14.00%
12.00%
10.00%
8.00%
6.00%
4.00%
2.00%
0.00%
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
2017
Inflation
GDP Growth
Linear (Inflation)
Linear (GDP Growth)