

A close-up, high-angle photograph of several interlocking metal gears. The gears are made of a dark, polished metal, possibly steel or aluminum, and are set against a dark, almost black background. The lighting is dramatic, highlighting the sharp teeth and the smooth surfaces of the gears. One gear in the foreground is particularly prominent, showing its circular face and the intricate details of its teeth. The overall composition is geometric and industrial, symbolizing the interconnectedness of financial markets and the mechanics of debt and inflation.

Debt and inflation

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Executive summary

Debt accumulation has been a hallmark of modern economies for the last 50 years. As this seems likely to continue, the impact of debt has become a major focal point for investors. Our analysis reveals that private debt accumulation does not have a direct causative effect on inflation but works within the mechanism of aggregate demand interacting with supply, concluding that inflation is fundamentally the result of demand exceeding supply.

Private debt growth generally arises initially from private consumption growth. However, as the economic cycle lengthens, easier access to debt can boost private spending, thereby leading to increased inflationary pressures. For this reason, private debt growth tends to precede inflation growth. However, the direct causative factor has historically been private net spending.

Rapid accumulation of private debt to excessive levels may cause fragility in households and businesses, and therefore greater susceptibility to crises; many crises tend to be preceded by excessive levels of private debt. Our analysis illustrates that the deleveraging that follows a crisis coincides with declining private net spending, thus easing inflationary pressures. The conclusion follows that private debt leads inflation upwards because it allows excessive spending and leads it downwards because it increases the likelihood of a crisis.

Conversely, government debt growth mainly follows inflation, but with a very weak link. This is because the automatic countercyclical nature of fiscal policy tends to dictate that budget deficits and public debt rise during downturns in the economic cycle, which is usually when a decline in inflation is already occurring. Our analysis shows that government debt levels only raise the likelihood of crises under certain conditions: 1) the debt is mainly foreign currency denominated, and 2) the country has a fixed exchange rate regime or currency union or its policymakers do not control monetary or fiscal policy. Government debt tends to move in line with countercyclical policy, and therefore helps accommodate private demand for safe assets. Our conclusion is that it can be used as a signal of the appetite for safety, which is usually high in times of low inflation. In practice, therefore, high and growing government debt may imply bond yields will remain lower for longer.

The current debate

The late 20th and early 21st centuries featured two economic characteristics little seen before: a large and broad accumulation of debt, and a widespread focus on inflation by governments and central banks. Currently, global debt is at higher levels than for most of history, but inflation is proving to be stubbornly low. Indeed, the inflation outcomes are puzzling many.

Could debt be driving inflation? This is a matter of hot debate, spawning many academic articles with strong conclusions. An analysis of the articles gives typical economic “conclusions” using the indecisive phrasing of “on one hand,” and “on the other hand.”

On the one hand, some market observers maintain that the only way out of high debt is inflation. This general line of argument draws on the experience of the 1970s, where high debt levels (compared to the previous decades) were matched by high inflation, which eroded the real value of the debt and is credited with deadening the economic impact of the early 1970s recession. Generally, the argument is that the current high debt levels will result in higher inflation either from governments monetising their debt, or from governments needing to stimulate growth and inflation to overcome the debt burdens.

Further, some maintain that because high government debt is equivalent to high private sector savings, high private sector savings will create a high level of demand on future goods and services, which will lead to high inflation.

On the other hand, some (such as Reinhart and Rogoff’s popular book, *This time is different*¹) maintain that high levels of debt will lead to lower inflation because debt threatens growth and low growth leads to low inflation.

Revisiting the drivers of inflation

The framework for analysing the impact of debt on inflation builds on the recent “Inflation Series” published by Macquarie Fixed Income where inflation was shown to be driven by an excess of demand over supply. It follows that any impact that debt has on inflation must be due to the impact that it has on demand and supply.

Table 1 shows that based on relative importance analysis, the direct importance of supply and demand factors are more than four times stronger than debt factors. The impact of debt on inflation will be analysed by assessing the relationship of debt with supply and demand.³

Finally, there are those who claim very little impact, such as the National Bureau of Economic Research (NBER) paper by Giannitsarou and Scott², which concludes that “the relation between fiscal imbalances and inflation suggests extremely modest statistical interactions”.

We can summarise the conclusions of academic literature on the subject as follows: “High debt levels will either lead to high inflation, or low inflation, or may have virtually no impact on inflation at all.” We could also summarise it as the following, “Not very helpful.”

In response, this paper seeks to address the question of whether debt drives inflation through a logical framework and statistical analysis. We found that the linkages between debt and inflation are indirect, and that link will vary depending on a number of factors including the type of debt, the starting level of debt and growth, the exchange rate regime, and the impact of crises. This perhaps explains why so many people who have investigated this topic have come to such differing conclusions.

In the analysis that follows, we have used US market data throughout, due to the market’s substantial size. However, analysis in the Appendix shows in part how many of the same relationships are evident across other markets.

1. *This Time Is Different: Eight Centuries of Financial Folly*, Carmen M. Reinhart and Kenneth S. Rogoff, 2009, Princeton University Press.

2. Chryssi Giannitsarou & Andrew Scott, 2006. “Inflation Implications of Rising Government Debt,” NBER Working Papers 12654, National Bureau of Economic Research, Inc.

Table 1: Fundamental determinants of inflation – a relative importance analysis

% direct variation in inflation accounted for on average	Post GFC (2010-2017)
Debt influence	17.9
Private debt	10.1
Government debt	7.8
Demand/supply influence	82.1
Unemployment rate	9.9
Income	10.3
External prices (e.g. commodities)	43.5
Unit labour costs	2.9
Industrial capacity	15.5

Source: S. Tonidandel and JM LeBreton, 2011.

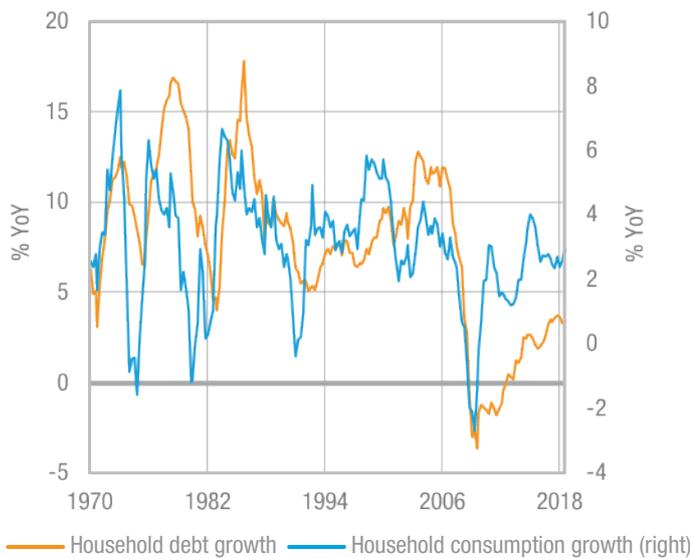
Further, it shows that the importance of debt is mainly from private debt, with government debt having a lesser role. This early exploratory finding calls for a more detailed analysis where the impact of household debt, corporate debt and government debt will be analysed separately.

3. For details, see Tonidandel, S. and LeBreton, J. M. (2011). Relative importance analysis: A useful supplement to regression analysis. *Journal of Business and Psychology*, 26, 1-9.

Household debt growth

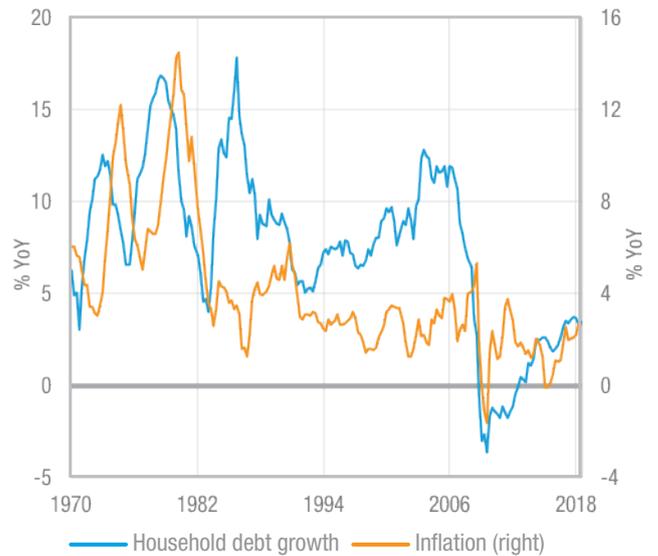
US household debt growth is initiated primarily by consumption growth. We have found that when household demand grows, it reaches a point where further spending – which now increasingly includes buying residential assets – requires increased household debt. The increased debt enables demand to grow even more, which leads to an imbalance between supply and demand, causing general price increases. Therefore, while debt does not have a significant direct impact on inflation, it does enable demand to rise to levels which generate inflation. Our analysis of US household debt data from the Federal Reserve Bank of New York shows that both household debt and inflation are by-products of household expenditure growth, initially through consumption and then, as the economic cycle progresses, spending on residential assets. The pattern of household consumption leading debt and then inflation in the United States is evident in charts 1 and 2.

Chart 1: Household consumption growth leads household debt growth



Sources: Thomson Reuters Eikon and Macquarie, 2018.

Chart 2: Household debt growth leads inflation



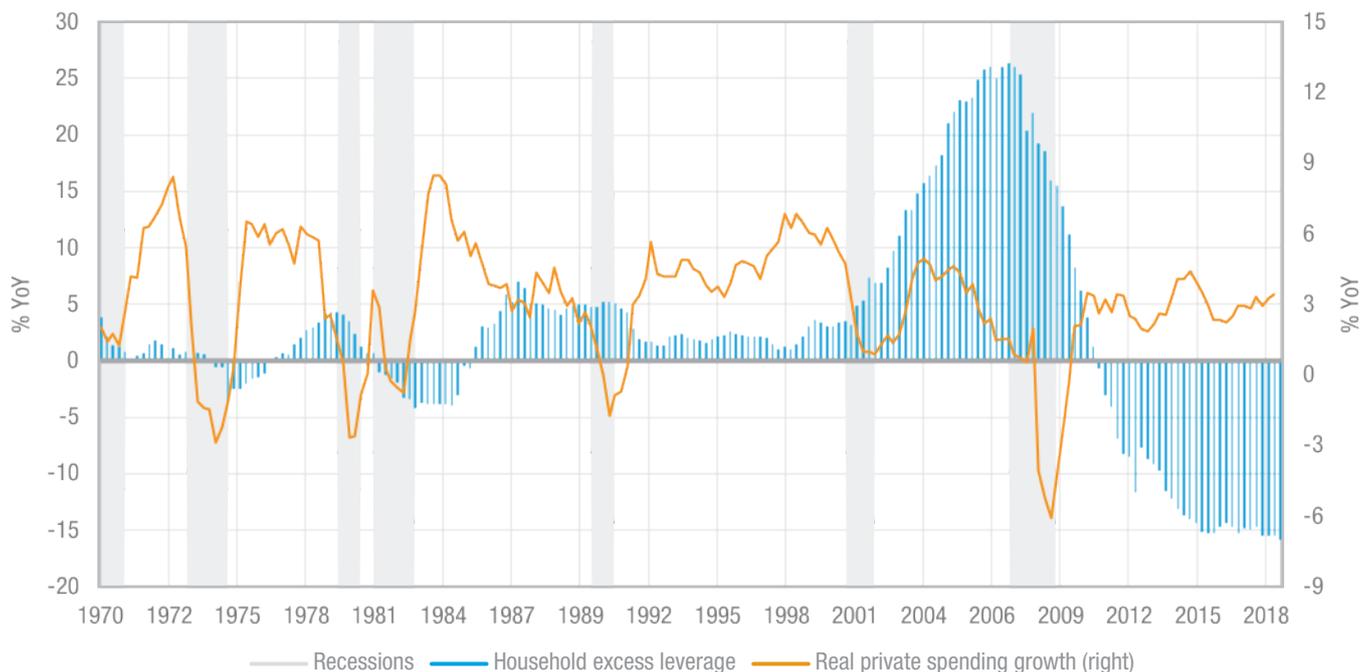
Sources: Thomson Reuters Eikon and Macquarie, 2018.

Household debt levels

There are limits to the amount that household debt can rise, and it is natural to assume that when household debt to income reaches levels that are uncomfortable for households, debt growth would slow and even reduce. However, in recent history this has only happened after an intervention such as a monetary policy tightening or a disruptive financial crisis. When household debt does decline, the deleveraging cycles have been disorderly and stressful. Declining debt has been accompanied by declining demand which slows the economy and may reduce incomes. Reduced incomes require further deleveraging to compensate. If the financial sector also tightens lending standards, as they often do in the down cycle, this will likely restrain demand even more.

The depth and severity of the debt reduction cycle is evident in Chart 3, which plots the level of excess household leverage (measured as a debt to income ratio in excess of its long-term trend), private spending, and inflation. Our analysis illustrates that when private leverage increasingly exceeds trend levels and makes new historical highs, the probability of a crisis increases. The larger the positive gap between leverage and its trend, the more likely a recession or crisis (or both) will occur, and the longer the deleveraging will persist. In Chart 3, when US household excess leverage hit historical highs in 2006, a credit crisis emerged the following year, which led to the worst recession since the Great Depression. The subsequent recovery was the slowest because of the significant deleveraging which continued for about another five years.

Chart 3: Excess household leverage is a sign of a impending crisis/recession and decline in spending

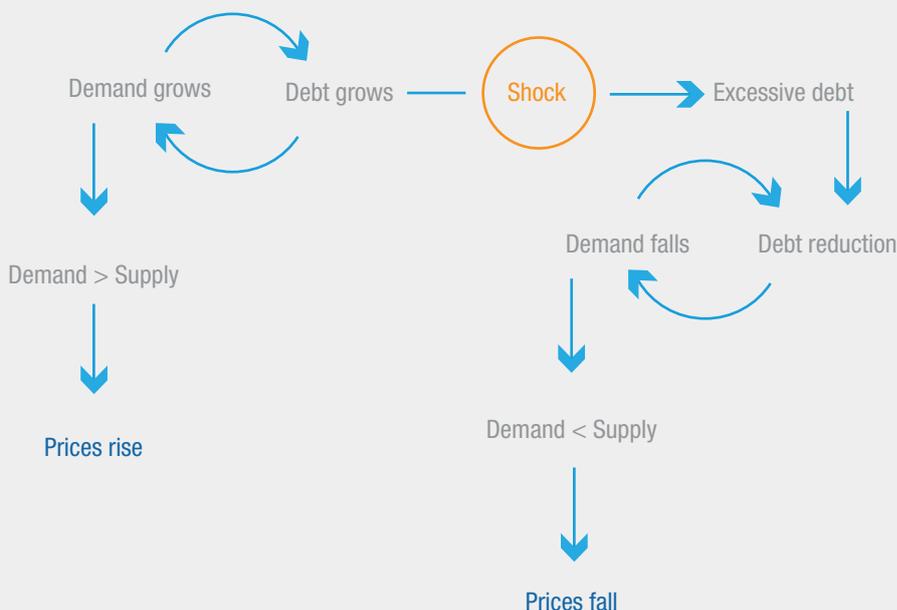


Sources: Thomson Reuters Eikon and Macquarie, 2018.

The debt deleveraging that occurs after a recession or crisis historically crimps demand and inflation declines, or becomes deflation in extreme cases, as was seen after the global financial crisis (GFC).

To summarise, we subscribe to the theory that the relationship between debt and inflation: spending, which initially tends to be consumption, drives debt growth which facilitates further spending, driving inflation. Conversely a pull-back in spending associated with redressing high debt levels will often be associated with a crisis and subsequent falling inflation. Diagram 1 below is a simple but effective summary of this interaction.

Diagram 1: Transmission mechanism from household and corporate debt to inflation

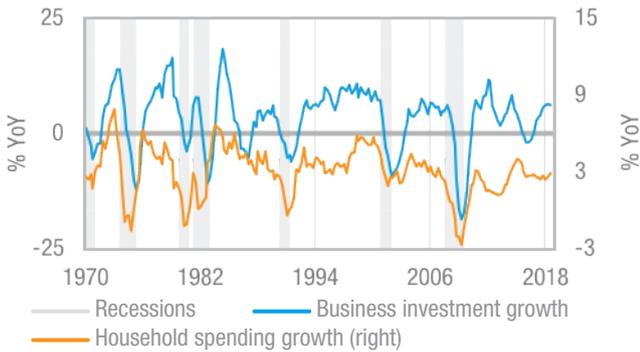


Source: Macquarie Fixed Income, 2019.

Corporate debt

The relationship between US corporate debt and inflation is similar to that of household debt and inflation, but with an additional link. Again, our analysis shows that the cycle begins with household spending. It drives business investment (Chart 4), which requires corporate debt to fund it, and then this is followed by inflation.

Chart 4: Household spending and business investment



Sources: Thomson Reuters Eikon and Macquarie, 2018.

The additional link means that corporate debt cycles lag consumption growth by a longer period than household debt, and therefore corporate debt leads inflation by a shorter period. Chart 5 shows the slight lag between household and corporate debt growth.

Chart 5: Corporate debt lags household debt



Sources: Thomson Reuters Eikon and Macquarie, 2018.

A similar pattern of household debt leading corporate debt and inflation is evident in Japan (more detail, in Appendix 1), which demonstrates that this structural relationship holds even in a low-growth, low yield environment.

Government debt and inflation

Government debt interacts with inflation very differently from the manner in which private debt interacts. We maintain this is because of the unique role of government fiscal policy, and hence, of government debt in the broader economy. As elsewhere, we have used US data as an example throughout this section.

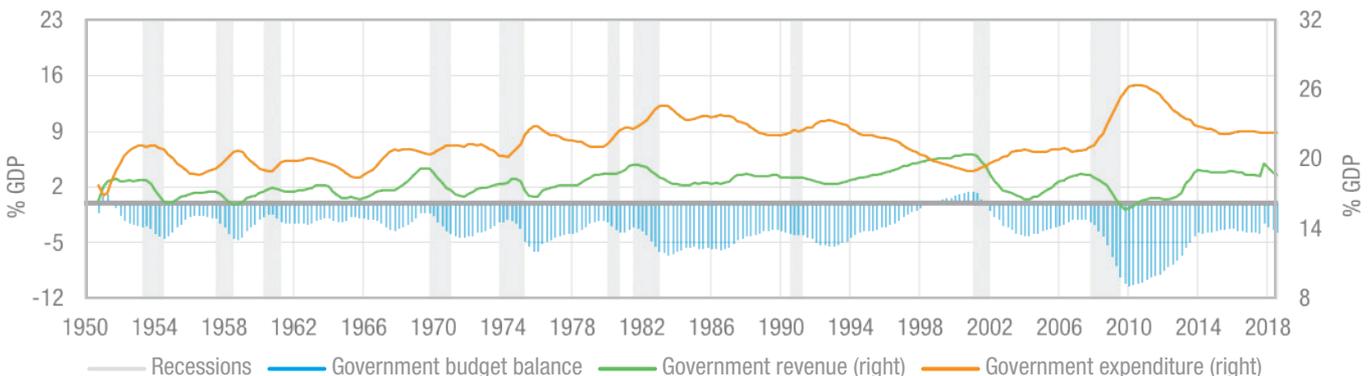
The counter-cyclical, automatic stabilizer nature of fiscal policy

Fiscal policy is designed to respond countercyclically to changes in the economic cycle. Historically, during (as well as just after) recessions when private demand is weak, revenues automatically fall, expenditure automatically rises, and deficits increase, as shown in Chart 6, thereby

creating more government debt. In Chart 6, a downturn in the economic cycle is highlighted by recession phases. Government debt, as a by-product of fiscal policy, is therefore, also counter-cyclical, so instead of rising together with private spending, government debt typically falls. Conversely, it historically rises at the time when demand is at its weakest.

That is also why interest payments on government debt tend to remain sustainable, measured as a share of government revenue, even in the longer term. Interest payments are part of the structurally counter-cyclical nature of government debt, providing income to the private sector, stimulating growth, and ultimately leading to increased government revenues.

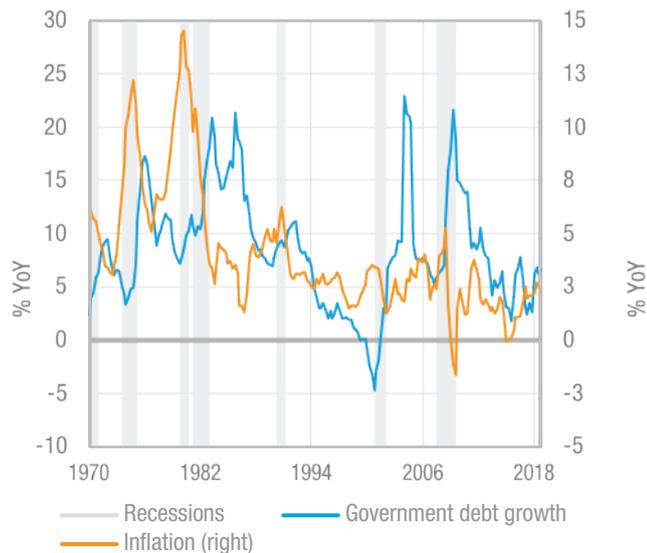
Chart 6: US Government budget balances and the economic cycle



Sources: Thomson Reuters Eikon and Macquarie, 2018.

Government spending as part of this countercyclical fiscal policy seldom triggers significant inflation, because immediately after a recession spare capacity tends to be readily available. As a result, rising government debt does not correspond to or precede rising inflation and is not correlated to rising corporate or household debt. Conversely, government debt growth tends to peak when inflation is falling or in a trough, as is shown for the US economy in Chart 7.

Chart 7: Government debt growth and inflation



Sources: Thomson Reuters Eikon and Macquarie, 2018.

Of course, if the government were to raise spending at a time when the economy is already strong, the resulting imbalance between demand and supply would likely cause inflation. It is because fiscal spending is mainly designed to be automatically counter-cyclical that government deficits and hence debt does not correspond to inflationary episodes.

The Japanese economy also conforms to this pattern of public debt growth lagging, not leading inflation. More information is available in Appendix 1.

The role of government debt as a safe asset

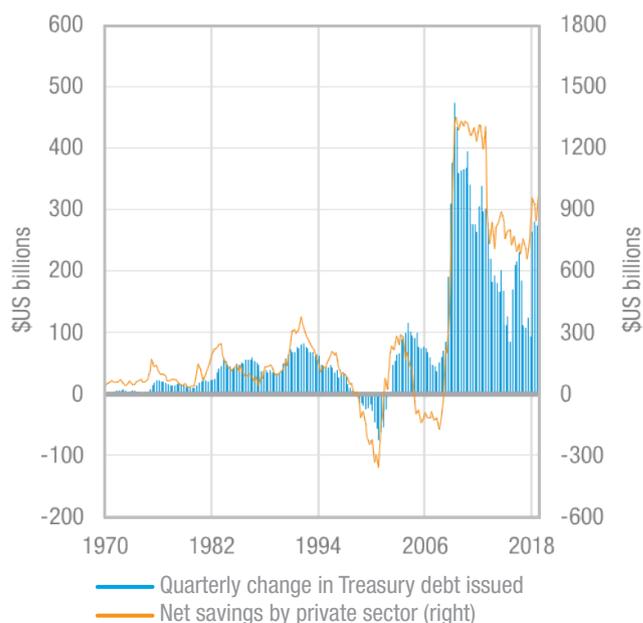
Government debt is a by-product of fiscal policy and the economic cycle and is therefore an outcome that is fundamentally driven by private sector intentions and in response to private sector needs. As a sovereign currency issuer with policy autonomy, the US federal government (in tandem with the US Federal Reserve) can procure domestic currency to avoid any domestic currency debt default. This is in contrast to the private sector, which must earn the domestic currency required to fulfil its debt obligations.

Government debt is also issued to accommodate the demand to hold default risk-free debt as wealth by the private sector. Chart 8 above right shows that the demand for government debt moves with demand for private sector net savings which itself determines long-term private

net wealth.⁴ That is also why the US government has periodically issued more debt than required by budget deficits (see Appendix 3).

4. In contrast, the demand for riskier assets such as equities moves in line with the economy (see Appendix 3) which is therefore not as good a structural net wealth preserver for the private sector.

Chart 8: Government debt provides safe assets for private sector savings



Sources: Thomson Reuters Eikon and Macquarie, 2018.

In other words, government debt reflects the structural long-term desire to save by the private sector. It is, essentially, the private sector's government savings account. Thus, there is perceived to be little cause for concern about the effects of higher government debt on growth and inflation.

In fact, the unique countercyclical nature of fiscal policy means government debt changes are a signal of how the economy in general, including inflation, is performing, rather than being a major driving factor for inflation. Government debt changes track the private sector's desire not to spend but to accumulate safe assets instead. In this regard, rising government debt could be used as an indicator of the lack of spending and hence for how low inflation can go (and stay there).

When could government debt be a problem?

Earlier we demonstrated that high private debt levels could lead to a crisis and a reduction in inflation. We believe the same is possible with government debt, but only in countries whose monetary regimes are under an external constraint beyond their control. Typical constraints would be running a fixed exchange rate system or taking on foreign currency debt.

Table 2 lists past crises, public and private debt conditions of that period, and the exchange rate regime. 10 of the 12 crises occurred in countries running constrained monetary regimes such as fixed exchange rate regimes or currency unions, or whose foreign currency debt is significant. These economies do not enjoy policy autonomy; they do not control their own monetary and/or fiscal policy.

We have found that the likelihood of a debt crisis in countries with floating exchange rate regimes depends mainly on the extent of private sector debt. In the two crises in floating exchange rate regimes, the US and Japan, it was private debt, not public, that predicted the crisis. Interestingly, these were two of the most severe crises in history.

Our analysis shows that government debt is very rarely a cause of crisis in floating exchange rate regimes like the US, because governments with monetary policy autonomy can always procure domestic currency to avoid any domestic currency debt default.

We found that only two crises, the Latin American debt crisis and Russian financial crisis, involved high public debt without high private debt, and both were in a fixed or constrained monetary environment (see Table 2). This indicates to us that regardless of the nature or level of government debt carried, it is the monetary regime adopted that is the major determinant of whether a debt burden precipitates a crisis. In countries with fixed or constrained exchange rate regimes, the level of foreign exchange reserves and foreign currency net capital inflows must be monitored carefully and government debt needs to be given equal consideration to private debt.

We believe a better method of predicting future incidents of crisis or disinflation is to use crisis indicators such as the ones developed by Macquarie Fixed Income and described in the research paper “Managing through a Crisis” (September 2013).

Table 2: Past crises and debt levels

CRISIS	MONETARY REGIME/ POLICY AUTONOMY	FOREIGN CURRENCY DENOMINATED DEBT	PRIVATE DOMESTIC CURRENCY DENOMINATED DEBT	GOVERNMENT DOMESTIC CURRENCY DENOMINATED DEBT
Latin American debt crisis (1982)	Constrained / No	High	Low	High
Japanese asset price bubble (1989-90)	Free float / Yes	Low	High	Low
Scandinavian banking (1991-92)	Constrained / No	Low	High	Relatively high
UK “Black Wednesday” (1992)	Constrained / No	Low	High	Relatively high
Mexican peso crisis (1994)	Constrained / No	Relatively high	High	Relatively low
Asian financial crisis (1997)	Constrained / No	Relatively low	High	Low
Russian financial crisis (1998)	Constrained / No	Low	Relatively low	High
Samba effect in Brazil (1999)	Constrained / No	Relatively high	Low	Relatively low
Argentine economic crisis (1999–2002)	Constrained / No	Relatively high	Relatively low	Relatively low
Icelandic financial crisis (2008)	Constrained / No	Low	High	Low
US credit GFC (2007-08)	Free float / Yes	Low	High	Relatively low
European sovereign debt crisis (2010-11)	Constrained / No	Low	Relatively high	Low overall / high in certain Euro member nations

Sources: Bloomberg and Macquarie, 2018.

Cross-country analysis and the impact of the GFC

An alternative way of analysing inflation is cross-sectional analysis. In this analysis, rather than studying whether debt and inflation within a country move together over time, correlation between countries is examined to determine whether those with high debt growth have high inflation and vice versa at specific points in time.

Debt and growth

Both prior to, and after the GFC, countries with faster household debt growth typically also experienced stronger economic growth, since household expenditure drove both debt accumulation and economic activity. For floating exchange rate countries, those with high household debt before the crisis tended to have low economic growth after it. In fixed exchange rate countries, high public debt, not private debt, was the major predictor of slow growth after it, confirming our earlier findings on the interaction between public debt and fixed exchange rate regimes. More detail is available in Appendix 5 where we have completed analysis that demonstrates this trend across Organisation for Economic Cooperation and Development (OECD) countries.

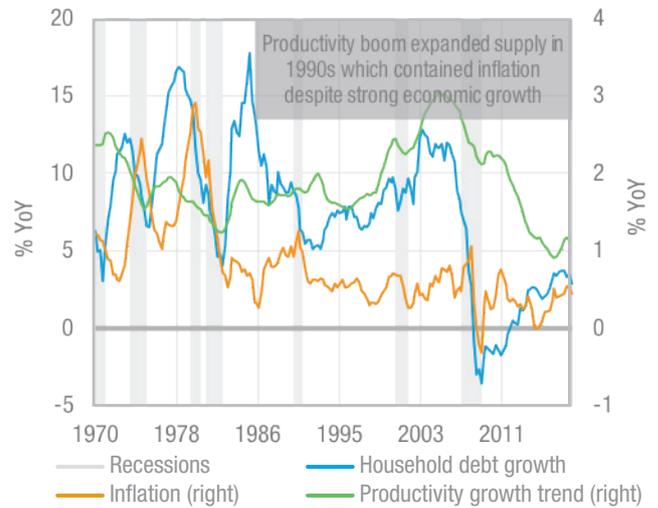
Debt and inflation

While a relationship was found between debt and growth before and after the crisis, no relationship was found between high debt of any type before the crisis and inflation after the crisis for floating exchange rate countries, and only a very weak and statistically insignificant relationship was found between high public debt and subsequent inflation in fixed exchange rate countries. More on this is also available in Appendix 5.

The link between growth and inflation

It may be a surprise to some that we found debt and economic growth before and after the crisis have been related, but that debt and inflation have not. This is because it has been readily accepted that high inflation will follow high growth. To understand the results requires remembering the framework we presented earlier on: inflation is affected when there is a supply and demand imbalance. In contrast, growth accelerates when both supply and demand rise in balance. For example, in the technology boom of the mid to late 1990s in the US, demand rose and was accompanied by productivity improvements that expanded capacity. Through the increase in capacity, that increase in demand was met (Chart 9), and so the balance between supply and demand was maintained. As a result, inflation was subdued while growth was very strong.

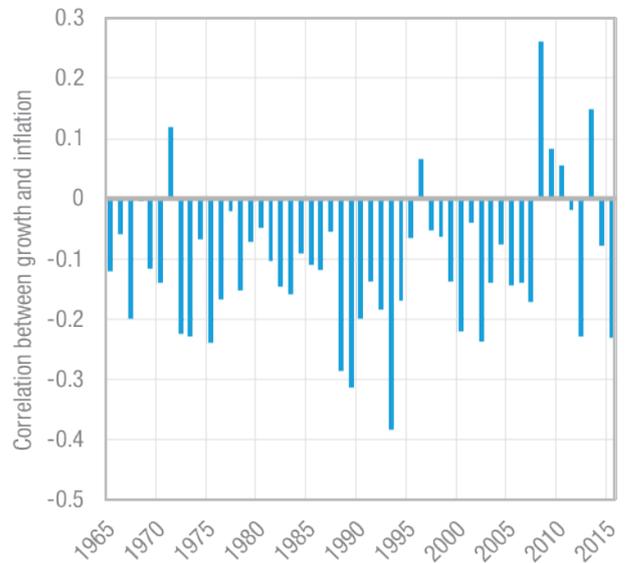
Chart 9: Demand and supply rose together in the 'tech' boom



Sources: Thomson Reuters Eikon and Macquarie, 2018.

Examples of negative relationships between growth and inflation are not rare. Chart 10 plots the correlation between growth and inflation across over 200 countries for the past 50 years. In 44 of those 50 years, the correlation was negative, meaning that countries with high growth were more likely to be those with low inflation.

Chart 10: A country's growth rate does not dictate its inflation



Sources: OECD and Macquarie, 2018.

Implications of the current state of debt

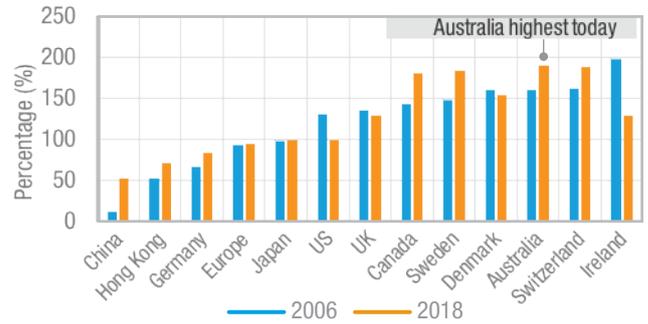
As shown in Chart 5, while debt growth is rising again, the private sector’s appetite for debt appears to remain tentative. Household debt growth is still below cyclical averages while levels relative to income remain well under long-term trends. Corporate debt growth is approaching historical averages, partly due to a revival in fixed capital expenditure. However, measures of excess leverage do not highlight any concerns, and hence, imminent inflationary pressures are not expected.

Meanwhile, US government debt has grown to historical highs but this reflects prolonged post-GFC deleveraging and the accompanying slow recovery in private demand. As shown by the earlier analysis of government debt, this indicates a desire to save by the private sector, and a sign that inflation is unlikely to prevail, in our view. This is consistent with the message from the current state of private sector debt.

However, this sanguine outlook is not shared by all countries; leverage is a serious problem in some. The accumulation of debt has created private sector balance sheet fragility in some countries, and household sector balance sheet fragility in others, with Australia being a notable example. Charts 11 to 12 show some nations which require watching in the near term.

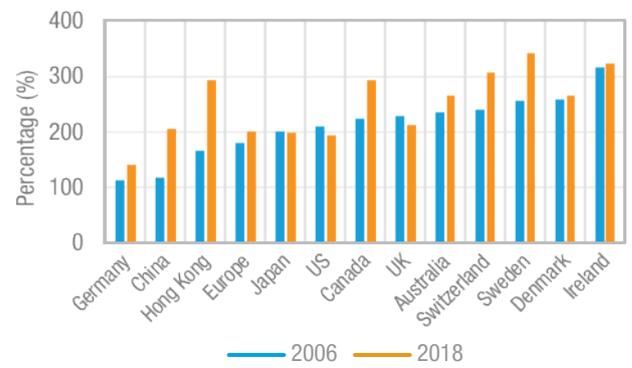
Those countries with a fixed exchange rate or currency union such as Hong Kong should also be monitored carefully. Some of these countries not only hold high levels of domestic debt, but also possess significant foreign currency debt.

Chart 11: Household leverage



Sources: Bank for International Settlements (BIS) and Macquarie, 2018.

Chart 12: Private leverage



Sources: BIS and Macquarie, 2018.

Conclusions

This paper has assessed whether debt drives inflation and what the current debt situation may imply for inflation. The investigations have also led to an understanding of the other implications of debt on the broader economy, including on the likelihood of crises. Importantly, the implications depend heavily on the type of debt, and the exchange rate regime of the country.

Our analysis indicates that a rise in household and corporate debt is driven, initially, by rising consumption. If consumption is rising faster than supply can expand, then inflation results. The more private debt levels stray from trend, the greater the likelihood of this expansion ending in a crisis, accompanied by a rapid decline in demand, and disinflation or even deflation.

In the current environment, where households and corporates have been deleveraging for a significant period in the US (around 10 years in the case of households) and in several other countries as shown in charts 11 and 12, we believe private debt is unlikely to be the cause of a financial crisis, and therefore unlikely to lead to a serious decline in inflation. Nor does it appear to us that the current environment tells of a rapid rise in demand that would lead to high inflation. This is despite the private sector deleveraging impeding growth. It is the relative growth of supply versus demand, not the growth in the overall economy, that drives inflation.

However, the debt situation is far from benign in some other countries and in fact, it indicates significant private sector balance sheet fragility in a few key investible markets. Debt metrics constructed for these countries, particularly for China and Australia, suggest they need watching very closely in the short term.

Government debt in floating exchange rate countries such as the US and UK, while at historical highs, is not at risk of default and hence not likely to be a cause of crisis. Neither is it an impediment to more expansionary fiscal policy. Therefore, we foresee the impact of US debt (private or public) on future inflation is negligible at present.

In fact, we believe the high stock of government debt is simply a reflection of the private sector's desire to spend less than normal, that is, its desire to save risk free assets. The more the private sector desires to do this, the more the government needs to issue debt otherwise the economy becomes imbalanced. Our conclusion is that the factors that cause this private desire to save are the very factors that cause government debt issuance to rise and simultaneously cause bond yields to remain low or fall.

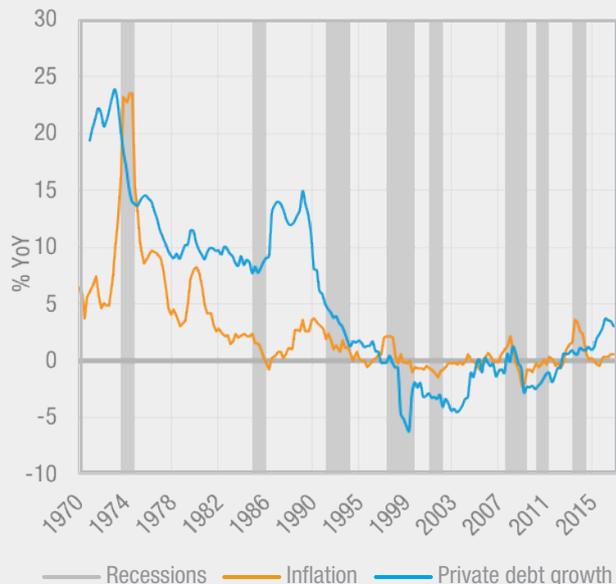
To answer the question posed at the beginning of this report, "Could debt be driving inflation?," we believe the short answer is, "no." Not in a direct causative sense. A slightly longer answer is that debt is not driving inflation at present levels. Debt can, of course, influence inflation indirectly by enabling spending to rise to the point of moving demand in excess of supply, which is what really causes inflation. At extremes, high private sector debt can make economies susceptible to crises, which are usually followed by recessions and disinflation. In constrained monetary regimes such as a fixed exchange rate regime or a currency union, extremely high public sector debt can have a similar impact.

Although debt does not drive inflation, our conclusion is that it can be a useful indicator of likely future inflationary results, as long as the right type of debt is analysed in the right type of monetary regime.

Appendix 1 – Debt growth and inflation in Japan

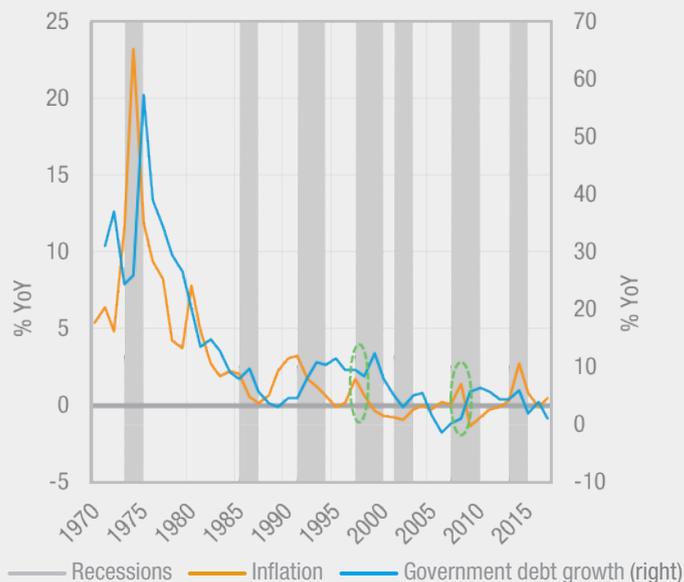
Many people have studied the Japanese experience post 1990 for potential information on how the US may behave post the GFC. An analysis of Japanese debt and inflation reveals similar relationships to those observed in the US.

Chart A1.1: Private debt growth leads inflation in Japan



Sources: Thomson Reuters Eikon and Macquarie, 2018.

Chart A1.2: Public debt growth lags inflation in Japan



Sources: Thomson Reuters Eikon and Macquarie, 2018.

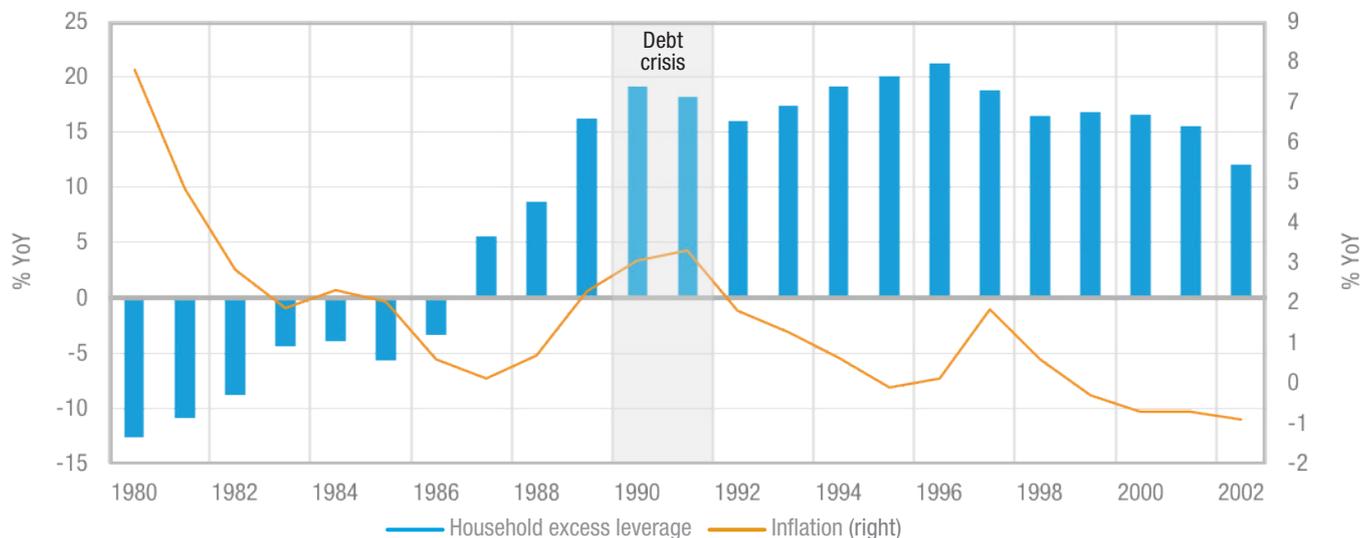
Debt growth and inflation

As was the case in the US, private debt growth leads inflation (Chart A1.1) because it only slightly lags demand growth, while public debt growth lags inflation (Chart A1.2) because government debt growth is strongest when private debt growth is weakest.

Debt levels and inflation

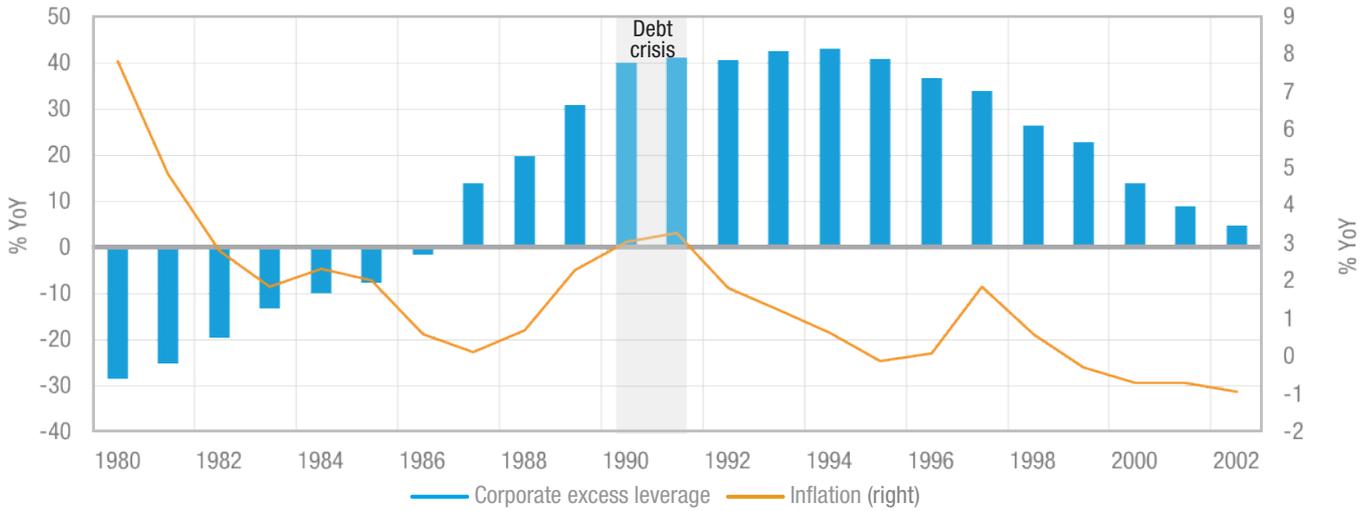
As in the US, both household debt (Chart A1.3) and corporate debt (Chart A1.4) were rising significantly above trend and setting new cycle peaks right up to the 1990s Japanese crisis, confirming the use of this measure as a crisis indicator (See Appendix 2), which will subsequently depress inflation.

Chart A1.3: Japanese household excess leverage and 1990 crisis



Sources: Thomson Reuters Eikon and Macquarie, 2018.

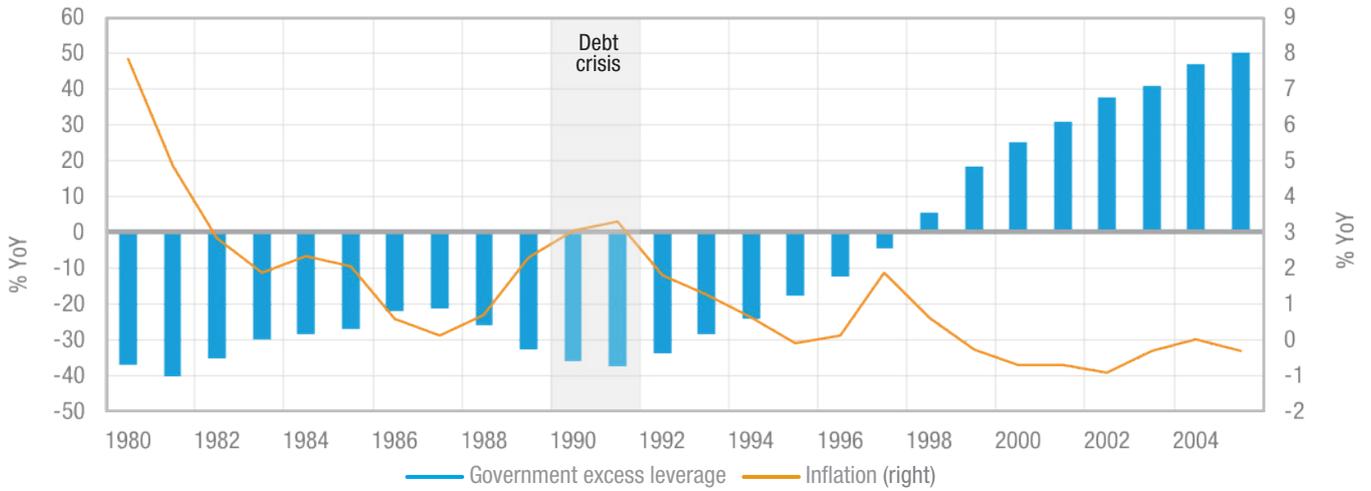
Chart A1.4: Japanese corporate excess leverage and 1990 crisis



Sources: Thomson Reuters Eikon and Macquarie, 2018.

One difference with the US credit crisis is that it was both household and corporate leverage that played a role in Japan’s crash, whereas it was predominantly excessive household debt in the case of the US. However, as expected, government debt lagged the crisis, and for the most part, rose significantly when the economy was already in recession with inflation steadily falling (Chart A1.5), rendering it ineffective as a predictor.

Chart A1.5: Japanese government excess leverage and 1990 crisis



Sources: Thomson Reuters Eikon and Macquarie, 2018.

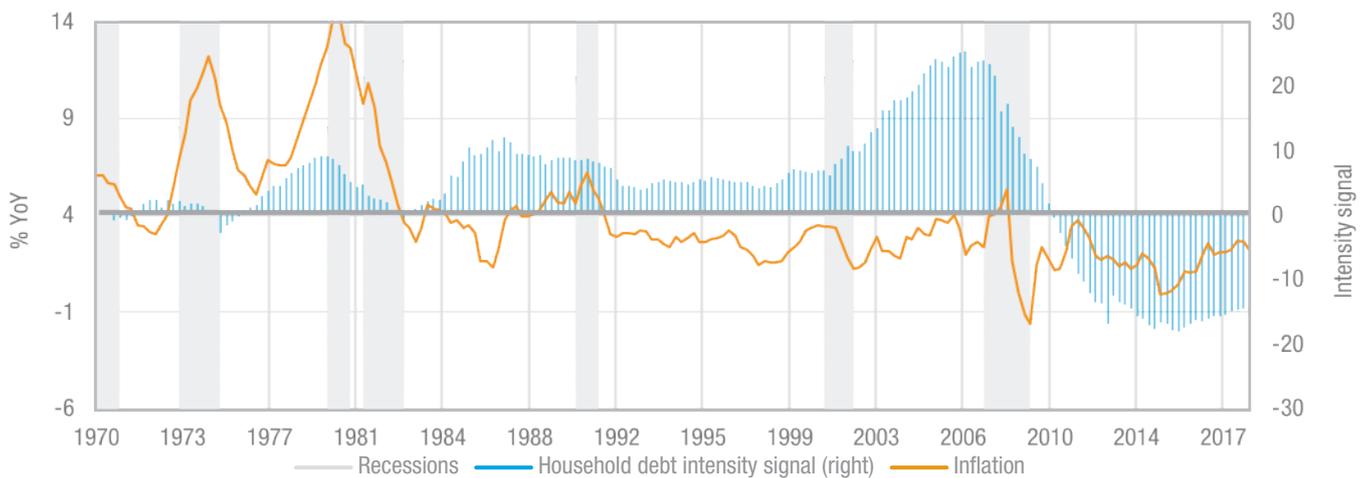
Appendix 2 – Private debt levels and crises

Since peaks in private debt levels, especially household debt, tend to precede crisis and/or recessions, they can be used to derive a signal of the likelihood of a recession and/or a crisis emerging. They can also be used to signal the severity of recession and inflation outcomes.

The debt/crisis indicator is devised by combining the growth rate of debt with the existing level of debt to income; called an excess debt intensity signal.⁵ The rationale is that fast household debt growth when debt to income levels are already high implies a greater probability of inflation, as well as of a future crisis or recession. Charts A2.1 and A2.2 demonstrate that these excess debt signals would have been useful in signalling the two most recent crisis episodes – the dot-com tech crash of 2000 and the GFC of 2007/08 (as well as the resulting inflation outcomes). These latter crisis episodes demonstrate the usefulness of having both household and corporate debt indicators. The 2007/08 episode was a housing-related household debt issue, with businesses less involved, and the household debt intensity signal effectively flagged it well in advance. On the other hand, as the 2000 episode was led mainly by the corporate sector: the corporate debt intensity indicator began flashing warning signs about a year before the crash while the household debt intensity signal was less definitive.

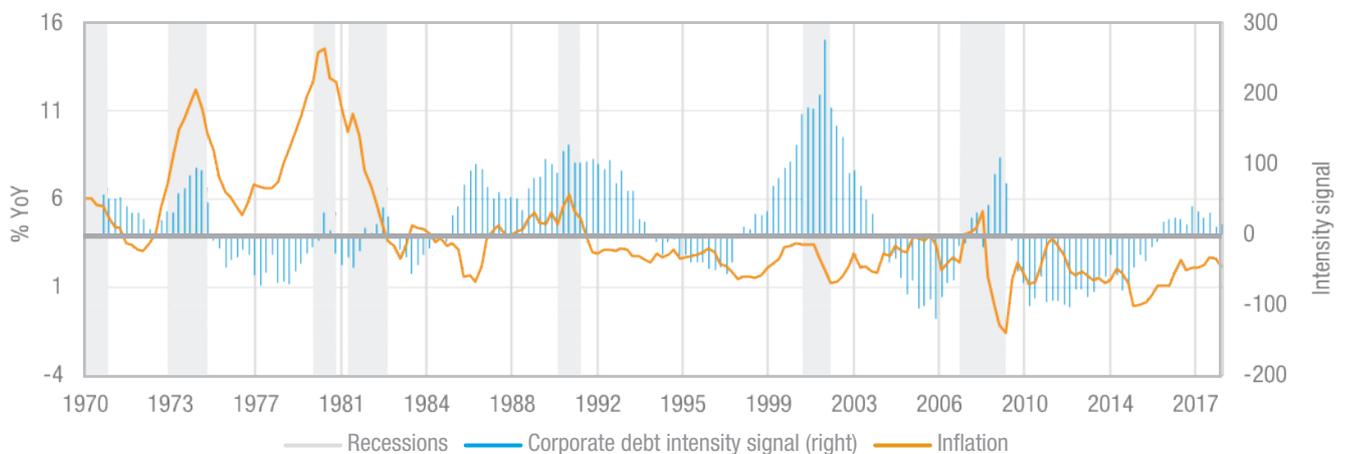
5. The debt intensity signal is calculated as the actual debt to income ratio less the average trend of the debt to income ratio. The average trend is estimated as an average of the 10-year moving average of the ratio and a linear trend of the ratio.

Chart A2.1: US Household excess debt intensity signal



Sources: Thomson Reuters Eikon and Macquarie, 2018.

Chart A2.2: US Corporate excess debt intensity signal



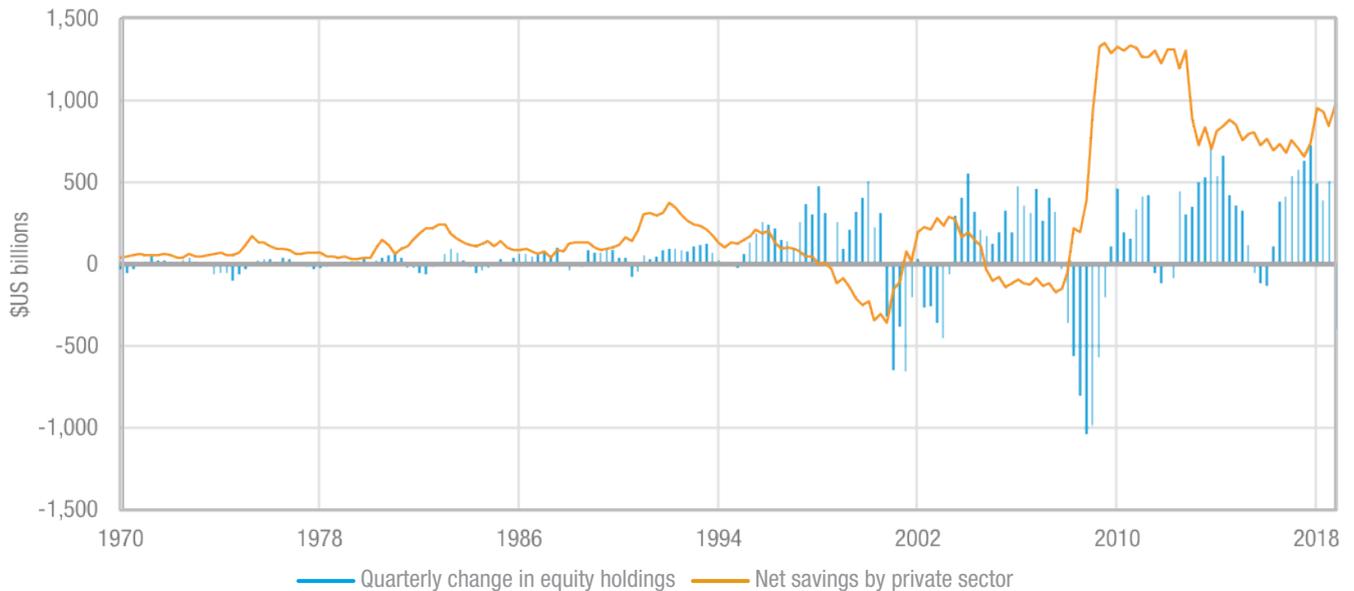
Sources: Thomson Reuters Eikon and Macquarie, 2018.

Similarly, the excess debt intensity signals for Japan would have provided an effective warning of both rising inflation and impending crisis and/or recession. The equivalent household and corporate debt intensity signals are available upon request.

Appendix 3 – The role of government debt in accommodating private net savings and in preserving private net wealth

Using the US again as an example, we can identify that a key reason government debt has been rising is structural demand by the private sector for risk-free assets. Factors such as an aging population have contributed to this demand. We have shown in the main body of this paper that the demand for government debt moves with demand for private sector net savings which itself may determine long-term private net wealth. In contrast, the demand for riskier assets such as equities tends to move in line with the economy (Chart A3.1) and is therefore, in our view, not as good a structural net wealth preserver for the private sector.

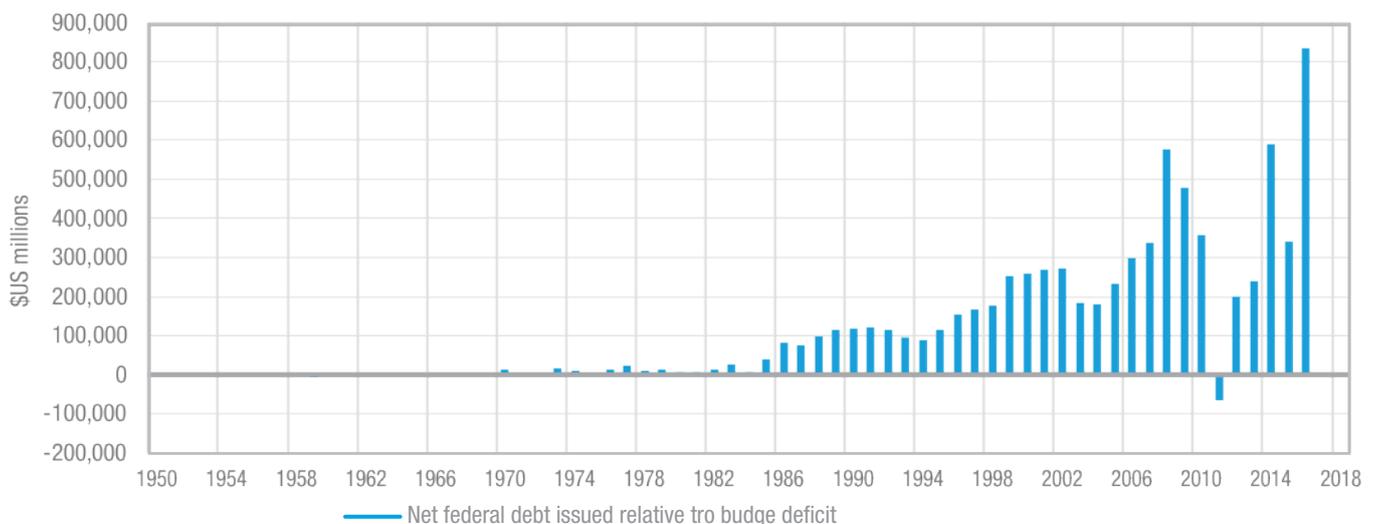
Chart A3.1: Equity holdings do not accommodate structural desire to save by private sector



Sources: Thomson Reuters Eikon and Macquarie, 2018.

Confirming that private sector demand, rather than budget balances, drives government debt issuance, Chart A3.2 shows that debt issuance has far exceeded the amount that would be needed to pay for budget deficits.

Chart A3.2: More government debt issued than was needed to cover deficits



Sources: Thomson Reuters Eikon and Macquarie, 2018.

Appendix 4 – Debt and economic growth cross-country analysis

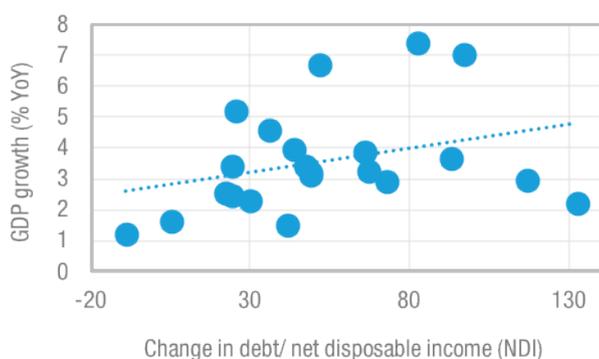
The following analysis is for OECD countries for the period immediately before and after the GFC.

Household debt growth

Fast-growing household debt is expected by many observers to correspond to fast-growing demand, and therefore to correlate with both high growth and inflation. Unfortunately, achieving strong fits in cross-sectional analysis is difficult, because many factors vary dramatically across countries, such as levels of public debt, the exchange rate regime, population growth and demographics; there are many possibilities.

Despite this statistical challenge, the expected results mostly confirm the general expectation. As seen in chart A4.1 below, skew is for high debt growth and high gross domestic product (GDP) growth stands out. Prior to the crisis, the countries with the fastest household debt growth also enjoyed some of the fastest economic growth. The fit is affected by Denmark, where debt grew quickly, but economic growth was slow. This was due to stagnant population growth and productivity growth, primarily driven by a rapidly aging population.

Chart A4.1: OECD countries' household debt growth and economic growth prior to the GFC



Sources: Thomson Reuters Eikon and Macquarie, 2017.

Table A4.1: Regression of economic growth on debt measures

	COEFFICIENT	STANDARD ERROR	T	P> t	95% CONFIDENCE INTERVAL	
Household debt	-0.0042	0.002	-1.727	0.101	-0.009	0.001
Europe	-1.2158	0.342	-3.558	0.002	-1.934	-0.498
Constant	2.5155	0.521	4.833	0.000	1.422	3.609
Public debt	-0.0095	0.004	-2.121	0.048	-0.019	-0.000

Sources: World Development Indicators and Macquarie, 2018.

Public debt and fixed exchange rates

The fact that public debt is such a strong factor may seem surprising, given that it was found to have little power in the time series analysis of Japan and the US. However, it is the combination of the fixed exchange rate and the high levels of debt in the countries with the fixed exchange rate that has coincided with a period of crises to drive these results.

The relationship of fast household debt growth being associated with fast economic growth has also been sustained after the crisis in countries with floating exchange rate regimes including Australia and the US but has been dominated by government debt issues in constrained exchange rate regimes such as Greece..

Controlling for other growth drivers

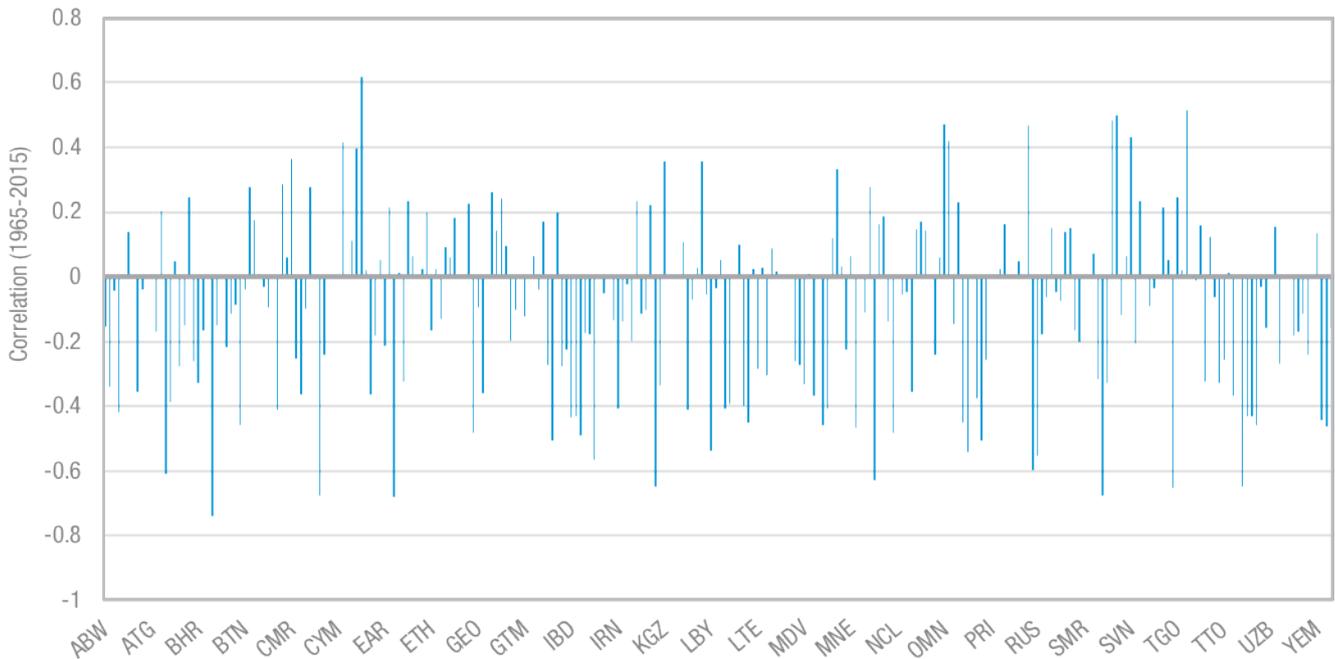
Theoretically, all the other factors impacting economies could be accounted for with a multi-variate regression which incorporates all the factors of interest. However, there are more potential factors than there are countries, so restraint needs to be exercised when deciding which factors to include. Table A4.1 shows the results of a regression which takes account of all the potential debt factors discussed as possible drivers of the relationship between debt and growth. Only debt-related factors have been chosen because they are the main areas of interest in this study. Both public and household debt have an impact, although the impact of public debt and whether a country is in the EU is stronger than the impact of household debt.

A separate regression on only non-EU OECD countries (those with floating exchange rates) confirms that the level of public debt had no explanatory power over subsequent economic growth for floating exchange rate regimes.

Appendix 5 – The relationship between growth and inflation

Statistically, Chart A5.1 demonstrates that for most countries, growth and inflation have been negatively correlated over the past 50 years.

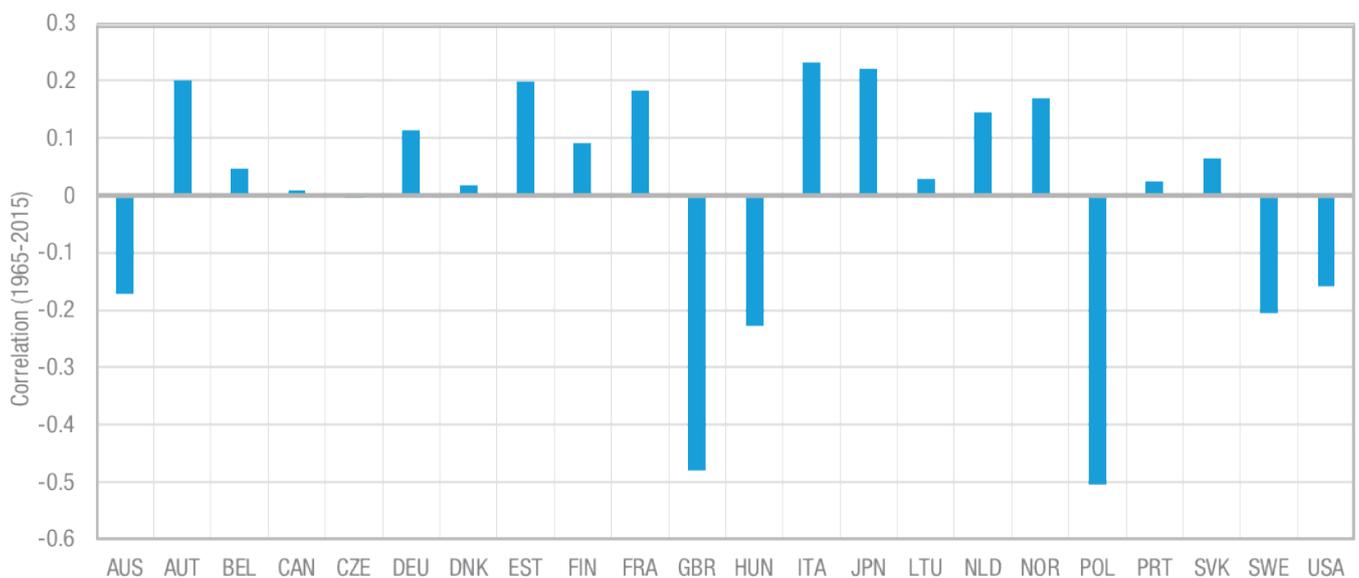
Chart A5.1: Cross country correlations of growth and inflation



Sources: World Development Indicators (WDI) and Macquarie, 2018.

The sample above clearly includes a lot of emerging countries, where the inflation results can be extreme. Therefore, the following analysis only includes OECD countries. With the more subdued inflation associated with this sample of countries negative correlations are still common, including in Australia, the US and UK.

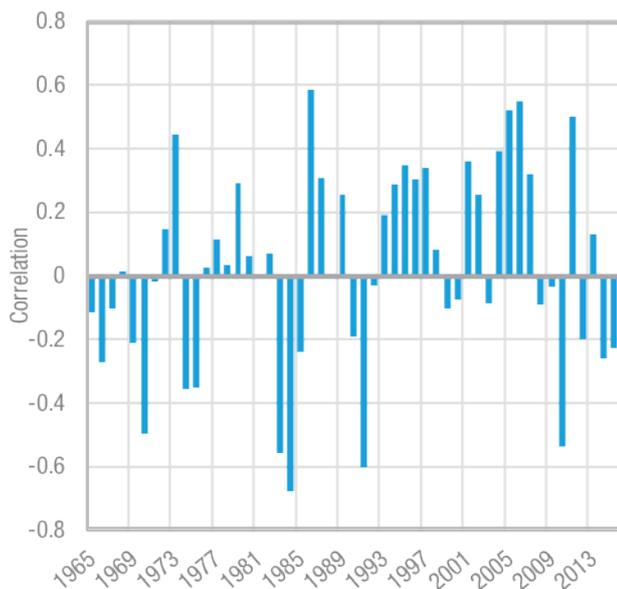
Chart A5.2: Correlation between economic growth and inflation across OECD countries annually



Sources: WDI and Macquarie, 2018.

Further, positive correlation between inflation and growth across countries is mostly only a feature of the period from the 1990s to the GFC in 2008. This was a period of low and steady inflation, a period where central banks appeared to be in control of inflation. Within this narrow window, inflation and growth have been positively correlated.

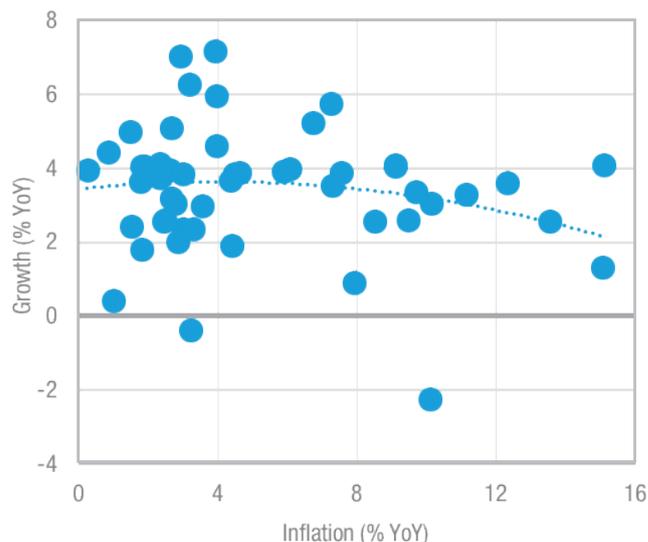
Chart A5.3: Annual correlation between growth and inflation for OECD countries



Sources: WDI and Macquarie, 2018.

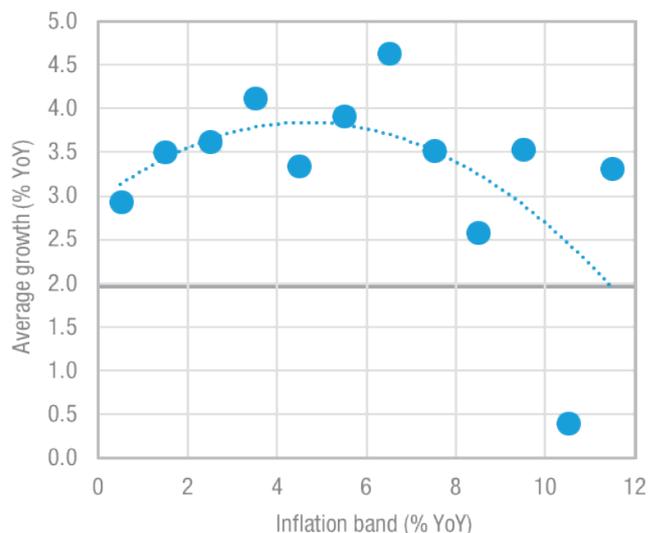
An examination of growth and inflation in Australia is instructive in understanding why this is the case. Chart A5.4 shows inflation and growth in Australia since 1965. Growth is highest, not when inflation is highest, but when inflation is low, but not “too low”, when inflation is around 2-4%. The pattern is even more evident in Chart A5.5, which averages economic growth by 1% inflation bands.

Chart A5.4 Australian annual economic growth versus inflation



Sources: WDI and Macquarie, 2018.

Chart A5.5: Average growth for 1% inflation bands in Australian since 1950



Sources: WDI and Macquarie, 2018.

The relationship between growth and inflation tends to be positive when inflation is low. When inflation becomes higher than optimal, the relationship becomes negative and higher inflation is associated with lower levels of growth. However, inflation lower than optimal is also undesirable as it may cause misallocation of resources. These results are in line with the inflation targeting of central banks, seeking to keep inflation at some “optimal” level around 2-3% per annum or yearly. This demonstrates our earlier finding that high debt levels may predict lower growth without predicting lower inflation is consistently reasonable.

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Dean is primarily responsible for investment research and process development for Macquarie Fixed Income. He has authored numerous research papers that have become the backbone of the team's investment philosophy and processes over time.

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