



Inflation: The defining macro story of this decade

DB Research is home to a broad church of views but we coalesce around a House View for our key macro forecasts. This will certainly continue. However, in these extraordinary times, the range of outcomes is wide. So, in the interest of intellectual diversity I have encouraged our research group to leave their comfort zone and carefully consider alternative viewpoints.

With this in mind, we intend to publish occasional papers under the new "What's in the tails?" banner. We hope this will stimulate debate with our clients by providing what we consider reasonable alternatives to the central forecasts and scenarios.

To kick this series off, I have joined my colleagues Jim Reid and Peter Hooper in examining the potential for higher inflation and a return of boom/bust cycles over the next few years.

David Folkerts-Landau – DB Chief Economist and Head of Research

[David Folkerts-Landau, Ph.D.](#)

Chief Economist, Global Head of Research
+44-20-754-55502

[Peter Hooper, Ph.D.](#)

Global Head of Economic Research
+1-212-250-7352

[Jim Reid](#)

Head of Thematic Research
+44-20-754-72943



Introduction

Ronald Reagan (1978): "Inflation is as violent as a mugger, as frightening as an armed robber and as deadly as a hit man."

Joe Biden (2021): "A job is about a lot more than a paycheck. It's about dignity. It's about respect. It's about being able to look your kid in the eye and say everything will be okay. Too many people today can't do that – and it's got to change."

Janet Yellen (2021): "Neither the president-elect, nor I, propose this relief package without an appreciation for the country's debt burden. But right now, with interest rates at historic lows, the smartest thing we can do is act big".

Jerome Powell (2021): "During this time of reopening, we are likely to see some upward pressure on prices ... But those pressures are likely to be temporary as they are associated with the reopening process."

Larry Summers, (2021): "I think this is the least responsible macroeconomic policies we've had in the last 40 years."

The above quotes highlight that US macro policy and, indeed, the very role of government in the economy, is undergoing its biggest shift in direction in 40 years. In turn we are concerned that it will bring about uncomfortable levels of inflation.

It is no exaggeration to say that we are departing from neoliberalism and that the days of the new-liberal policies that begun in the Reagan era are clearly fading in the rear view mirror. The effects of this shift are being compounded by political turmoil in the US and deeply worrying geopolitical risks.

As we step into the new world, we are no longer sure how much of what we thought we understood about financial and macro-economics is still valid. We have lived through a decade of extraordinary and unconventional monetary stimulus to prevent economies from sliding into deflation, but this effort barely succeeded in propping up growth at what have been historically low levels.

The most immediate manifestation of the shift in macro policy is that the fear of inflation, and of rising levels of government debt, that shaped a generation of policymakers is receding. Replacing it is the perspective that economic policy should now concentrate on broader social goals. Such goals are as necessary as they are admirable. They include greater social support for minority groups, greater equality in income, wealth, education, medical care, and more broad-based economic opportunity and inclusion. They should be front and centre of the policies of any government in these times.

The increased focus on these priorities can be seen not just in the ongoing expansionary policy response to the pandemic, but also in policymakers' other longer-term objectives, such as combating climate change and tightening the social safety net. It is also evident in recent legislative and regulatory efforts to achieve a more balanced distribution of economic and political power between the corporate sector, labour, and the consumer.

Despite the shift in priorities, central bankers must still prioritise inflation. Indeed, history has shown that the social costs of significantly higher inflation and greatly expanded debt servicing obligations make it hard, if not impossible, to reach the



social goals that the new US administration (among others) is keen to achieve. We fear that the vulnerable and disadvantaged will be hit first and hardest by mistakes in policy.

The foundation for today's paradigm shift in policy was laid last decade. After the Global Financial Crisis, concerns turned to high and rising levels of sovereign debt. Market fears of peripheral Eurozone countries led governments to pre-emptively move towards fiscal consolidation before bond market vigilantes could force them. The effect of austerity was worsened as banks and consumers simultaneously tried to repair their balance sheets. Hence low interest rates and asset purchases continued even as economies were relatively stagnant and inflation stayed low.

Even before the pandemic, this orthodoxy was being increasingly questioned. Voters had rendered their verdict at the ballot box as inequality and lacklustre growth fuelled support for populist parties and unconventional leaders. Meanwhile, continued low inflation despite low interest rates led economists to be more relaxed about the levels of debt that countries could sustain.

The pandemic has accelerated this shift in thinking. Sovereign debt has risen to levels unimaginable a decade ago with large industrial countries exceeding red-line levels of 100% of GDP. Yet, there is little serious concern about debt sustainability on the horizon from investors, governments or international institutions. Similarly on inflation, the vast majority of central bankers and economists believe any rise in prices away from the historically-low levels of the last decade will be transitory. It is assumed that base line effects, one-offs, and structural forces will continue to suppress prices.

So two of the biggest historic constraints on macroeconomic policy – inflation and debt sustainability – are increasingly perceived as not binding. In turn, the removal of these constraints has opened the door for new goals for macro policy, which go far beyond simply stabilising output across the business cycle.

This changing approach to macro policy has been formalised in the Federal Reserve's operating procedures, making a broader interpretation of its mandate possible. Unlike in previous eras, when it was common practice to pre-empt inflation overshoots with higher rates, today's Fed has said they want to see actual progress, not just forecast progress. The new average inflation targeting approach only increases tolerance for inflation.

Where the US leads, others tend to follow. Even in Germany, with its reliable fiscal discipline, there is growing support for to reform the constitutional debt brake in order to permit more deficit spending. And although in aggregate the EU's fiscal stimulus has been more limited than that seen in the US, the arrival of the €750bn Recovery Fund financed by collective borrowing potentially opens the way for further such packages in response to future crises. It is hard to see the ECB stepping back from helping to finance such fiscal investments in the continent or moves to promote further integration.

In short, we are witnessing the most important shift in global macro policy since the Reagan/Volcker axis 40 years ago. Fiscal injections are now "off the charts" at the same time as the Fed's modus operandi has shifted to tolerate higher inflation. Never before have we seen such coordinated expansionary fiscal and monetary policy. This will continue as output moves above potential. This is why this time is different for inflation.



Even if some of the transitory inflation ebbs away, we believe price growth will regain significant momentum as the economy overheats in 2022. Yet we worry that in its new inflation averaging framework, the Fed will be too slow to damp the rising inflation pressures effectively. The consequence of delay will be greater disruption of economic and financial activity than would be otherwise be the case when the Fed does finally act. In turn, this could create a significant recession and set off a chain of financial distress around the world, particularly in emerging markets.

History is not on the side of the Fed. In recent memory, the central bank has not succeeded in achieving a soft landing when implementing a monetary tightening when inflation has been above 4%.

Policymakers are about to enter a far more difficult world than they have seen for several decades.

Covid-19 and the policy response

The Covid-19 pandemic has been one of the biggest disasters to befall the global economy in modern times, leading to the most severe economic shock since the Great Depression. The speed of the decline was unprecedented, and once it became clear in February 2020 that the coronavirus was not simply a localised problem in China, the global economy went from a fairly strong position to a near-collapse in activity within a matter of weeks.

But the pandemic recession is a very different phenomenon from the standard cyclical downturn, that is, one induced by a monetary contraction or the consequences of a financial crisis. What we have seen is a collapse in both demand and supply not only due to enforced shutdowns (important though those are), but just as much due to consumers' own fears about the virus. This unprecedented type of demand drop meant the standard ideas of Keynesian stimulus needed to be used with caution so as not to overheat economies.

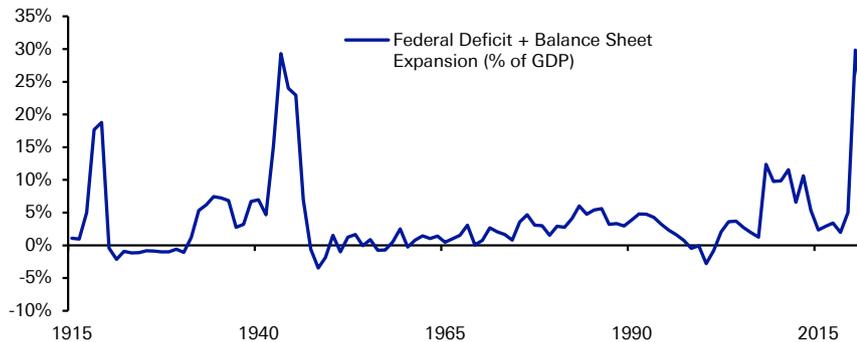
In any event, policymakers have over-corrected for the mistakes of 2008. It is now widely agreed that back then the quantity of US stimulus was insufficient to close the output gap, and the recovery was needlessly slow. It was not until 2017 that the broader measures of labour underutilisation fell back to their pre-crisis level. This was in keeping with the historic playbook, whereby recoveries from financial crises have tended to take longer than those caused by standard cyclical downturns.

This time around, the amount of stimulus has been an order of magnitude greater. The sum total of legislated stimulus packages so far has totalled well in excess of \$5tn or more than 25 per cent of GDP, not counting the infrastructure packages in the pipeline. The US federal deficit is likely to come in at 14-15% (over \$3tn) of GDP in both 2020 and 2021 and come to rest in the mid-to-high single digit range in the years thereafter. In totality, this is well in excess of the 10% deficit in 2009 (\$1.8tn in 2020 dollars).

The chart below helps visualise the nature of this stimulus. It shows the annual increase in the US federal deficit alongside the increase in the Fed's balance sheet, both as a proportion of GDP. There is a striking difference between today's response and that of prior financial crashes as today's stimulus dwarfs the response to the crises in 2008 and the 1930s.



Figure 1: US fiscal and monetary policy has only been as coordinated during WWII



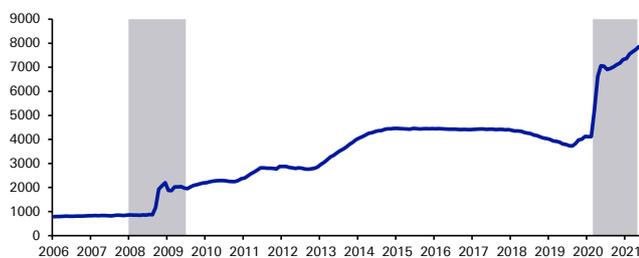
Source : GFD, Deutsche Bank

The current fiscal stimulus is more comparable with that seen around WWII. Then, US deficits remained between 15-30% for four years. While there are many significant differences between the pandemic and WWII we would note that annual inflation was 8.4%, 14.6% and 7.7% in 1946, 1947 and 1948 after the economy normalised and pent-up demand was released.

Monetary stimulus has been equally breath-taking. In numerical terms, the Fed's balance sheet has almost doubled during the pandemic to nearly \$8tn. That compares with the 2008 crisis when it only increased by a little more than \$1t, and then increased another \$2tn in the subsequent six years.

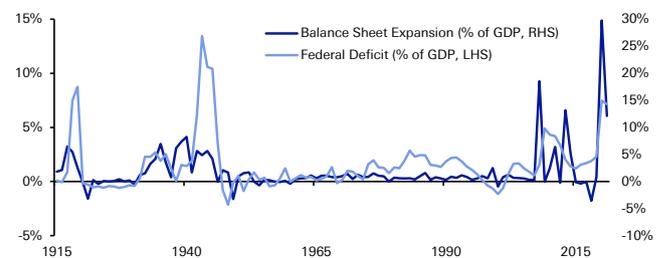
If the fiscal deficit and Fed's balance sheet expansion are combined, they amount to around 30% of GDP in 2020. Our forecasts see it remaining above 20% in 2021. In effect, the US administration has argued that the risks of doing too little far outweigh the risks of doing too much.

Figure 2: Fed Reserve Bank Balance Sheet \$bn



Source : Federal Reserve Board, Deutsche Bank

Figure 3: Fiscal and monetary stimulus

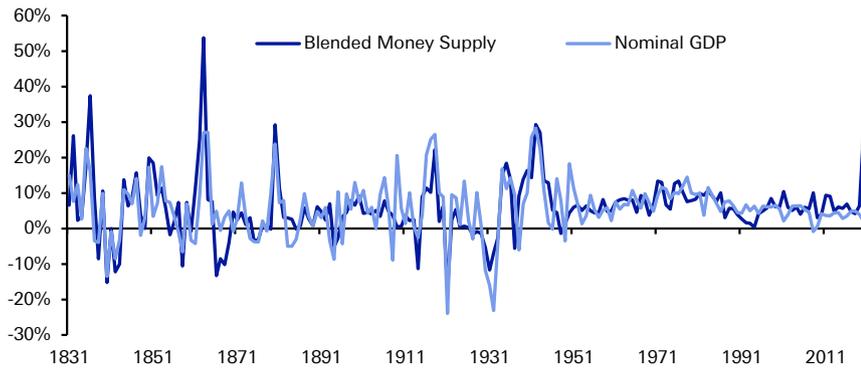


Source : GFD, Deutsche Bank

Given the epic proportion of both monetary and fiscal stimulus, it is no wonder there has been an explosive spike in money supply. And as the following chart shows, a spike of this magnitude has, for the last 200 years, coincided with a similar spike in nominal GDP. Note that the money supply growth following the 2008 crisis does not stand out from the surrounding years. This is what makes the response to today's crisis so different. The coordinated monetary and fiscal response has practically no parallel in US history. This will only be exacerbated by further legislation for infrastructure spending currently moving through Congress.



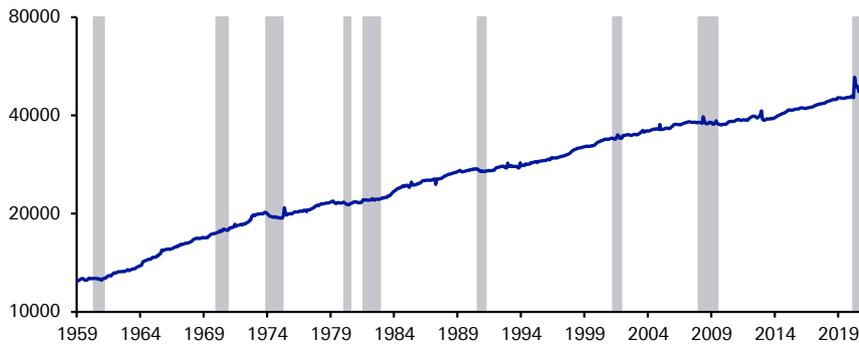
Figure 4: A spike in nominal GDP usually accompanies a spike in money supply



Source : GFD, Deutsche Bank

Another key difference between today and the 2008 crisis is that real disposable incomes have hit all-time highs in the US in spite of the severe recession. Indeed, direct stimulus helped boost incomes more than 5% in 2020 compared with 2019. This compares with 2009 when incomes fell 1% relative to 2008.

Figure 5: Real Disposable Personal Income per Capita (seasonally adjusted in chained 2012 dollars)



Source : BEA, NBER, Deutsche Bank

With less ability to spend their extra cash, Americans have saved. In fact, US savings rates have hit levels not recorded in more than seven decades of available data. At its peak in April 2020, more than a third of disposable income was being saved. Even the lowest savings rate during the pandemic, 13%, was still above any level seen since the early 1980s. As a result, the total amount of excess savings has reached over \$2tn, or more than 10% of GDP.



Figure 6: Personal Saving Rate (SA, %)



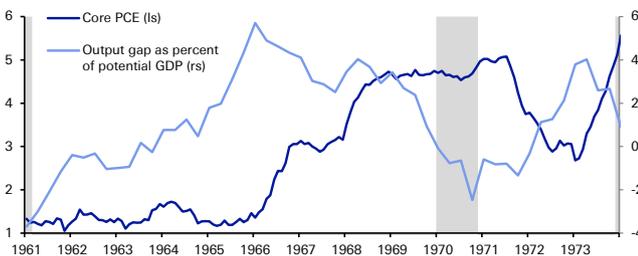
Source : BEA, Deutsche Bank

Consumers will surely spend at least some of their savings as economies reopen. This raises the very real spectre of consumer-driven inflation. To judge the impact on the economy, assume that 25% of the increase in savings is spent over the next 18 months. This spending, along with the full passage of the Biden Jobs and Families plans, will be enough to push GDP to more than 5% above potential by the latter part of 2022 (assuming a “high growth” scenario). In turn, this would move the output gap to the highest level since the mid-1960s.

Consistent with this move in the output gap, we would expect the unemployment rate to dip to between 2% and 3%. That is about 2 percentage points below consensus estimates of the natural rate of unemployment, around 4.5%. The last time unemployment fell that far below the natural rate was in the mid-60s (which was then around 5.5%). An overheating economy was quickly followed by a sharp run-up in inflation, amidst strong pressures on government spending. We believe it is entirely possible, if not likely, that this degree of overheating will be enough to induce a similar substantial and sustained overshoot of inflation over the next couple of years.

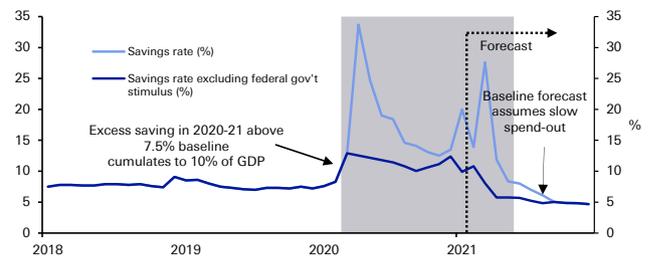
Already, there are initial signs that aggregate demand is far in excess of potential supply. Even with our economists’ base case scenario, the imbalance of demand and supply could send the output gap above a positive 2% level, its highest in over two decades. In a high-growth scenario, it could hit positive 5.5%, the highest since the mid-1960s.

Figure 7: 1960s output gap and inflation



Source : BEA, NBER, Deutsche Bank

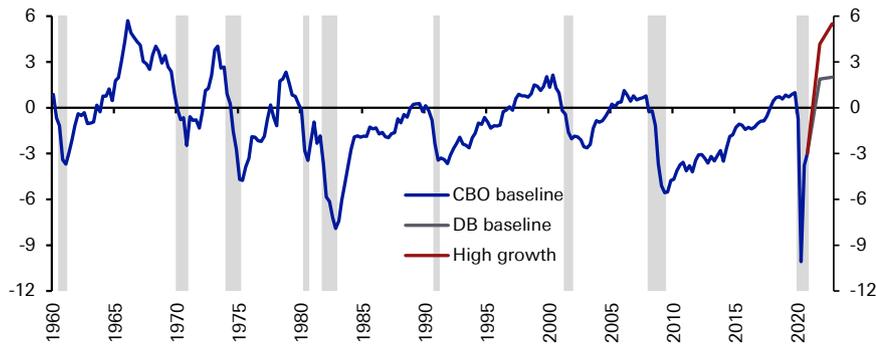
Figure 8: Household saving has boomed



Source : NBER, Haver Analytics, Deutsche Bank



Figure 9: US output gap (plus projections) as a proportion of potential GDP (%)



Source : BEA, CBO, Deutsche Bank

Rising oil prices could compound any consumer-driven inflation. Indeed the price of oil has haunted the Fed before. A series of oil shocks contributed to the ratcheting up of inflation during the 1970s, but the Burns Fed chose to focus more on the CPI excluding oil. Then it excluded surging food prices and the idea of “core” inflation took shape. Subsequently, more and more items were excluded. Eventually, however, the Fed recognised that all the supposed transitory sources of inflation had spread everywhere and double-digit inflation had leaked into the “core”.

Is the Fed making the same mistake again by justifying its extremely patient approach on the basis of transitory inflation? That question is being asked just as it risks being caught in today’s political mood and supporting the administration rather than leaning against the macroeconomic implications of its actions.

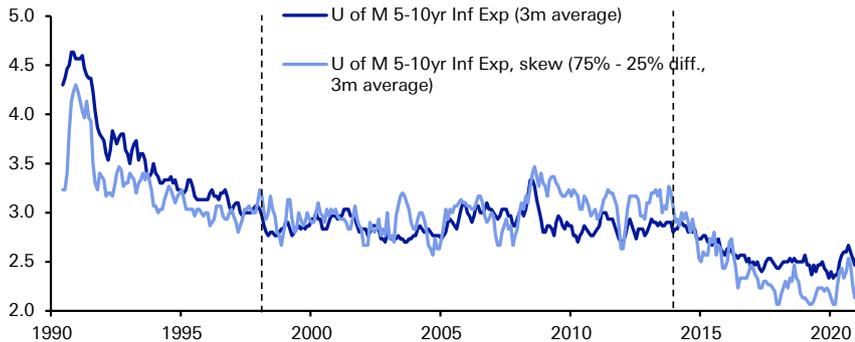
Human biases are also feeding the “transitory” narrative. Just one example regards inflation expectations. These have proven near impossible for economists to model. Hence, the profession will overweight the bottom-up micro components – they are easier to predict. Furthermore, model-based analyses find it difficult to predict the turn in inflation if prompted by a paradigm shift that raises expectations.

With a few years of very low inflation expectations behind us, we are ill-prepared for a dramatic shift. That is especially the case as many asset prices today rely on the monetary policy support of low rates and abundant liquidity that has been a hallmark of the post-2008 world.

Already, many sources of rising prices are filtering through into the US economy. Even if they are transitory on paper, they may feed into expectations just as they did in the 1970s. The risk then, is that even if they are only embedded for a few months they may be difficult to contain, especially with stimulus so high.



Figure 10: A jump in inflation expectations



Source : University of Michigan, Deutsche Bank

How will the Fed react to inflation?

As we recover from Covid, we expect the Fed to stick to its widely and repeatedly advertised current policy stance of unchanged interest rates for some time to come, even in the face of a significant inflation overshoot as the economy returns to full employment. This means the economy will be allowed to “run hot” before policy is tightened significantly. Previously, the Fed has raised rates by several hundred basis points or more by that time in a tightening cycle. However, there are several reasons why we expect the Fed to be much slower to act this time around.

First, the Fed expects the current rise in inflation to prove temporary. It will take considerable time just to establish that what we are seeing is a more persistent step up in inflation.

Second, under its new average inflation targeting framework, the Fed has made it clear that it will need to see realised progress towards a desired overshoot of their inflation target, rather than simply forecasts. This gives the Fed a greater cushion to be patient.

Third, the political environment has shifted toward pressuring the Fed to err in the direction of delaying policy tightening and its inevitable negative impact on economic activity and employment. While the Fed is an independent institution, its leadership, up for reappointment next year, could not totally ignore the very dim view the Administration and Democratic Congress would take of a shift toward a more pre-emptive policy stance in the next year or two. Unlike the early 1980s, when Reagan supported the Volcker Fed’s putting the economy through a wringer to quell inflation, that problem is today viewed as much less important than unemployment and the broader goals of achieving greater equality in income and wealth. Indeed, we expect upcoming new appointments to the Fed Board of Governors to reflect a greater sensitivity to these shifting priorities.

The Fed’s move away from pre-emptive action in its new policy framework is the most important factor raising the risk that it will fall well behind the curve and be too late to deal effectively with an inflation problem without a major disruption to activity. Monetary policy operates with long and variable lags, and as we have noted, it will also take time to recognize that inflation has actually overshoot excessively and persistently. As inflation rises sustainably above target, forward looking expectations are likely to become unanchored and drift higher, adding momentum to the process.



By this point, the Fed will likely be moved to act, and when it does the impact will be highly disruptive to the markets and the economy. In the past, the Fed has not been able to reverse a sustained run-up in inflation without causing a recession and potentially large increase in unemployment. Being behind the curve when it starts will make the event that much more painful. Rising interest rates will also cause havoc in a debt-heavy world, leading to financial crises especially in emerging markets. If the Fed lets up and reverses rate increases in response to rising unemployment and other economic pain as occurred during the 1970s, inflation could back up again, leading to a repeat of the stop-go economic cycles that occurred during that period.

Depending on the timing of this potential inflation scenario, the 2022 midterm elections could be crucial. A surprisingly strong showing on the Democratic side could even pave the way for modifying the Federal Reserve Act to raise the inflation objective. This discussion has been brewing in academic circles for some time, not the least as a way to enhance the Fed's power to move interest rates into negative territory when needed. But such a move could damage the Fed's inflation fighting credibility. It could also lead to still higher inflation over time and ultimately intensifying the kind of boom-bust cycle experienced during the 1970s.

In brief, the easy policy decisions of the disinflationary 1980-2020 period appear to be behind us.

This transition has arrived just as longer-term forces are also becoming more inflationary

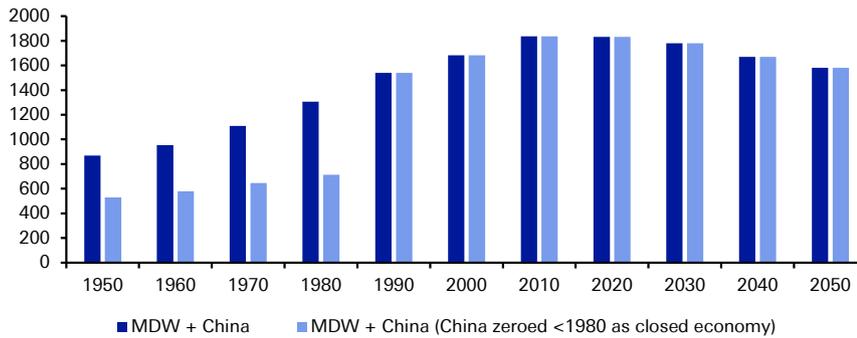
The short-term factors pushing inflation higher are being amplified by longer-term structural forces which are also becoming more inflationary.

The first of these is demographics. Over the last 40 years, the integration of China and other emerging markets into the global economy has effectively meant that hundreds of millions of cheap workers have been absorbed into the global economy. In turn, this put downward pressure on wages and prices in the developed world.

The integration process has now matured. In the years and decades ahead, the size of the working-age people is set to decline both in absolute terms and relative to the overall population. This will occur both in advanced economies and in China. A scarcity of workers will pressure wages upwards and, in turn, prices of goods and services. Any political moves to redistribute from the rich to the poor could also support such a move.



Figure 11: The working age population in the more-developed world and China

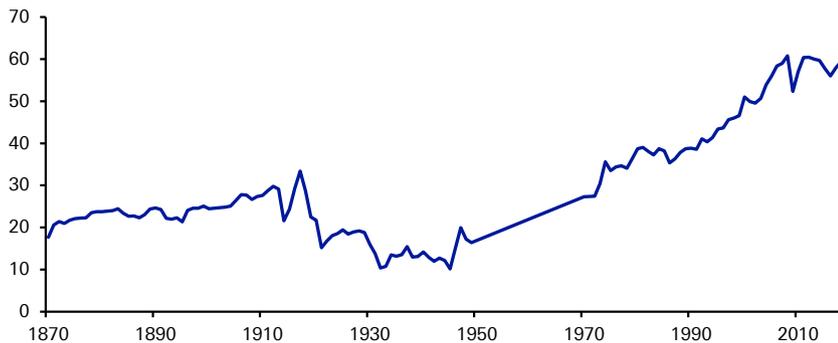


Source : United Nations, Haver Analytics, Deutsche Bank

Another factor nudging up inflation is waning globalisation. We must say that globalisation itself has arguably been the major economic story of recent decades. Indeed the last 50 years have seen global trade more than double as a share of GDP, from 27% in 1970 to 60% in 2019 just before the pandemic. But this trend of upwards growth is unlikely to continue. In fact, it stalled in the 2010s, as the political climate moved increasingly towards protectionism. Furthermore, the pandemic has placed global supply chains under fresh scrutiny. Both countries and corporates are keen to ensure the resilience of key inputs, particularly amidst rising geopolitical tensions.

The desire for resilience means there will likely be a bias towards investment in home production, especially in critical sectors, such as personal protective equipment, drug manufacturing, and semiconductors. The likely result is higher production costs. These will eventually be passed on to the consumer.

Figure 12: Global trade as a proportion of GDP



Source : World Bank, Deutsche Bank

These inflationary structural forces are growing just as the 2020s looks set to be the decade of major climate and sustainability investment. This is likely going to be a negative supply shock and prompt wide-scale fiscal spending to reengineer greener economies. It seems likely that policymakers will increasingly try to price externalities which will increase business costs and ultimately lead to inflation as they are passed on to consumers.



Conclusion

We worry that inflation will make a comeback. Few still remember how our societies and economies were threatened by high inflation 50 years ago. The most basic laws of economics, the ones that have stood the test of time over a millennium, have not been suspended. An explosive growth in debt financed largely by central banks is likely to lead to higher inflation. We worry that the painful lessons of an inflationary past are being ignored by central bankers, either because they really believe that this time is different, or they have bought into a new paradigm that low interest rates are here to stay, or they are protecting their institutions by not trying to hold back a political steam roller. Whatever the reason, we expect inflationary pressures to re-emerge as the Fed continues with its policy of patience and its stated belief that current pressures are largely transitory. It may take a year longer until 2023 but inflation will re-emerge. And while it is admirable that this patience is due to the fact that the Fed's priorities are shifting towards social goals, neglecting inflation leaves global economies sitting on a time bomb.

It is a scary thought that just as inflation is being deprioritised, fiscal and monetary policy is being coordinated in ways the world has never seen. Recent stimulus has been extraordinary and economic forecasting, which is difficult at the best of times, is becoming harder by the day. Fractured politics amplifies the problem. Needless to say, the range of global outcomes over the coming years is wide.

When central banks are eventually forced to act on inflation, they will find it themselves in a difficult, if not untenable, position. They will be fighting the increasingly-ingrained perception that high levels of debt and higher inflation are a small price to pay for achieving progressive political, economic and social goals. That will make it politically difficult for societies to accept higher unemployment in the interest of fighting inflation.

Eventually, though, any social priorities that policymakers have will be set aside if inflation returns in earnest. Rising prices will touch everyone. The effects could be devastating, particularly for the most vulnerable in society. Sadly, when central banks do act at this stage, they will be forced into abrupt policy change which will only make it harder for policymakers to achieve the social goals that our societies need.

Low, stable inflation and historically low interest rates have been the glue that have held together macro policy for the last three decades. If, as we expect, this starts to unravel over the next year or two, then policymakers will face the most challenging years since the Volcker/Reagan period in the 1980s.



Appendix 1

Important Disclosures

*Other information available upon request

*Prices are current as of the end of the previous trading session unless otherwise indicated and are sourced from local exchanges via Reuters, Bloomberg and other vendors. Other information is sourced from Deutsche Bank, subject companies, and other sources. For disclosures pertaining to recommendations or estimates made on securities other than the primary subject of this research, please see the most recently published company report or visit our global disclosure look-up page on our website at <https://research.db.com/Research/Disclosures/CompanySearch>. Aside from within this report, important risk and conflict disclosures can also be found at <https://research.db.com/Research/Topics/Equities?topicId=RB0002>. Investors are strongly encouraged to review this information before investing.

Analyst Certification

The views expressed in this report accurately reflect the personal views of the undersigned lead analyst(s). In addition, the undersigned lead analyst(s) has not and will not receive any compensation for providing a specific recommendation or view in this report. David Folkerts-Landau, Peter Hooper, Jim Reid.



Additional Information

The information and opinions in this report were prepared by Deutsche Bank AG or one of its affiliates (collectively 'Deutsche Bank'). Though the information herein is believed to be reliable and has been obtained from public sources believed to be reliable, Deutsche Bank makes no representation as to its accuracy or completeness. Hyperlinks to third-party websites in this report are provided for reader convenience only. Deutsche Bank neither endorses the content nor is responsible for the accuracy or security controls of those websites.

If you use the services of Deutsche Bank in connection with a purchase or sale of a security that is discussed in this report, or is included or discussed in another communication (oral or written) from a Deutsche Bank analyst, Deutsche Bank may act as principal for its own account or as agent for another person.

Deutsche Bank may consider this report in deciding to trade as principal. It may also engage in transactions, for its own account or with customers, in a manner inconsistent with the views taken in this research report. Others within Deutsche Bank, including strategists, sales staff and other analysts, may take views that are inconsistent with those taken in this research report. Deutsche Bank issues a variety of research products, including fundamental analysis, equity-linked analysis, quantitative analysis and trade ideas. Recommendations contained in one type of communication may differ from recommendations contained in others, whether as a result of differing time horizons, methodologies, perspectives or otherwise. Deutsche Bank and/or its affiliates may also be holding debt or equity securities of the issuers it writes on. Analysts are paid in part based on the profitability of Deutsche Bank AG and its affiliates, which includes investment banking, trading and principal trading revenues.

Opinions, estimates and projections constitute the current judgment of the author as of the date of this report. They do not necessarily reflect the opinions of Deutsche Bank and are subject to change without notice. Deutsche Bank provides liquidity for buyers and sellers of securities issued by the companies it covers. Deutsche Bank research analysts sometimes have shorter-term trade ideas that may be inconsistent with Deutsche Bank's existing longer-term ratings. Some trade ideas for equities are listed as Catalyst Calls on the Research Website (<https://research.db.com/Research/>), and can be found on the general coverage list and also on the covered company's page. A Catalyst Call represents a high-conviction belief by an analyst that a stock will outperform or underperform the market and/or a specified sector over a time frame of no less than two weeks and no more than three months. In addition to Catalyst Calls, analysts may occasionally discuss with our clients, and with Deutsche Bank salespersons and traders, trading strategies or ideas that reference catalysts or events that may have a near-term or medium-term impact on the market price of the securities discussed in this report, which impact may be directionally counter to the analysts' current 12-month view of total return or investment return as described herein. Deutsche Bank has no obligation to update, modify or amend this report or to otherwise notify a recipient thereof if an opinion, forecast or estimate changes or becomes inaccurate. Coverage and the frequency of changes in market conditions and in both general and company-specific economic prospects make it difficult to update research at defined intervals. Updates are at the sole discretion of the coverage analyst or of the Research Department Management, and the majority of reports are published at irregular intervals. This report is provided for informational purposes only and does not take into account the particular investment objectives, financial situations, or needs of individual clients. It is not an offer or a solicitation of an offer to buy or sell any financial instruments or to participate in any particular trading strategy. Target prices are inherently imprecise and a product of the analyst's judgment. The financial instruments discussed in this report may not be suitable for all investors, and investors must make their own informed investment decisions. Prices and availability of financial instruments are subject to change without notice, and investment transactions can lead to losses as a result of price fluctuations and other factors. If a financial instrument is denominated in a currency other than an investor's currency, a change in exchange rates may adversely affect the investment. Past performance is not necessarily indicative of future results. Performance calculations exclude transaction costs, unless otherwise indicated. Unless otherwise indicated, prices are current as of the end of the previous trading session and are sourced from local exchanges via Reuters, Bloomberg and other vendors. Data is also sourced from Deutsche Bank, subject companies, and other parties.

The Deutsche Bank Research Department is independent of other business divisions of the Bank. Details regarding our organizational arrangements and information barriers we have to prevent and avoid conflicts of interest with respect to our research are available on our website (<https://research.db.com/Research/>) under Disclaimer.

Macroeconomic fluctuations often account for most of the risks associated with exposures to instruments that promise to pay fixed or variable interest rates. For an investor who is long fixed-rate instruments (thus receiving these cash flows), increases in interest rates naturally lift the discount factors applied to the expected cash flows and thus cause a loss. The longer the maturity of a certain cash flow and the higher the move in the discount factor, the higher will be the loss. Upside surprises in inflation, fiscal funding needs, and FX depreciation rates are among the most common adverse macroeconomic shocks to receivers. But counterparty exposure, issuer creditworthiness, client segmentation, regulation (including changes in assets holding limits for different types of investors), changes in tax policies, currency convertibility (which may constrain currency conversion, repatriation of profits and/or liquidation of positions), and settlement issues related to local clearing houses are also important risk factors. The sensitivity of fixed-income instruments to macroeconomic shocks may be mitigated by indexing the contracted cash flows to inflation, to FX depreciation, or to specified interest rates – these are common in emerging markets. The index fixings may – by construction – lag or mis-measure the actual move in the underlying variables they are intended to track. The choice of the proper fixing (or metric) is particularly important in swaps markets, where floating coupon rates (i.e., coupons indexed to a typically short-dated interest rate reference index) are exchanged for fixed coupons. Funding in a currency that differs from the currency in which coupons are denominated carries FX risk. Options on swaps (swaptions) the risks typical to options in addition to the risks related to rates movements.

Derivative transactions involve numerous risks including market, counterparty default and illiquidity risk. The appropriateness



of these products for use by investors depends on the investors' own circumstances, including their tax position, their regulatory environment and the nature of their other assets and liabilities; as such, investors should take expert legal and financial advice before entering into any transaction similar to or inspired by the contents of this publication. The risk of loss in futures trading and options, foreign or domestic, can be substantial. As a result of the high degree of leverage obtainable in futures and options trading, losses may be incurred that are greater than the amount of funds initially deposited – up to theoretically unlimited losses. Trading in options involves risk and is not suitable for all investors. Prior to buying or selling an option, investors must review the 'Characteristics and Risks of Standardized Options', at <http://www.optionsclearing.com/about/publications/character-risks.jsp>. If you are unable to access the website, please contact your Deutsche Bank representative for a copy of this important document.

Participants in foreign exchange transactions may incur risks arising from several factors, including the following: (i) exchange rates can be volatile and are subject to large fluctuations; (ii) the value of currencies may be affected by numerous market factors, including world and national economic, political and regulatory events, events in equity and debt markets and changes in interest rates; and (iii) currencies may be subject to devaluation or government-imposed exchange controls, which could affect the value of the currency. Investors in securities such as ADRs, whose values are affected by the currency of an underlying security, effectively assume currency risk.

Unless governing law provides otherwise, all transactions should be executed through the Deutsche Bank entity in the investor's home jurisdiction. Aside from within this report, important conflict disclosures can also be found at <https://research.db.com/Research/> on each company's research page. Investors are strongly encouraged to review this information before investing.

Deutsche Bank (which includes Deutsche Bank AG, its branches and affiliated companies) is not acting as a financial adviser, consultant or fiduciary to you or any of your agents (collectively, "You" or "Your") with respect to any information provided in this report. Deutsche Bank does not provide investment, legal, tax or accounting advice, Deutsche Bank is not acting as your impartial adviser, and does not express any opinion or recommendation whatsoever as to any strategies, products or any other information presented in the materials. Information contained herein is being provided solely on the basis that the recipient will make an independent assessment of the merits of any investment decision, and it does not constitute a recommendation of, or express an opinion on, any product or service or any trading strategy.

The information presented is general in nature and is not directed to retirement accounts or any specific person or account type, and is therefore provided to You on the express basis that it is not advice, and You may not rely upon it in making Your decision. The information we provide is being directed only to persons we believe to be financially sophisticated, who are capable of evaluating investment risks independently, both in general and with regard to particular transactions and investment strategies, and who understand that Deutsche Bank has financial interests in the offering of its products and services. If this is not the case, or if You are an IRA or other retail investor receiving this directly from us, we ask that you inform us immediately.

In July 2018, Deutsche Bank revised its rating system for short term ideas whereby the branding has been changed to Catalyst Calls ("CC") from SOLAR ideas; the rating categories for Catalyst Calls originated in the Americas region have been made consistent with the categories used by Analysts globally; and the effective time period for CCs has been reduced from a maximum of 180 days to 90 days.

United States: Approved and/or distributed by Deutsche Bank Securities Incorporated, a member of FINRA, NFA and SIPC. Analysts located outside of the United States are employed by non-US affiliates that are not subject to FINRA regulations.

European Economic Area (exc. United Kingdom): Approved and/or distributed by Deutsche Bank AG, a joint stock corporation with limited liability incorporated in the Federal Republic of Germany with its principal office in Frankfurt am Main. Deutsche Bank AG is authorized under German Banking Law and is subject to supervision by the European Central Bank and by BaFin, Germany's Federal Financial Supervisory Authority.

United Kingdom: Approved and/or distributed by Deutsche Bank AG acting through its London Branch at Winchester House, 1 Great Winchester Street, London EC2N 2DB. Deutsche Bank AG in the United Kingdom is authorised by the Prudential Regulation Authority and is subject to limited regulation by the Prudential Regulation Authority and Financial Conduct Authority. Details about the extent of our authorisation and regulation are available on request.

Hong Kong SAR: Distributed by Deutsche Bank AG, Hong Kong Branch, except for any research content relating to futures contracts within the meaning of the Hong Kong Securities and Futures Ordinance Cap. 571. Research reports on such futures contracts are not intended for access by persons who are located, incorporated, constituted or resident in Hong Kong. The author(s) of a research report may not be licensed to carry on regulated activities in Hong Kong, and if not licensed, do not hold themselves out as being able to do so. The provisions set out above in the 'Additional Information' section shall apply to the fullest extent permissible by local laws and regulations, including without limitation the Code of Conduct for Persons Licensed or Registered with the Securities and Futures Commission. This report is intended for distribution only to 'professional investors' as defined in Part 1 of Schedule of the SFO. This document must not be acted or relied on by persons who are not professional investors. Any investment or investment activity to which this document relates is only available to professional investors and will be engaged only with professional investors.

India: Prepared by Deutsche Equities India Private Limited (DEIPL) having CIN: U65990MH2002PTC137431 and registered office at 14th Floor, The Capital, C-70, G Block, Bandra Kurla Complex Mumbai (India) 400051. Tel: + 91 22 7180 4444. It is registered by the Securities and Exchange Board of India (SEBI) as a Stock broker bearing registration no.: INZ000252437;



Merchant Banker bearing SEBI Registration no.: INM000010833 and Research Analyst bearing SEBI Registration no.: INH000001741. DEIPL may have received administrative warnings from the SEBI for breaches of Indian regulations. Deutsche Bank and/or its affiliate(s) may have debt holdings or positions in the subject company. With regard to information on associates, please refer to the "Shareholdings" section in the Annual Report at: <https://www.db.com/ir/en/annual-reports.htm>.

Japan: Approved and/or distributed by Deutsche Securities Inc.(DSI). Registration number - Registered as a financial instruments dealer by the Head of the Kanto Local Finance Bureau (Kinsho) No. 117. Member of associations: JSDA, Type II Financial Instruments Firms Association and The Financial Futures Association of Japan. Commissions and risks involved in stock transactions - for stock transactions, we charge stock commissions and consumption tax by multiplying the transaction amount by the commission rate agreed with each customer. Stock transactions can lead to losses as a result of share price fluctuations and other factors. Transactions in foreign stocks can lead to additional losses stemming from foreign exchange fluctuations. We may also charge commissions and fees for certain categories of investment advice, products and services. Recommended investment strategies, products and services carry the risk of losses to principal and other losses as a result of changes in market and/or economic trends, and/or fluctuations in market value. Before deciding on the purchase of financial products and/or services, customers should carefully read the relevant disclosures, prospectuses and other documentation. 'Moody's', 'Standard Poor's', and 'Fitch' mentioned in this report are not registered credit rating agencies in Japan unless Japan or 'Nippon' is specifically designated in the name of the entity. Reports on Japanese listed companies not written by analysts of DSI are written by Deutsche Bank Group's analysts with the coverage companies specified by DSI. Some of the foreign securities stated on this report are not disclosed according to the Financial Instruments and Exchange Law of Japan. Target prices set by Deutsche Bank's equity analysts are based on a 12-month forecast period..

Korea: Distributed by Deutsche Securities Korea Co.

South Africa: Deutsche Bank AG Johannesburg is incorporated in the Federal Republic of Germany (Branch Register Number in South Africa: 1998/003298/10).

Singapore: This report is issued by Deutsche Bank AG, Singapore Branch (One Raffles Quay #18-00 South Tower Singapore 048583, 65 6423 8001), which may be contacted in respect of any matters arising from, or in connection with, this report. Where this report is issued or promulgated by Deutsche Bank in Singapore to a person who is not an accredited investor, expert investor or institutional investor (as defined in the applicable Singapore laws and regulations), they accept legal responsibility to such person for its contents.

Taiwan: Information on securities/investments that trade in Taiwan is for your reference only. Readers should independently evaluate investment risks and are solely responsible for their investment decisions. Deutsche Bank research may not be distributed to the Taiwan public media or quoted or used by the Taiwan public media without written consent. Information on securities/instruments that do not trade in Taiwan is for informational purposes only and is not to be construed as a recommendation to trade in such securities/instruments. Deutsche Securities Asia Limited, Taipei Branch may not execute transactions for clients in these securities/instruments.

Qatar: Deutsche Bank AG in the Qatar Financial Centre (registered no. 00032) is regulated by the Qatar Financial Centre Regulatory Authority. Deutsche Bank AG - QFC Branch may undertake only the financial services activities that fall within the scope of its existing QFCRA license. Its principal place of business in the QFC: Qatar Financial Centre, Tower, West Bay, Level 5, PO Box 14928, Doha, Qatar. This information has been distributed by Deutsche Bank AG. Related financial products or services are only available only to Business Customers, as defined by the Qatar Financial Centre Regulatory Authority.

Russia: The information, interpretation and opinions submitted herein are not in the context of, and do not constitute, any appraisal or evaluation activity requiring a license in the Russian Federation.

Kingdom of Saudi Arabia: Deutsche Securities Saudi Arabia LLC Company (registered no. 07073-37) is regulated by the Capital Market Authority. Deutsche Securities Saudi Arabia may undertake only the financial services activities that fall within the scope of its existing CMA license. Its principal place of business in Saudi Arabia: King Fahad Road, Al Olaya District, P.O. Box 301809, Faisaliah Tower - 17th Floor, 11372 Riyadh, Saudi Arabia.

United Arab Emirates: Deutsche Bank AG in the Dubai International Financial Centre (registered no. 00045) is regulated by the Dubai Financial Services Authority. Deutsche Bank AG - DIFC Branch may only undertake the financial services activities that fall within the scope of its existing DFSA license. Principal place of business in the DIFC: Dubai International Financial Centre, The Gate Village, Building 5, PO Box 504902, Dubai, U.A.E. This information has been distributed by Deutsche Bank AG. Related financial products or services are available only to Professional Clients, as defined by the Dubai Financial Services Authority.

Australia and New Zealand: This research is intended only for 'wholesale clients' within the meaning of the Australian Corporations Act and New Zealand Financial Advisors Act, respectively. Please refer to Australia-specific research disclosures and related information at <https://australia.db.com/australia/content/research-information.html> Where research refers to any particular financial product recipients of the research should consider any product disclosure statement, prospectus or other applicable disclosure document before making any decision about whether to acquire the product. In preparing this report, the primary analyst or an individual who assisted in the preparation of this report has likely been in contact with the company that is the subject of this research for confirmation/clarification of data, facts, statements, permission to use company-sourced material in the report, and/or site-visit attendance. Without prior approval from Research Management, analysts may not



accept from current or potential Banking clients the costs of travel, accommodations, or other expenses incurred by analysts attending site visits, conferences, social events, and the like. Similarly, without prior approval from Research Management and Anti-Bribery and Corruption ("ABC") team, analysts may not accept perks or other items of value for their personal use from issuers they cover.

Additional information relative to securities, other financial products or issuers discussed in this report is available upon request. This report may not be reproduced, distributed or published without Deutsche Bank's prior written consent.

Backtested, hypothetical or simulated performance results have inherent limitations. Unlike an actual performance record based on trading actual client portfolios, simulated results are achieved by means of the retroactive application of a backtested model itself designed with the benefit of hindsight. Taking into account historical events the backtesting of performance also differs from actual account performance because an actual investment strategy may be adjusted any time, for any reason, including a response to material, economic or market factors. The backtested performance includes hypothetical results that do not reflect the reinvestment of dividends and other earnings or the deduction of advisory fees, brokerage or other commissions, and any other expenses that a client would have paid or actually paid. No representation is made that any trading strategy or account will or is likely to achieve profits or losses similar to those shown. Alternative modeling techniques or assumptions might produce significantly different results and prove to be more appropriate. Past hypothetical backtest results are neither an indicator nor guarantee of future returns. Actual results will vary, perhaps materially, from the analysis.

The method for computing individual E,S,G and composite ESG scores set forth herein is a novel method developed by the Research department within Deutsche Bank AG, computed using a systematic approach without human intervention. Different data providers, market sectors and geographies approach ESG analysis and incorporate the findings in a variety of ways. As such, the ESG scores referred to herein may differ from equivalent ratings developed and implemented by other ESG data providers in the market and may also differ from equivalent ratings developed and implemented by other divisions within the Deutsche Bank Group. Such ESG scores also differ from other ratings and rankings that have historically been applied in research reports published by Deutsche Bank AG. Further, such ESG scores do not represent a formal or official view of Deutsche Bank AG.

It should be noted that the decision to incorporate ESG factors into any investment strategy may inhibit the ability to participate in certain investment opportunities that otherwise would be consistent with your investment objective and other principal investment strategies. The returns on a portfolio consisting primarily of sustainable investments may be lower or higher than portfolios where ESG factors, exclusions, or other sustainability issues are not considered, and the investment opportunities available to such portfolios may differ. Companies may not necessarily meet high performance standards on all aspects of ESG or sustainable investing issues; there is also no guarantee that any company will meet expectations in connection with corporate responsibility, sustainability, and/or impact performance.

Copyright © 2021 Deutsche Bank AG



David Folkerts-Landau

Group Chief Economist and Global Head of Research

Pam Finelli
Global Chief Operating
Officer Research

Steve Pollard
Global Head of Company
Research and Sales

Anthony Klarman
Global Head of
Debt Research

Michael Spencer
Head of APAC
Research

Andreas Neubauer
Head of Germany
Research

Gerry Gallagher
Head of European
Company Research

Matthew Barnard
Head of Americas
Company Research

Tim Rokossa
Head of German
Company Research

Peter Milliken
Head of APAC
Company Research

Jim Reid
Global Head of
Thematic Research

Francis Yared
Global Head of Rates Research

George Saravelos
Global Head of FX Research

Peter Hooper
Global Head of
Economic Research

International Production Locations

Deutsche Bank AG

Deutsche Bank Place
Level 16
Corner of Hunter & Phillip Streets
Sydney, NSW 2000
Australia
Tel: (61) 2 8258 1234

Deutsche Bank AG

Equity Research
Mainzer Landstrasse 11-17
60329 Frankfurt am Main
Germany
Tel: (49) 69 910 00

Deutsche Bank AG

Filiale Hongkong
International Commerce Centre,
1 Austin Road West, Kowloon,
Hong Kong
Tel: (852) 2203 8888

Deutsche Securities Inc.

2-11-1 Nagatacho
Sanno Park Tower
Chiyoda-ku, Tokyo 100-6171
Japan
Tel: (81) 3 5156 6000

Deutsche Bank AG

1 Great Winchester Street
London EC2N 2EQ
United Kingdom
Tel: (44) 20 7545 8000

Deutsche Bank Securities Inc.

60 Wall Street
New York, NY 10005
United States of America
Tel: (1) 212 250 2500
