

## Do Inflationary Concerns Warrant Hedging?

*Some sources of inflationary risk are more benign than others. Given the structural headwinds that the global economy faces, a broad inflation hedging programme can be expensive and unnecessary. On the other hand, the likelihood of unexpected inflation driven by regulation or supply shocks is increasing. This points to a more targeted approach when managing inflation risk.*



For years LINKS have been intentionally steering clear of the big inflation discussion. It is a thorny issue for two reasons: there is little consensus about how to measure inflation and how to assess its impact on the economy as a whole. The latter issue is perhaps the most contentious one: we define inflation as an increase in the overall level of prices, and yet in itself such an increase does not imply positive or negative consequences for the economy beyond redistribution effects unless the inflation is of a magnitude that it severely impacts confidence levels of economic actors and subsequently their behaviour.

Whatever the implications for the overall economy, however, as far as pension funds are concerned, higher inflation levels will cut their ability to meet pension indexation goals. The size of the impact for pension funds, given the extremely long duration of liabilities, is clearly very large. On the other hand, the costs of continuously hedging against inflation, are also high. The question is then, are the recent global inflationary concerns significant enough to warrant either or both of the policy responses below:

- i. gain more exposure to “natural” inflation hedging assets in the asset allocation process,
- ii. take active inflation hedging measures, i.e. inflation hedging programs.



Download a public version of LINKS Mira Agent Based Model (ABM): a class of models for simulating the interactions of organizations or groups with a view to assessing their effects on the system as a whole:

<https://linksanalytics.com/inboundmiratest/>

This issue of Risk Wire examines the multiple secular trends that have opposite effects on the long-term inflation risk. It attempts to reconcile the effects of the multiple secular trends and arrive at the likely level of steady-state inflation going forward.

To summarize our main findings: we have used our Agent Based Model MIRA to assess the impacts of different types of cost-push inflationary shocks. Our research shows that typical demand-driven “predictable” inflation is unlikely to appear any time soon. However, cost-push inflation, whether caused by the traditionally known or other, newly identified sources of inflation, can still at any time impact economies. Therefore, in our view, a structured inflation hedging programme cannot be justified. We would suggest to protect portfolios against these ‘event-driven’ inflation episodes via (financial) assets with specific industry exposures.

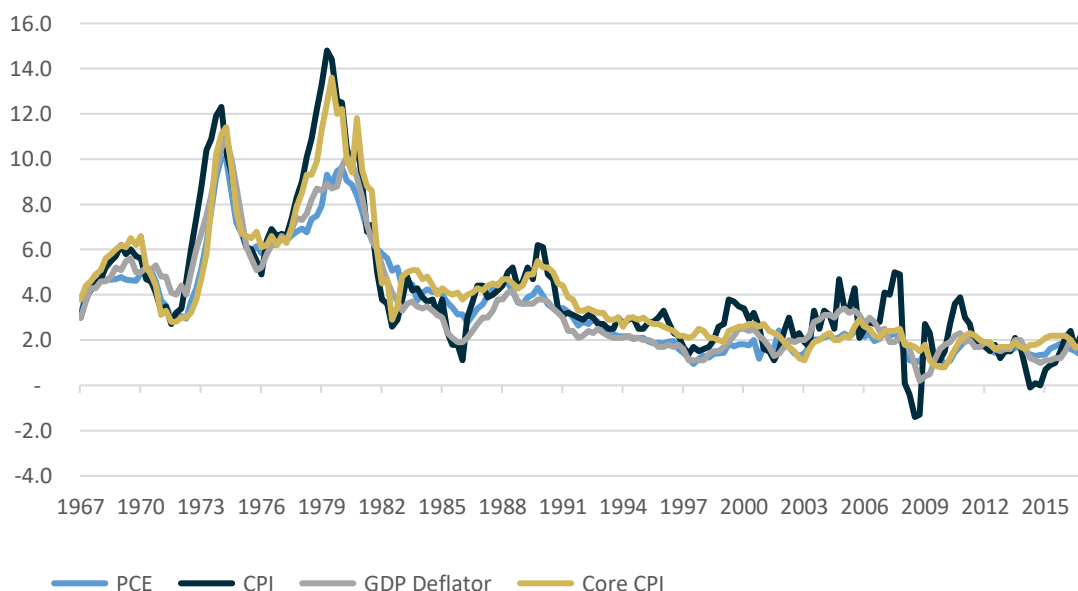
## Does the Measurement Matter?

Measuring the changes in general price level is not straight forward and the fact that inflation compensation has become a political battle ground has not helped the issue. Co-existence of multiple indices: CPI, core CPI, GDP Deflator, Personal Consumption Expenditure (PCE) at any given time only adds to the confusion. To be clear, all of these indices have their drawbacks. Consumer Price Inflation (CPI) has been criticized for both under-estimating and over-estimating inflation at different times: substitution, the Wal-Mart effect, quality bias, quality of life factors are all examples of how inflation measures are imperfect.

One drawback is shared by all these different, generally known and used measures of inflation: none of them has included the price (development) of externalities, even though technology nowadays enables us to account for most of the externalities. We are able to put a price tag on externalities and the increased attention for ESG aspects of investments points to an increased awareness that externalities are becoming more ‘valuable’. It is very likely that the question is not IF but when these externalities will be priced and become part of these inflation measures.

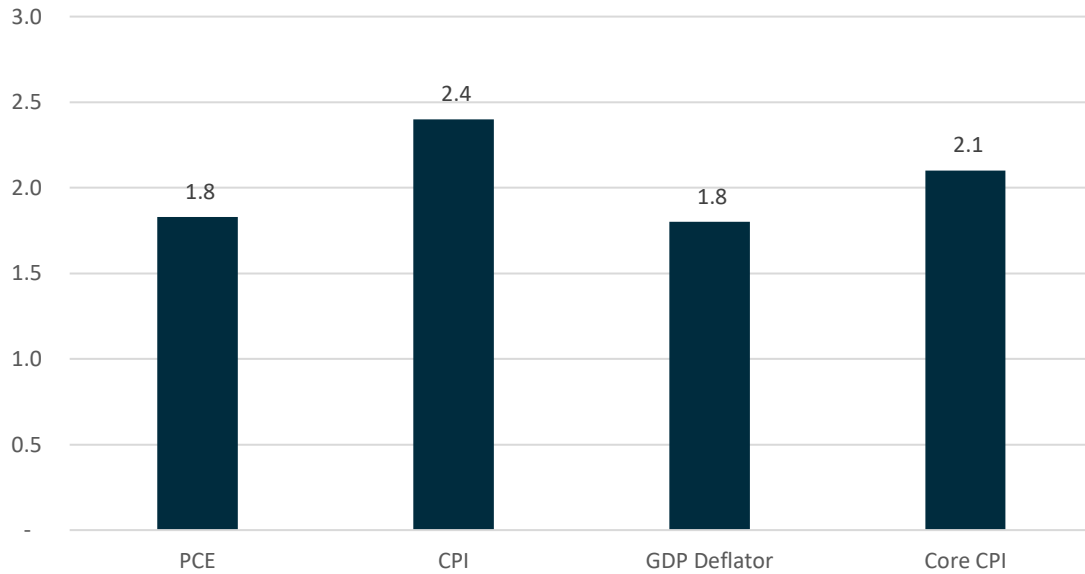
However, using what we have and looking back in history (Figure 1) as well as at the most recent readings (Figure 2) of the US inflation measures, one conclusion is clear: no matter the calculation method, inflation levels have gone through structural decline over the past decades.

Figure 1: PCE, CPI, Core CPI and GDP Deflator, Source: Bloomberg



Regardless of the calculation approach, the price level appears to increase by less than 2.5% on average, which given the context of near full employment in the US may appear to be a low number.

Figure 2: Recent readings of US inflation measures. Source: Bloomberg



## Is Inflation Level Low Given the Economic Environment?

Traditional understanding of inflation driven by wage growth implies a fully functioning Phillips curve: the inverse relationship between unemployment and inflation. The only problem is of course that by all measures and calculations, either such a relationship never existed or it broke down since 1990s. Not only higher levels of employment tend to leave inflation unaffected (Figure 3), but even actual wage growth has limited impact on inflation (Figure 4).

Figure 3: Relationship between unemployment and inflation, Source: FRED

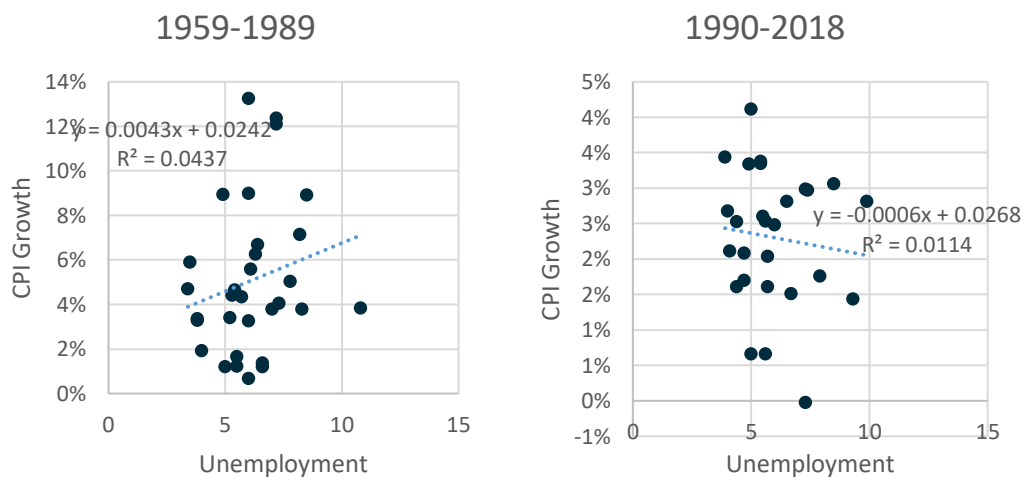
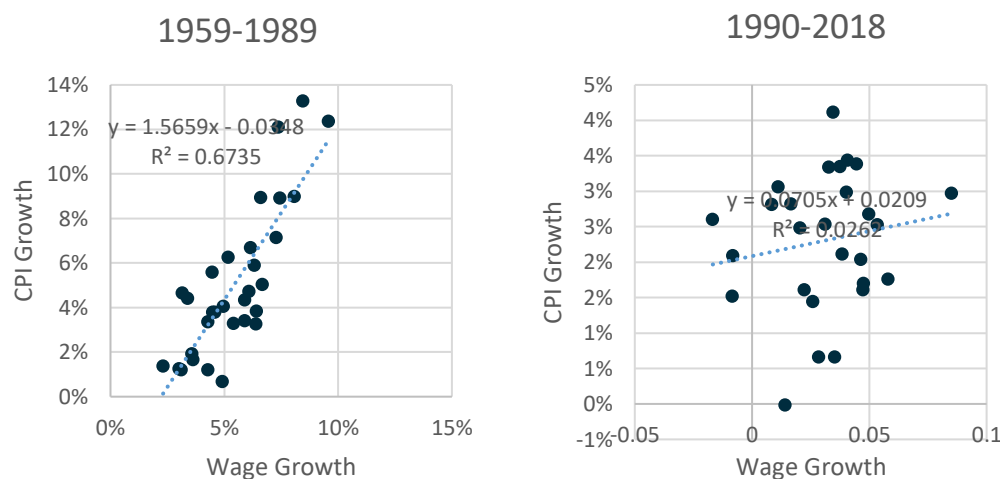


Figure 4: Relationship between wages and inflation, Source: FRED



The cautious conclusion from wage-inflation data is that any common reasons for wage growth and inflation to co-move have disappeared over the last few decades. In order to assess the risk of inflation going forward, it is worthwhile to try and understand what happened so far: why has inflation (and interest rates) been disconnecting from employment and wages?

## Reasons for Inflation or Lack Thereof

Economic theory recognises two distinct sources of inflation:

- i. demand-driven inflation, whereby higher demand for goods and services pushes the price level higher due to the economy approaching its short-term maximum production capacity
- ii. cost-push inflation, whereby scarcity of some of the inputs push input and output prices higher.

Various long-term trends such as automation or ageing population impact the level of inflation through changing the aggregate demand (demand-driven inflation) or the structure of supply (cost-push inflation). However, there are trends that are not important in the context of economic theory, but may nevertheless be potent sources of inflation:

- i. **policy mistakes:** propensity of the central banks to be “behind the curve” and cause inflation by improperly changing monetary levers. Since there is no reason to believe that central banks are structurally and consistently wrong, this type of inflation can be considered insignificant in the long term.
- ii. **externality related:** many production processes have direct or indirect negative impact on the environment. This impact has traditionally been ignored in the costs of production, which in economics is referred to as externality. Over time, however, technology enables a better measurement, control and understanding of these externalities, while policy initiatives attempt to “internalise” these costs through indirect taxation. Such indirect taxation can be a source of significant inflation.

Under normal circumstances, increasing business activity in the economy results in increases in employment level until maximum employment is achieved, beyond which firms begin to drive wages higher that in turn result in greater income and demand for goods and services. Since in the short-term the production capacity of the economy is physically constrained, the prices of goods and services begin to increase.

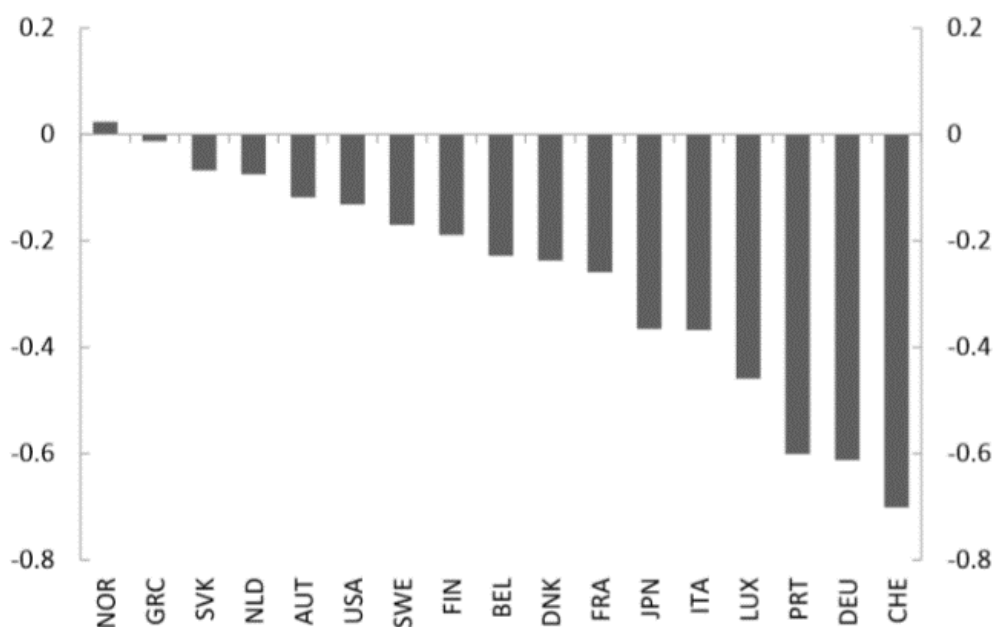
Two structurally potent trends upset this traditional understanding of demand-driven inflation:

1. emergence of global value chains in the late 1990s and through the 2000s blurred the national production capacity limits,
2. extreme differences in productivity growth rates in industries that are susceptible to automation and other industries caused migration of number of employees to low-paid low-productive low-knowledge industries, where they have no or limited bargaining power.

Both trends have the same effect: companies are able to sustain higher production growth while hiring fewer employees and paying them less.

The effect of global value chains is intuitive: instead of pushing domestic wages higher, companies actively outsource or relocate to countries with slack or cheap labour. As a result, companies are able to increase output without pushing domestic wages higher, which also translates into higher margins. With stable domestic wages, there is little pressure on inflation. The effect of global supply chains on inflation (in this case producer price inflation) is estimated at between 0 and -0.7% annually (Figure 5)

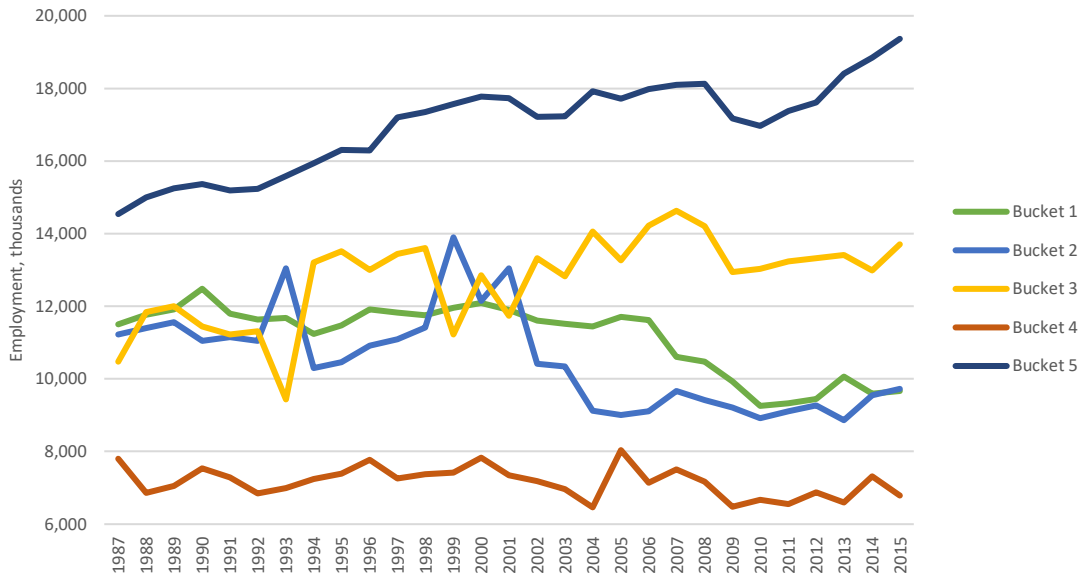
Figure 5: Impact on inflation in 2014 due to global slack and the expansion of Global Value Chains (GVCs) since 1996, Source: (Dan Andrews, 2018). Note: The figure shows the annual change in producer price inflation in 2014 that is explained by the change in the level of GVCs since 1996 and the interaction of GVCs with the foreign and domestic output gaps.



Increasing gaps between productivity improvements in various industries has resulted in uneven distribution of labour over time. To put it simply, improvements in productivity of most

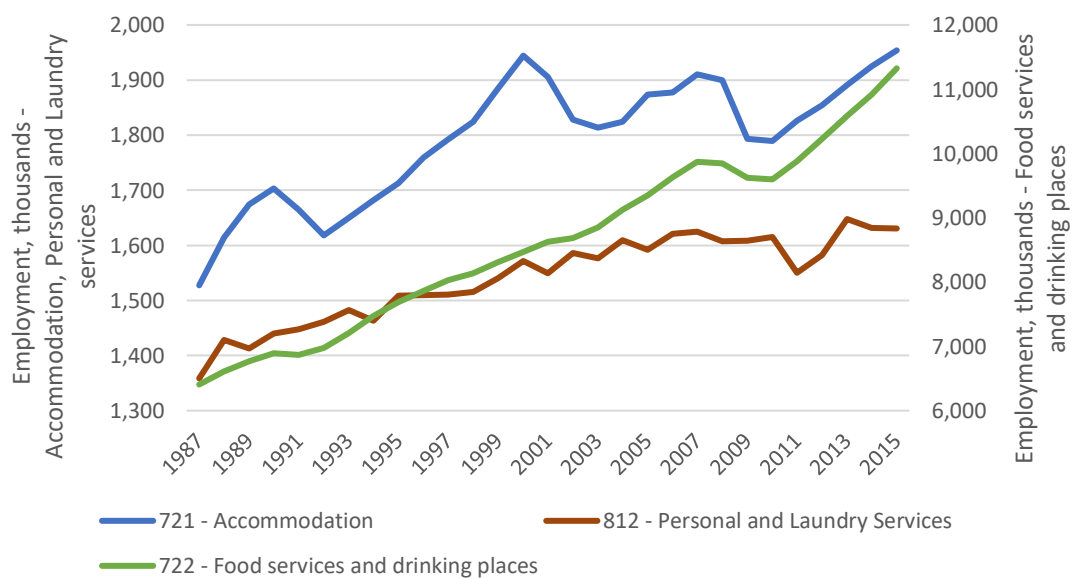
productive industries have been high enough to limit employment requirements. Employees that were left out of these industries partly migrated to industries with lower productivity and pay and partly remained permanently out of the labour pool (Figure 6). This phenomenon explains also why the *average* productivity has not risen over the last decades.

Figure 6: Number of people employed by year in five buckets of industries ranked by labour productivity, Source: LINKS analytics research, BLS data. Bucket 1 includes the most productive industries, Bucket 5 includes the least productive industries.



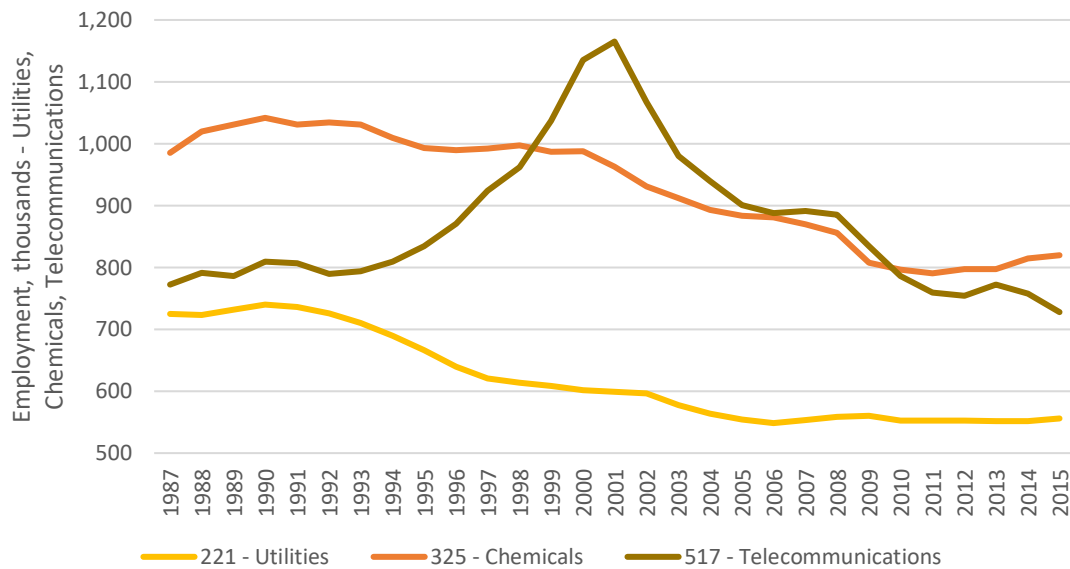
The list of least productive industries includes accommodation (hotels), personal and laundry services and food services (restaurants). The restaurants alone have nearly doubled their workforce since 1987 (Figure 7)

Figure 7: Number of people employed by industry, low productivity industries, Source: BLS, LINKS calculations



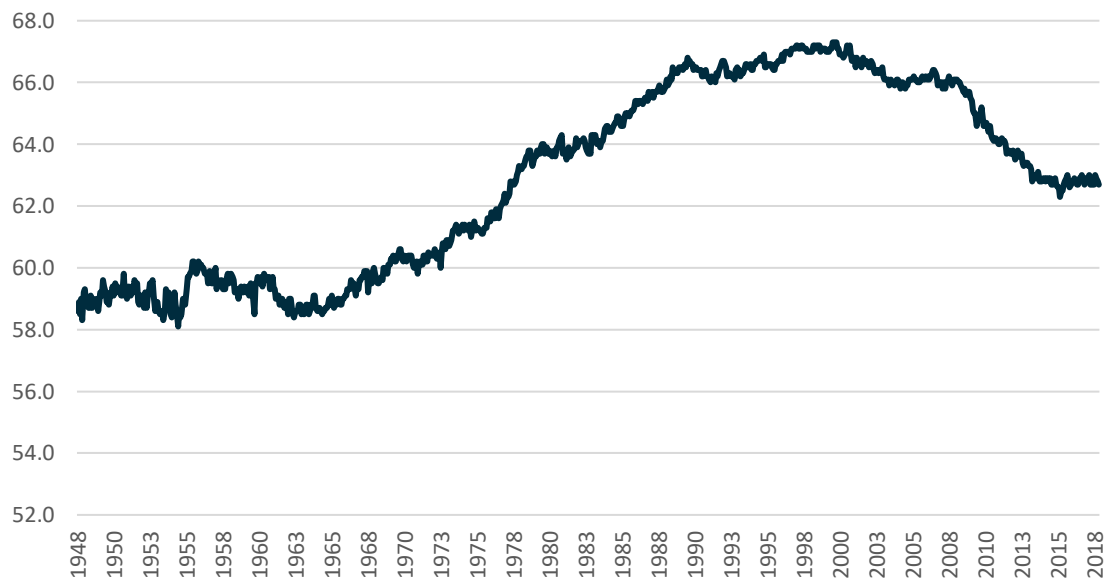
In contrast, most productive industries: utilities, telecommunications and chemicals have seen their number of people employed shrink since 1987 (Figure 8)

Figure 8: Number of people employed by industry, high productivity industries, Source: BLS, LINKS calculations



It is likely that the combined effect of globalization and productivity-driven labour redundancy has temporarily limited the bargaining power of employees and domestic wage growth. Lower labour participation rate (Figure 9) is also related to the two factors, as not all employees that were made redundant find suitable employment elsewhere in the economy.

Figure 9: Labour participation rate, Source: FRED

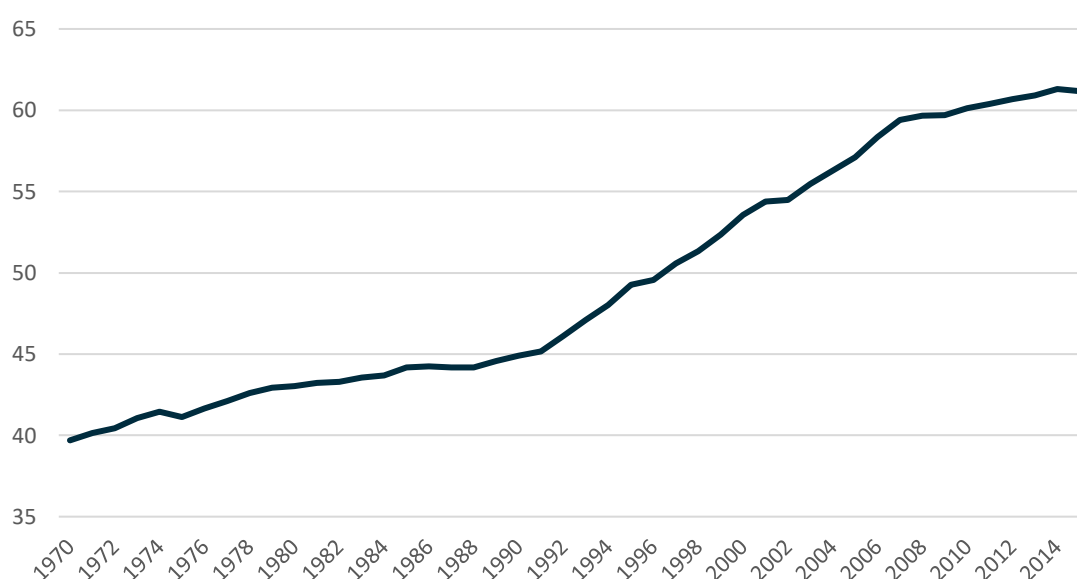


## Is This Process Nearly Over?

Although it is plausible that the two effects have limited the inflationary pressure, the question is whether these structural trends have room to continue going forward. To some extent the question touches on subject area beyond economics and into the global geo-politics.

While the effects of globalization and automation were arguable and disputed a decade ago, the mainstream political life has caught on to the harmful effects on the distribution of incomes and wages. To an extent we have seen a backlash as far as globalization is concerned: BREXIT, US trade war, nationalist and protectionist tendencies elsewhere are arguably a reaction to the changing bargaining power of domestic (US and European) labour. To some extent, the process of further globalisation has slowed or halted, as evidenced by the KOF globalization index (Gygli, Haelg, & Sturm, 2018). Although the headline index still shows some upward movement (Figure 10), some of the constituents, such as cross-border financial asset holdings have peaked and reversed.

Figure 10: KOF globalisation index, Source: ETH Zurich



It is not hard to imagine that with worsening trade war rhetoric globally, increasing trade barriers as well as increasing wages in the low-cost countries combined with subdued wage growth in the US and Europe will eventually (have already to some extent) trigger a reversal. Such a reversal will inevitably have an inflationary effect that is similar in size but opposite in direction of the effects in Figure 5. The magnitude of the effect on inflation is likely to be no more than +70 basis points.



## Automation Has Only Started

The effects of automation, on the other hand, are far from being fully absorbed by the economy. An often quoted work by Osborne and Frey of the University of Oxford (Osborne, 2013) focuses on advances in the fields of machine learning, data mining, computational statistics and particularly artificial intelligence. Drawing from advice from a set of in-house experts, the researchers estimate the probability of automation for each of nearly 800 occupations. Their conclusions are stark: approximately 47% of occupations in the US are highly susceptible to automation. It is important to note that although there is a lot of discussion of lost jobs in the manufacturing industry, the conclusions of Osborne and Frey largely relate to the services sector – the next big “shredder of jobs”.

Since the publication of the Osborne and Frey study, there has been significant follow up research. One of the more critical research pieces published by OECD (Melanie Arntz, 2016) cites several reasons for a lot more subdued impact of automation than suggested by Osborne and Frey:

- i. automation impacts specific tasks and not whole occupations; if an occupation has even a single task that cannot be automated, the whole occupation is unlikely to be replaced
- ii. there are cultural and ethical hurdles to full automation
- iii. costs of automation were not part of Osborne and Frey study.

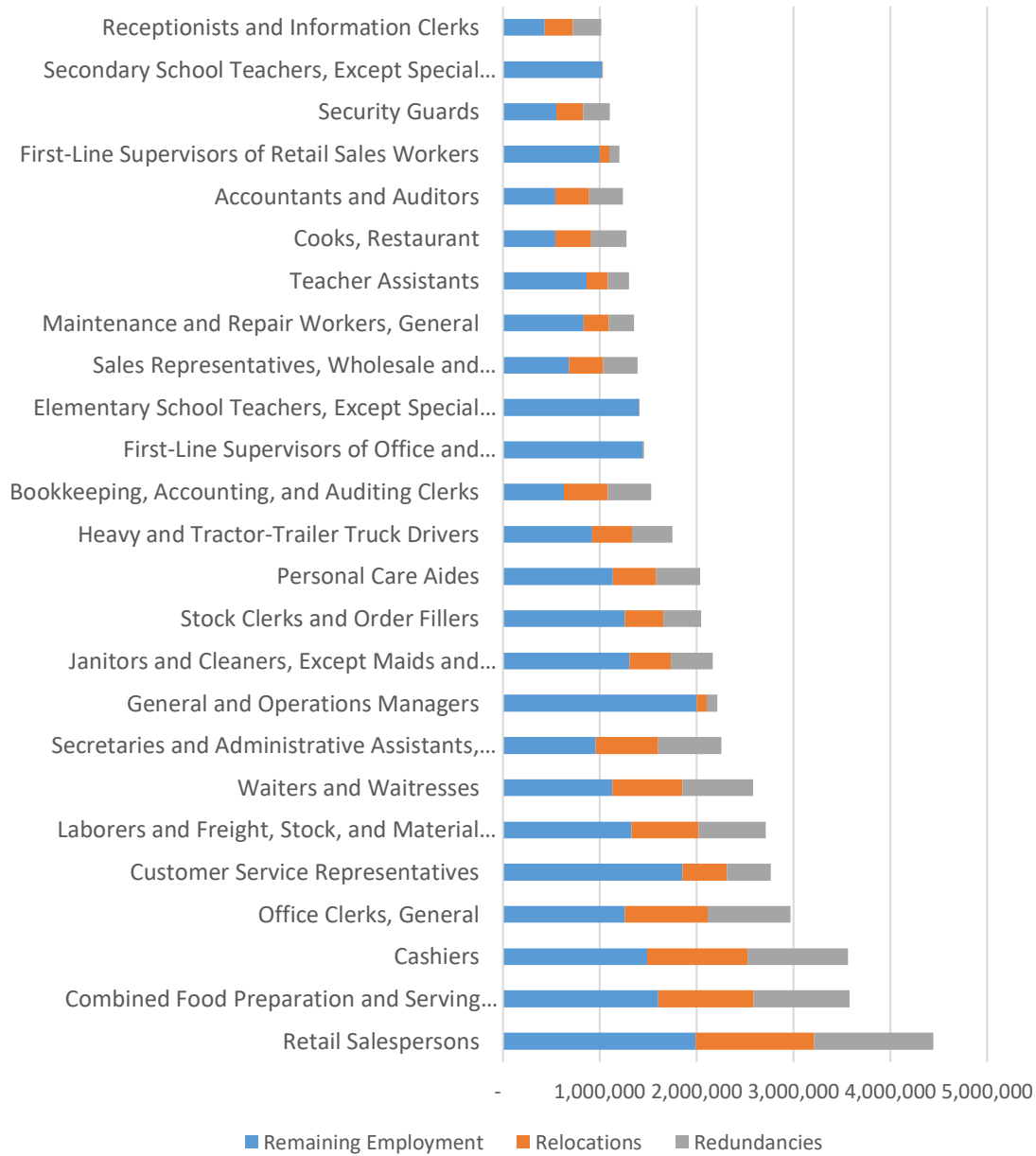
While admitting that all of the reasons above are valid, we believe they are also very temporary. Even if some tasks are not possible to automate, automation of most tasks will result in fewer individuals employed carrying out different types of tasks. Costs of automation in most industries eventually fall rapidly, while ethical and cultural issues do get resolved over time. It should be noted that according to the conservative estimates of OECD, 9% of jobs in the US are susceptible to automation, which is still a significant number.

## Estimating the Impact of Automation on Inflation

The most significant effect of automation is the impact on wages and the total number of people employed. We have used the Osborne and Frey study estimates of automation probability by occupation and made an additional assumption that 40% of employees that were made redundant would find jobs in other occupations with comparable pay, 30% will have to fall back to low-skilled low-paid jobs and another 30% will be permanently out of the labour pool.

These assumptions result in a -15% decline in wage income over the period in which automation occurs, or ~1.5% per year assuming a decade-long process. The corresponding headwind for inflation is -1.2% annually. Automation wave that is happening currently and into the future affects the occupations with largest number of people employed (Figure 11).

Figure 11: Impact of automation on largest occupations by people employed, Source: LINKS calculations, (Osborne, 2013) data



## Ageing – a New Structural Trend

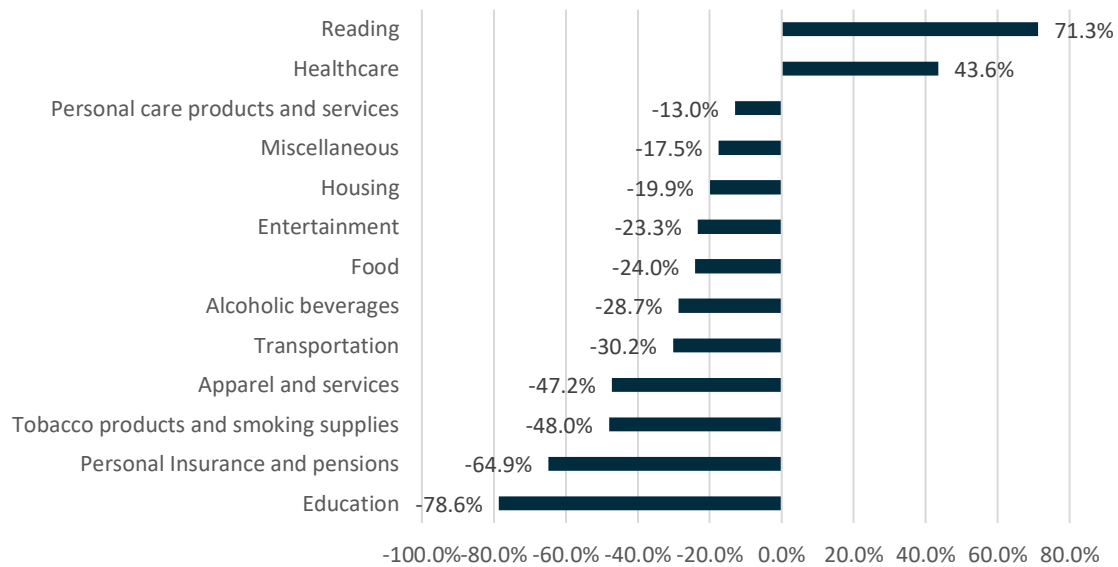
Rapidly ageing population is another major structural issue affecting long-term inflation. First, upon retirement not surprising both earned income and actual expenditures fall. Although spending falls less than income, the overall ~20% fall is still significant to make a difference (Figure 12).

Figure 12: Per capita spending by age group, US, Source: US BLS

	Age of householder						
	Under 25 years	25 to 34 years	35 to 44 years	45 to 54 years	55 to 64 years	65 to 74 years	75 years and over
Income after taxes	12761	20443	22697	27664	32184	24288	19545
Difference income and expenditures	-1299	3838	5333	6697	7201	1679	-253
Average annual expenditures (dollars)	14060	16605	17364	20967	24982	22609	19798
Food	2090	2203	2352	2659	3001	2927	2618
Food away from home	866	961	1004	1108	1250	1049	836
Housing	4868	6164	6274	6787	8091	7612	7382
Apparel and services	698	668	711	673	758	696	496
Transportation	2667	2740	2535	3360	3963	3702	2269
Health care	338	645	764	1133	1855	2582	2987
Entertainment	617	894	1005	1134	1384	1315	992
Personal care products and services	180	198	208	238	294	316	285
Reading	21	25	26	43	70	81	84
Education	955	289	283	734	478	95	88

Secondly, the structure of spending changes away from regular consumer goods towards health care (at least in the US - Figure 13). Since the weight of baskets of products in CPI change very slowly, this shift is likely to become a structural limit to the prices over time.

Figure 13: Spending by product after retirement, Source: US BLS



In order to estimate the impact of ageing on inflation, we base the proportion of working age population on the UN forecast: the proportion of working age population in developed countries will be down from 48.1% in 2015 to 43% in 2035. This means net retirement of 0.25% annually, or change in income and spending of ~ 0.2% , translating into -0.3% annual decline in the rate of change in CPI.

## Cost-Push Shocks

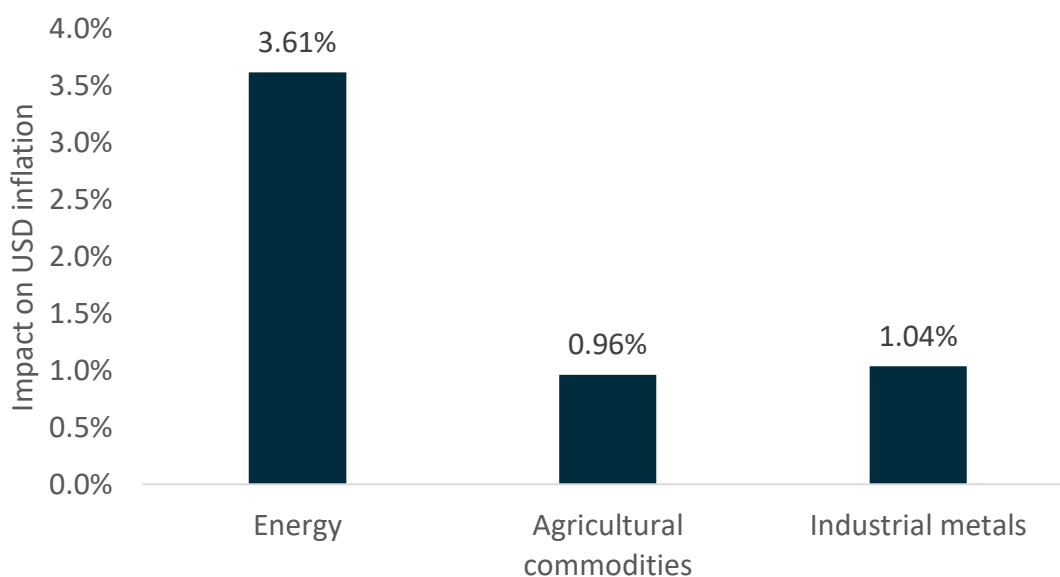
Up to this point it is clear then that there are very few real sources of structural inflation in the economy due to the accelerating automation and ageing population. This however does not mean that there will not be any significant unexpected inflationary episodes. Such rapid increases in the price level, just as in the past hundred years, are likely to be caused by sudden interruptions of global supply chains. Shortage in key commodities, such as oil, metals or agricultural commodities is likely to cause a temporary but severe increase in general price levels.

Such a scenario is more damaging than the demand-driven inflation, since it may occur with equal probability in both full-employment and subdued economic environments. A combination of low labour participation rate, stagnant incomes and rapidly increasing price levels can also have dangerous long-term effects.

We use LINKS Mira ABM to assess the impact of an arbitrary 75% price increase in major commodity prices. Such an increase is not too far from historic precedents, particularly the first and second oil crises in 1970s and 80s. Today, just as then, there is open multilateral warfare in the region that produces a significant proportion of global oil supply. Oil is still 31% of Total Produced Energy Globally. Too much to realistically expect that oil will be replaced by renewable energy in the next decades.

Energy is still the most strategically important commodity globally, with about 3.6% immediate inflation impact (Figure 14). Although this would bring the total level of inflation to ~5.5% at least in the US, this is still half the level seen in 1970s and 1980s.

Figure 14: Impact of a 75% price increase due to disruption in global supplies by commodity, Source: LINKS Mira ABM estimates



The question remains whether the impact of such a shock is temporary. If the resulting inflation remains high over the following years, there is clearly need for considering a hedge. However,

previous episodes of rapid increase in prices of commodities have resulted in two reactions: shrinking business activity, and rapid substitution and technological change. Both effects limited the long-term impact of supply shock inflation.

## Externality-related Inflation

Up to this point we have covered the “known knowns” of inflation, i.e. the sources of price level increase that are traditionally at play. The traditional demand-driven inflation is hampered by long-term headwinds of ageing population and extreme automation. Cost-push inflation, on the other hand, may be significant at least as far as energy costs are concerned, however, by definition, it will be temporary in nature.

The assessment of long-term inflation, however, would be incomplete without considering the “known unknowns” of externality-related inflation – the likelihood of increasing price levels due to the social and government pressure to address the costs of environmental issues of development by indirect taxation. Many of the listed environmental issues either have already or are likely to trigger new indirect taxation:

- i. Worsening air quality due to fine particles (droplets in the air carrying heavy metals that are smaller in width than 2.5 micron) already leads to 7 million pre-mature deaths globally according to the World Health Organisation (WHO). Many countries have already imposed taxes on factories and road vehicles emitting these particles.
- ii. CO2 and global warming: the global production of CO2 is 10 bn tons where the natural absorption capacity of the earth is 5 bn tons. CO2 emissions are already priced and can be traded, though the scale will likely grow.
- iii. Water aquifers (underground water reserves) will soon (matter of decades) be depleted in India, China, Pakistan, southern Europe, western United States. As 40% of the world food production relies on irrigation with groundwater, it is plausible to expect policy action to address unsustainable ground water use.
- iv. Contamination of the oceans with plastic is a rising issue with continued calls for replacement of plastic packaging with alternatives that are considerably more expensive. Biodegradable plastics are not necessarily a solution, since they do not degrade sufficiently quickly in an ocean environment. The move in many countries to introduce additional taxes, minimum price or a combination for plastic packaging, straws, bags and cups is likely to add to inflation.
- v. The automotive industry already faces significant indirect taxation of internal combustion engines in Europe. Over time the question of recycling of lithium ion batteries is likely to add to the price level.

The common feature of all of the factors in this incomplete list is the unknown probability, timing and size of impact on inflation. But it is difficult to ignore these forces either, since they may turn out to have a significant impact on inflation. The inherent uncertainty of impact means that actively hedging against these sources of inflation cannot be effective<sup>1</sup>. Taking these factors into account when building the asset mix is another matter: many asset classes have an inverse

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<sup>1</sup> Active hedging implies an ability to measure the potential impact, timing, calculate hedge ratios etc. Uncertain nature of these forces means that it is impossible to build an effective hedging programme.

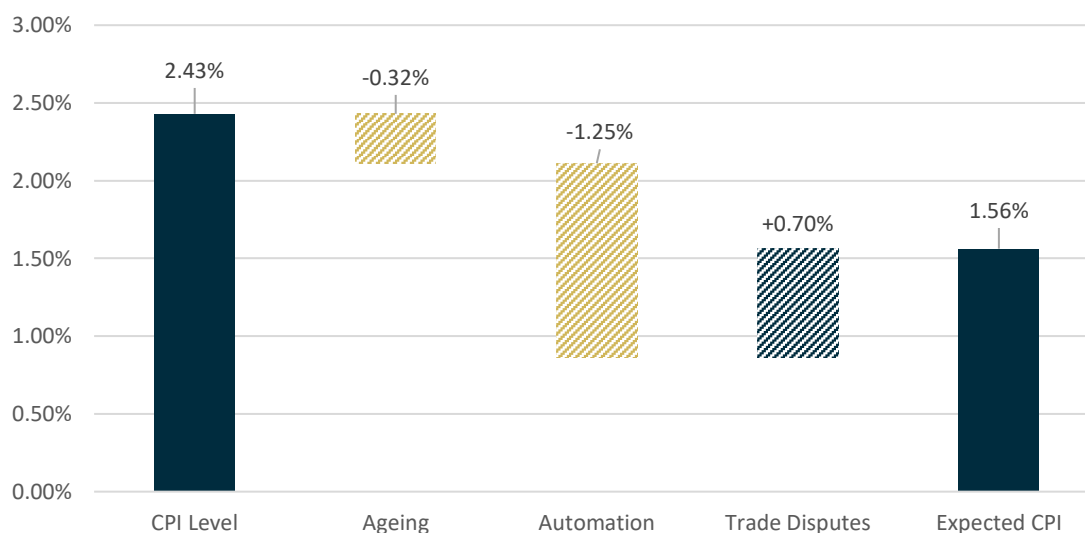
relationship with the sources of inflation risk. Including these assets in the asset mix will provide a “free” hedge as well as income.

## Conclusion

Continuously low interest rates in the face of very low unemployment rate justifiably raise inflationary concerns. Protecting institutional portfolios against inflation does not come cheap – sensible hedge against inflation comes with increasing volatility and adds to the risk of the portfolio. It is therefore worthwhile to consider whether at least in the typical “core” scenarios of pension funds, inflationary concerns are truly justified.

The persistent low-trending levels of inflation in the past two decades are likely to be the effect of the emergence of global value chains and automation. Although there is significant political push-back against globalisation that can in theory reverse its effect on inflation, i.e. cause domestic price increases, our estimates suggest that the disinflationary effects of automation and ageing population in the coming years more than make up for the difference. In fact, if anything, the combined effect of long-term structural trends point at ~ 90 bp lower demand-driven inflation going forward (Figure 15). An active inflation hedging program for demand-driven inflation is therefore likely to cost more than its potential benefit.

Figure 15: Impact of long-term structural trends on inflation in the US, Source: LINKS estimates



However, the effects of cost-push and externality-driven inflation can be large. Although it is possible to assess the magnitude of cost-push inflation depending on the source, the timing of such an event is still unknown. Both timing and magnitude of externality-driven forces impacting inflation are uncertain. Such an inflation risk can be addressed by holding assets that have “natural” hedging features, such as energy-related assets, agricultural trading and commodity exposure. We have used our Agent Based Model MIRA to go one level deeper and ‘translated’ these known resource-related price shocks in order to assess which industries would suffer and profit the most. That generates a clearer picture of how to diversify in case one intends to protect the portfolio against adverse supply-side driven inflation shocks.

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