HONG KONG MONETARY AUTHORITY

Research Memorandum 10/2019

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WHAT EXPLAINS THE LOW INFLATION IN THE US? A REVIEW OF RECENT LITERATURE

Key points

- *This paper synthesises selected findings from five strands of research that may jointly account for the subdued inflation in the US after the Global Financial Crisis: (1) under-estimated labour market slack constraining cost-push inflation pressures, (2) demographic and socio-economic factors dampening wage growth, (3) labour productivity growth putting a lid on unit labour costs, (4) increased market contestability capping firms' ability to raise prices and (5) better anchoring of inflation expectations leading the public to expect low inflation.*

- *These areas of research have identified cyclical and structural factors that may have attenuated the response of inflation to tightening labour market conditions. While some of the cyclical factors can be expected to dissipate — and thereby providing uplift to inflation — going forward, it remains to be seen whether such boost is sufficient in offsetting the disinflationary effect of more structural changes in the US labour and product markets.*

- *The flattening of the Phillips curve, if persistent, carries two policy implications. On one hand, it provides more leeway for the Fed to run a "high pressure economy" to reverse the labour market hysteresis caused by the Global Financial Crisis. On the other hand, it could imply greater difficulty for the Fed to attain its 2% inflation target, and that the Fed would find itself having to trade-off between achieving its 2% inflation target and accumulating financial imbalances in the process of doing so.*

- *That being said, inflation momentum appears to be strengthening somewhat more recently. Aggressive monetary easing might point to the risks of a stronger-than-expected pick-up in the cyclical component of inflation, due to possible nonlinearities of the Phillips curve.*

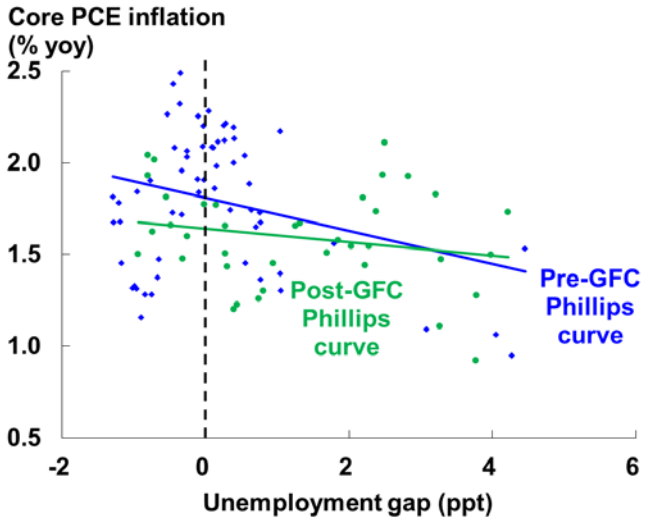
Prepared by: *Eric Tsang*
Economic Research Division, Research Department
Hong Kong Monetary Authority

I. INTRODUCTION

Since the Global Financial Crisis (GFC), inflation in the US has remained muted despite substantial improvement in labour market conditions — in Q2 2019, the headline unemployment rate fell to a half-century low of 3.6%, but the year-on-year increase in core personal consumption expenditure (PCE) inflation decelerated to just 1.5%. The reduced responsiveness of inflation to tightening labour market conditions has popularised the notions of "missing inflation" and "flattening Phillips curve".

To illustrate this idea, consider a scatterplot of core PCE inflation versus unemployment gap, with blue and green dots pertaining to observations before and after GFC respectively (Chart 1). For each sample period, a Phillips curve is constructed as the best-fit line of the pertinent dots. It is evident that the post-GFC Phillips curve (green) is flatter than the pre-GFC one (blue); meaning that, for the same decrease in unemployment gap, the associated rise in core PCE inflation is smaller after the GFC.

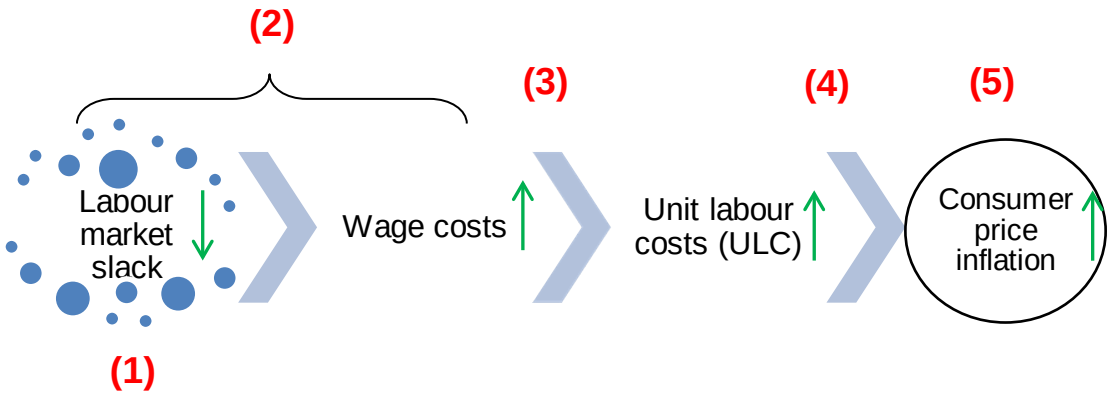
Chart 1: Pre- and post-GFC US Phillips curves



Note: Quarterly data between Q1 1995 and Q2 2019 are shown, with observations up to Q4 2009 being designated as belonging to the "pre-GFC" period. Unemployment gap is defined as the difference between the headline unemployment rate and the non-accelerating inflation rate of unemployment (NAIRU) estimated by the Congressional Budget Office (CBO). A positive (negative) unemployment gap means that the labour market is operating below (above) potential.
Sources: CBO, CEIC and HKMA staff calculations.

Researchers have conjectured many explanations to account for the observed flattening of the US Phillips curve (see, for example, Kiley (2015) for a summary of recent works). However, organising these diverse findings into a coherent train of thought is not straightforward. This Research Memorandum fills this gap by fitting the relevant findings along a simple transmission channel from labour market slack to consumer price inflation, which can be visualised as follows.

Typical transmission channel from lower labour market slack to higher consumer inflation



II. CYCLICAL AND STRUCTURAL FACTORS HAVE IMPAIRED THIS TRANSMISSION CHANNEL

Before discussing the various research findings that may explain the flattening of US Phillips curve, a brief explanation of how labour market slack is *supposed* to affect consumer price inflation through the above transmission channel is in order:

- A decrease in labour market slack **(1)** puts upward pressure on wages **(2)**.[1]

[1] It is not necessarily the case if labour supply is highly elastic, e.g. in the early phase of a recovery, idle workers are plentiful and firms can increase hiring without paying higher wages. However, this does not seem to be the case in the US, as anecdotal evidence has suggested rising labour shortages in several sectors in recent years.

- If labour productivity growth is insufficient to compensate for higher wages, unit labour costs (i.e. productivity-adjusted wages) will increase **(3)**, driving up the production costs faced by firms.

- Depending on their pricing power, firms may choose to pass on some, or even all, of the cost increases to consumers by raising their products' prices **(4)**, which in turn leads to higher actual and expected consumer price inflation **(5)**.

With this conceptual framework in mind, the observed flattening of the US Phillips curve can be understood as the combined effects of a number of impairments along the transmission mechanism. In the following sub-sections, these points of failure will be explained in terms of findings from five areas of research, namely, (1) under-estimation of labour market slack, (2) dampening factors on wage growth, (3) wedge between labour productivity and wage growth, (4) increased market competition and (5) improved anchoring of inflation expectations.

(1) Labour market slack may have been under-estimated

Cyclical factors

➢ *Underemployment may have been under-estimated*

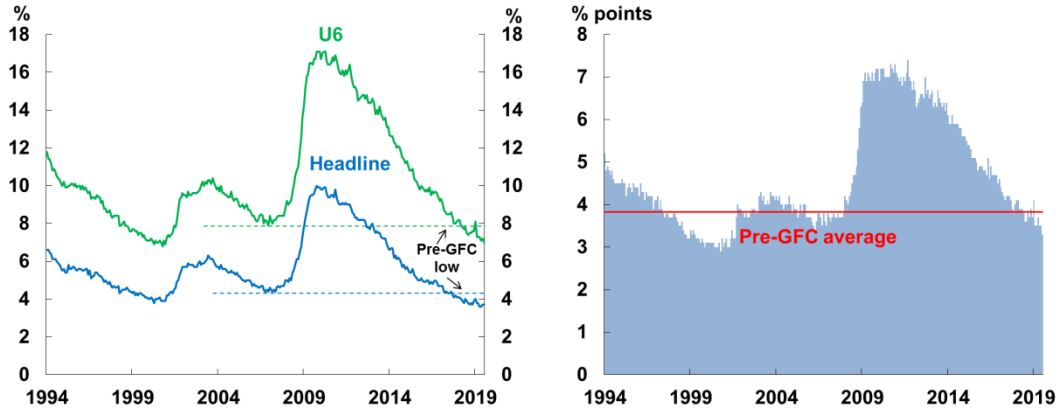
As mentioned in the Introduction, the headline unemployment rate dropped to a 50-year low of 3.6% in Q2 2019. However, this measure only takes into account workers in the labour force and is not a very comprehensive measure of *potential* labour market slack. A broader indicator, known as the "U6" unemployment rate, also counts "marginally attached" workers and people working part-time for economic reasons (PTER). [2] While the U6 and headline unemployment rates have already dropped below their respective pre-GFC lows

[2] People marginally attached to the labour force are defined as those who currently are neither working nor looking for work, but indicate that they want and are available for a job and have looked for work sometime in the past 12 months. People employed part-time for economic reasons refer to those who want and are available for full-time work, but have had to settle for a part-time schedule.

(Chart 2a), the gap between the two (Chart 2b) has just returned to pre-GFC average and is still above the historical low (3.3 percentage points in July 2019 vs. 2.9 percentage points in October 2000), suggesting that there may still be some way to go before the labour market slack is meaningfully depleted.

Chart 2: Headline and U6 unemployment rates in the US

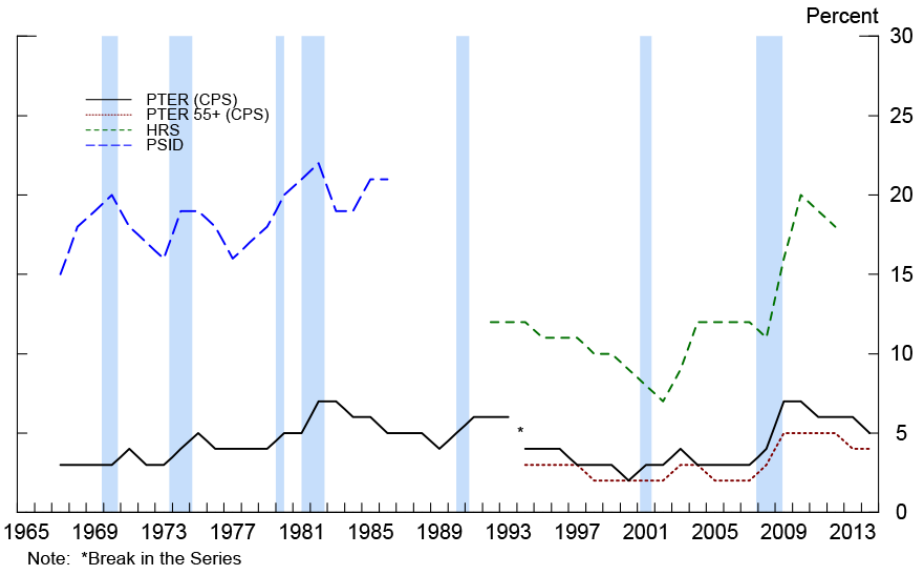
(a) In levels (b) Gap between the two



Note: U6 unemployment rate data were only available from January 1994 onwards.
Source: CEIC.

Moreover, research finds that conventional PTER statistics embodied in the U6 unemployment rate (Chart 2(a)), which is based on data collected from the Current Population Survey (CPS), tends to under-estimate the extent of underemployment. By making use of data from the Panel Study of Income Dynamics (PSID) and the Health and Retirement Survey (HRS), Li et al. (2016) constructed a survey-based indicator of work-hour constraints (dotted blue and green lines, Chart 3), which showed a much higher share of workers who were unable to work as many hours as they wanted than revealed by CPS-based PTER statistics (solid black and dotted red lines, Chart 3). Such findings are important because higher involuntary part-time employment is associated with slower wage growth (Hong et al., 2018).

Chart 3: CPS-based PTER and share of workers willing, but unable, to work more hours in PSID and HRS



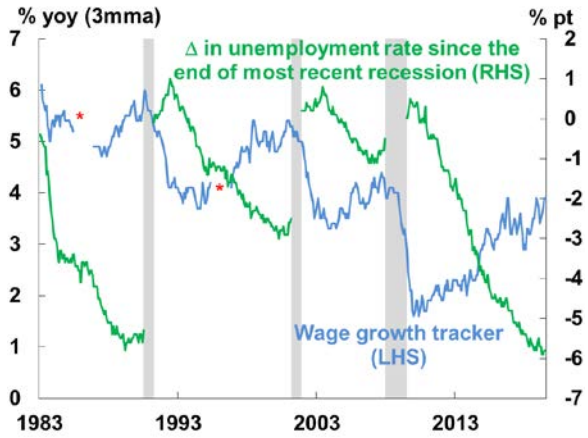
Source: Li et al. (2016).

Structural factors

- *Population ageing may have disrupted the historical wage Phillips curve relationship by introducing downward bias to the unemployment rate*

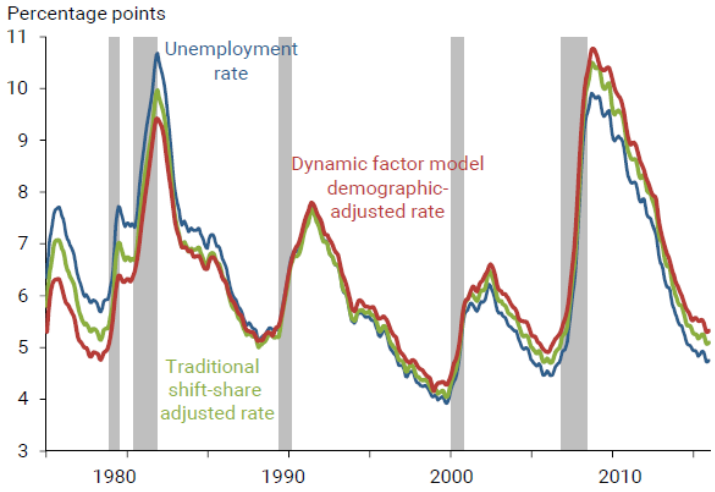
Historical experience suggests that, given the very substantial drop in unemployment rate during the current recovery, wage growth should have been much stronger than what transpired after the GFC (Chart 4). However, it is recognised that unemployment rates are not comparable across time if the composition of the labour force is not constant. Barnichon et al. (2017) argued that an ageing population, such as the one in the US, tends to introduce downward bias to the headline unemployment rate over time because the share of young workers (who typically have an above-average unemployment rate) in the labour force is shrinking. The researchers constructed an alternative measure of unemployment rate that removed such downward bias (red line in Chart 5). As at February 2017 (latest data prior to publication of their paper), their preferred measure of unemployment rate was as much as 0.5 percentage points above the headline unemployment rate (blue line in Chart 5), which could partly explain the modest observed wage pressure in recent years.

Chart 4: Wage growth and changes in unemployment rate during the three most recent recoveries



Notes: (*) Breaks in time series. Shaded areas denote NBER recessions.
Sources: Atlanta Fed, CEIC and HKMA staff calculations.

Chart 5: US unemployment rate adjusted for demographic changes



Source: Barnichon et al. (2017).

➢ *Hidden labour market slack: Self-employed people in the "gig" economy*

Based on data from the New York Fed's Survey of Informal Work Participation, Bracha et al. (2018) found that informal "gig" work embodied a significant amount of labour market slack not captured by traditional unemployment rates, estimated to be equivalent to between 2.2% and 5.7% of the labour force. Among the surveyed "gig" workers, most reported that, for some increase in pay, they would be willing to drop hours of informal work in exchange

for added hours of formal work. Such findings reveal a sizeable potential supply of labour.

- *Globalisation renders domestic labour supply constraints less binding*

In a widely cited paper, Borio et al. (2007) showed that global, rather than domestic, economic slack was increasingly more relevant to the determination of domestic inflation across a panel of advanced economies, because the trends of globalisation and outsourcing imply that part of the domestic labour markets are opened up to foreign competition. As such, domestic wages, and their relationship to domestic prices, would also depend on supply conditions in the rest of the world.[3] As a case in point, US companies are increasingly tapping into the low-wage workforce in popular outsourcing destinations — employment by majority-owned foreign affiliates of US multinational enterprises in Mexico, China and India increased sharply from 2009 to 2017, by 44%, 84% and 149% respectively.[4]

Assessment: Both cyclical and structural factors suggest that the availability of labour market slack is likely to be larger than indicated by headline unemployment rates, so it is possible for the labour market to tighten further without triggering inflationary pressures in the near term. That being said, it remains to be seen whether the increasingly inward-looking US trade policy, as well as rising wages in popular outsourcing destinations, would undo the disinflationary impact of globalisation as observed by Borio et al. (2007) going forward.

(2) The tightening in the labour market has not translated into wage pressure

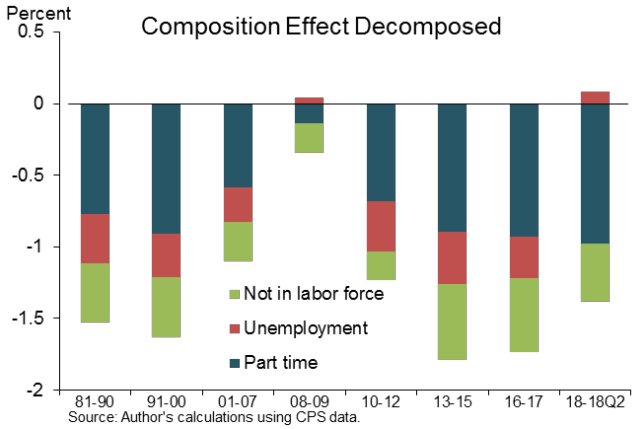
Cyclical factors

- *Entry of low-paid workers and exit of high-paid baby boomers have likely weighed on wage growth*

[3] More specifically, they estimated an extended version of the Phillips curve for the US economy, and found that the global output gap had a weighting as large as +0.61, compared with a (statistically insignificant) weighting of -0.13 for the domestic output gap.
[4] Source: "Activities of U.S. Multinational Enterprises", Bureau of Economic Analysis.

Studies find that changes in labour force composition can affect wage growth. Daly et al. (2016) found that, after the GFC, aggregate wage growth was more constrained by the transition of new and part-time workers to full-time employment (who were more likely to accept below-average wages) and the retirement of baby boomers (who were likely to be high-wage earners). Chart 6 shows that, in the post-GFC years, the transition of low-paid part-time workers into full-time jobs (deep green bars), as well as the flow of baby boomers from full employment to retirement (light green bars), gave rise to sizeable drags on wage growth.[5]

Chart 6: Drag on median wage growth from entry to, and exit from, full-time employment



Source: "Revisiting wage growth", San Francisco Fed Blog, published 16 August 2018.

Structural factors

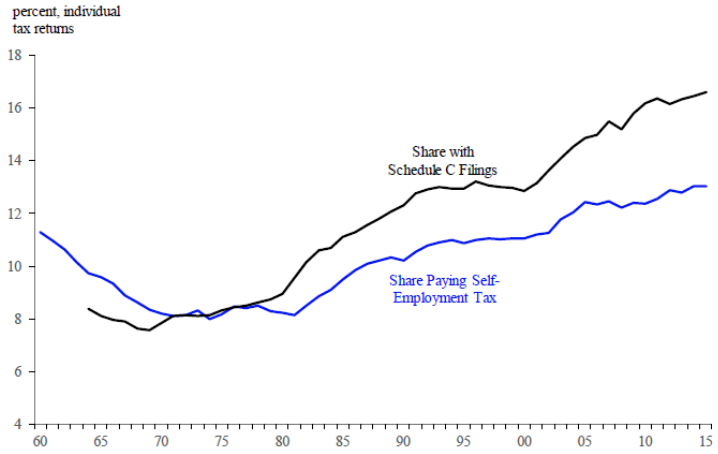
- *Rise of the "gig" economy, falling unionisation and increasing automation may have reduced workers' bargaining power*

Duca (2018) reasoned that the trend of rising self-employment since the 1980s (Chart 7) could have reduced the natural rate of unemployment (i.e. NAIRU). This is because greater use of just-in-time labour (e.g. gig employment) can render the labour market more contestable and erode workers' wage bargaining

[5] The red bars in Chart 4, which refer to the contribution to median wage growth due to labour flows between unemployment and full-time employment, showed a positive contribution the H1 2018, conceivably due to more low-paid workers quitting their jobs in search of better-paid employment. This is consistent with a notable 0.3 percentage point jump in quits rate between January and June 2018.

power. From a different perspective, Dunn et al. (2016) documented a steady decline in union membership rate among private industries since the 1980s, which arguably may have eroded union members' wage bargaining power, with a side-effect of constraining the wage growth of non-union workers as well. Separately, Leduc et al. (2019) found that the increasingly widespread use of labour-replacing automation have likely enhanced firms' wage-setting power and depressed wage growth since the GFC.

Chart 7: Measures of self-employment share in US total employment



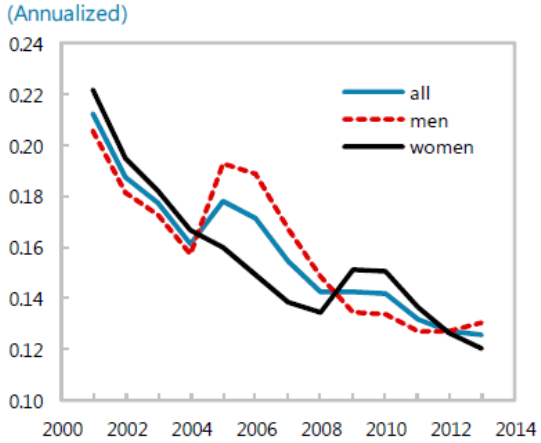
Source: Duca (2018).

➢ *Disappearance of middle-level jobs may have impeded income mobility*

Research (e.g. Chetty et al. (2017)) finds that the ladder of upward mobility (i.e. children earning more money than their parents) has stalled in the US over the past few decades, as middle-skill job opportunities disappeared (Cortes (2016)). Against this background, it has become increasingly difficult for low-skilled workers to move up the job ladder.[6] Consequently, it is found that job-to-job transitions among low-skilled workers, which are usually associated with higher wage growth, have slowed considerably since mid-2000s, and fell further after the GFC (Chart 8) (Danninger, 2016).

[6] Using data between 2011 and 2017 and focusing on short-term labour market transitions, Gabe et al. (2018) found that around 70% of low-wage workers stayed in the same job, and only slightly more than 5% of low-wage workers found a better-paid job within a 12-month period.

Chart 8: Job-to-job transition rates in the US

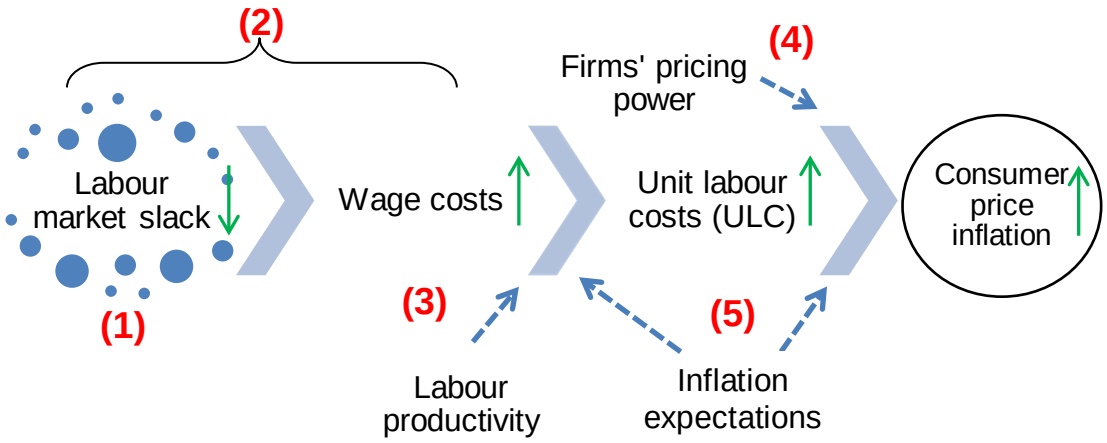


Source: Danninger (2016).

Assessment: While the drag on wage growth by the entry of low-wage earners into full-time employment is unlikely to persist, that caused by retiring baby boomers may be here to stay as the US population continues to grow older. Moreover, the rise of the "gig" economy, the declining influence of labour unions, the increasing use of automation and the polarisation of job markets are unlikely to reverse in the near future, and will likely continue to pose headwinds to wage growth.

Having discussed a number of cyclical and structural factors affecting the measurement of labour market slack **(1)** and the pass-through of slack to wage costs **(2)**, the next three sub-sections will elaborate on points of failure further down the transmission channel, namely, the roles of labour productivity **(3)**, firms' pricing power **(4)** and inflation expectations **(5)**.

Transmission channel from labour market slack to inflation (extended version)



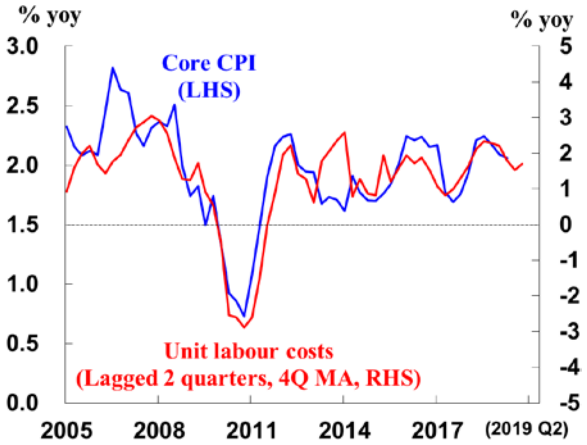
(3) Cyclically higher labour productivity has constrained unit labour costs (ULC)

Cyclical factors

- *Cyclical pick-up in labour productivity dampened ULC as firms improved efficiency*

Economic theory suggests that inflation should depend more on *labour costs per unit of output*, rather than just overall wage payment. As long as firms' pricing power or "mark-up" does not change, all else equal, inflation should be roughly be equal to wage growth minus productivity growth. Therefore, the growth rate of ULC, which measures wage increases adjusted for productivity growth, leads core CPI inflation (Chart 9). Since 2017, the US economy experienced a cyclical pickup in labour productivity, conceivably as firms tried to mitigate increasing labour shortages by improving production efficiency. This, in turn, helped contain the rise in ULC and hence the broader inflationary pressure in recent quarters.

Chart 9: ULC and core CPI inflation

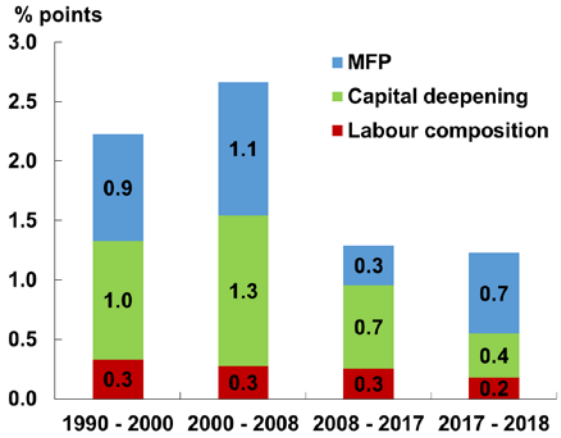


Sources: CEIC and HKMA staff calculations.

Nonetheless, it appears unlikely that the recent labour-shortage-driven productivity improvement alone can help the US economy buck the trend of falling global productivity in the post-GFC era, which are caused by headwinds that are more structural in nature.[7] Indeed, decomposing the sources of productivity growth would reveal that the contribution from capital deepening actually declined in recent years (green bars, Chart 10), meaning that capital investment has not kept up in pace, thereby casting doubt into the sustainability of the recent productivity pick-up.

[7] Adler et al. (2017) argued that a number of structural headwinds, such as reduced private-sector R&D expenditure in the presence of credit constraints, slowdown in business dynamism in technological sectors and population ageing may have weighed on post-GFC productivity growth.

Chart 10: Contributions to annual productivity growth (private non-farm sector)



Note: Multifactor productivity (MFP) is calculated by dividing an index of real output by an index of combined units of labor input and capital services, and is a proxy of technological advancements.

Sources: Bureau of Labour Statistics and HKMA staff calculations.

Structural factors

➢ *Labour productivity may have been under-estimated*

Beyond short-term, cyclical fluctuations in productivity growth, it is argued that US labour productivity growth may have been suffering from increasingly severe mis-measurement problems of the digital economy (e.g. Goldman Sachs (2016)). The basic idea is that, in order to measure real GDP (and hence labour productivity) correctly, one needs reasonable estimates of (1) the value-added of the digital economy and (2) the price deflator for digital technologies; yet, most of the benefits of ICT (Information and Communications Technologies) are available to consumers at no or minimal monetary costs (e.g. online social networks), and in practice it is very difficult to estimate quality-adjusted prices of ICT, which tend to fall rapidly over time. These problems resulted in a downward bias in nominal GDP and an upward bias in the overall price deflator, and hence, lower real GDP and labour productivity growth. An upshot of such mis-measurement problem is that the labour force may have actually been more productive than typical indicators of productivity would indicate.

Assessment: Cyclically, the recent pick-up in labour productivity is largely driven by firms economising their use of labour in face of rising labour shortages, and a lack of corresponding capital deepening suggests that the improvement in productivity is unlikely to last. Structurally, however, mis-measurement of the digital economy is believed to result in downward bias in the estimated labour productivity growth. With technological advancement set to accelerate further, the disinflationary impact of an ICT-induced productivity boom will likely continue to constrain price pressures in the foreseeable future.

(4) Firms have not fully passed on higher production costs to consumers

➢ *Globalisation may have increased product market contestability…*[8]

Some research finds that firms are less able to maintain their mark-ups (i.e. prices above and beyond marginal costs) in the face of increasing global competition. For example, Auer et al. (2010) found that a 1% increase in market share of a US industry by nine low-wage countries[9] could reduce that sector's producer prices by more than 2.3%, while Feenstra et al. (2017) found that greater competition due to globalisation resulted in higher US import shares, exit of US firms and a fall in implied mark-ups among US firms between 1992 and 2005.

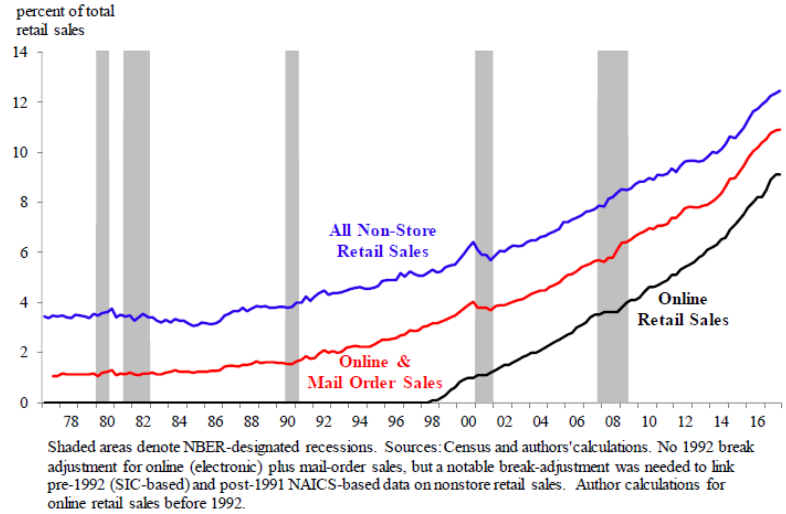
➢ *… and so may have the rise in "Amazonisation"*

Recent years have seen rising online shopping (especially via Amazon) and the consolidation of brick-and-mortar retail outlets into warehouse clubs and supercentres (e.g. Walmart) in the US (Hortacsu et al, 2015). Duca (2018) found that the rise of online shopping (Chart 10) has likely exerted downward pressures on wage growth and inflation, by rendering the retail market more contestable in the form of higher frequency of price changes and greater uniformity in pricing across locations in the US (e.g. Cavallo (2018)).

[8] Nonetheless, the empirical literature investigating whether globalisation leads to increased product market contestability is giving quite mixed conclusions. For instance, Bianchi et al. (2015) found a relatively limited impact of globalisation on domestic inflation across countries, while Hall (2018) found that the mark-up ratios among US firms actually increased between 1998 and 2015 in the US.

[9] China, Brazil, Indonesia, India, Malaysia, Mexico, the Philippines, Thailand and Vietnam.

Chart 10: Share of online and non-store retail sales in the US



Source: Duca (2018).

Assessment: Globalisation and the rise in online shopping encourage greater price competition among firms, which is likely to represent a structural, persistent decline in their pricing power. Nonetheless, similar to the case of global versus domestic economic slack as described on page 9, a more inward-looking US trade policy could risk partly undoing the disinflationary impact of globalisation.

(5) Better anchoring of inflation expectations contributed to lower actual inflation

➢ *Well-anchored inflation expectations*

In theory, well-anchored inflation expectations can result in low actual inflation, by reducing the impact of any shocks to prices on expected inflation (Mishkin, 2007). More concretely, it means that during an inflation shock, firms and workers will not raise prices and demand wage increases as much as when inflation expectations are loosely anchored. Recent empirical research suggests that the anchoring of inflation expectations has improved in the post-GFC era (e.g. Grishchenko et al. (2017)). On a more sectoral level, Luengo-Prado et al. (2017) also found that the slopes of the many sector-specific Phillips curves (including housing and some services) have flattened in recent years, and that the forward-looking component of inflation expectations has been more important in determining the sector-specific inflation persistence. As a testament to the Fed's inflation-targeting credibility, Jordà et al. (2019) found that inflation expectations

have likely played a more important role than either economic slack or inflation persistence in determining current inflation.

Assessment: With inflation persistently below the Fed's price stability objective in recent years, the Fed's concern is that public inflation expectations become de-anchored to the *downside*, which could only further dampen the inflation response to labour market slack (i.e. leading to a flat Phillips curve).

III. IMPLICATIONS

As seen from the summary table below, while a few cyclical factors that currently suppress inflation are likely to dissipate going forward, most structural factors are pointing to sustained headwinds to inflation. As such, the inflation outlook would hinge upon the relative strengths of cyclical versus structural forces.

Summary: What explains the low inflation in the US?

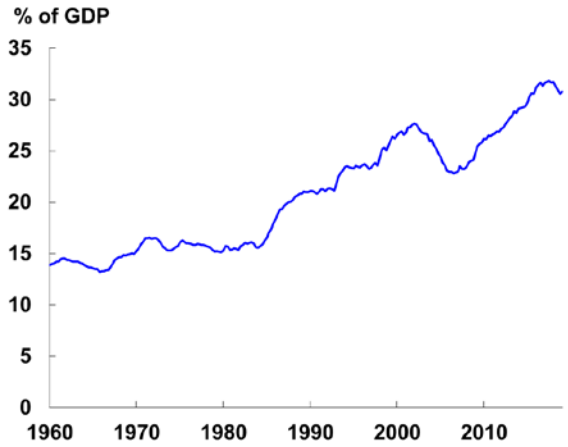
Transmission mechanism	How does it affect US inflation?
1. Labour market slack	↓ Under-estimated labour market slack to keep inflation in check
2. Wage growth	(Cyclical) Flow of low-skilled workers into / out of labour force to drag on inflation in the near term but could reverse ↓ (Structural) Falling unionisation and rising automation to weigh on wage growth in foreseeable future
3. Unit labour cost and labour productivity	(Cyclical) Short-term labour productivity improvement that suppressed ULC could dissipate ↓ (Structural) ICT advancements to support sustained productivity growth beyond near term
4. Firms' pricing power	↓ Weaker pricing power of retailers constrains their ability to pass on cost increases to consumers
5. Inflation expectations	↓ Better anchoring of inflation expectations leads to lower actual inflation

The flatness of the Phillips curve, if it were to persist, carries a few policy implications:

1. It provides more leeway for the Fed to run a "high pressure economy" (Yellen, 2016) to reverse the labour market hysteresis caused by the GFC. Indeed, as highlighted by Blanchard (2016), the flat Phillips curve "implies an attractive trade-off between inflation and unemployment".

2. However, many factors that caused the flat Phillips curve (e.g. population ageing, globalisation, increased product market contestability, etc.) are unlikely to be influenced by monetary policy and, hence, out of the Fed's control. In the near-term, with US monetary policy still not very far away from the effective lower bound, it will take much more than low policy rate for the Fed to attain its 2% inflation target on a sustained basis, and unconventional monetary policy tools such as Quantitative Easing or forward guidance may need to be reintroduced. But the use of these tools has associated costs, such as accumulation of financial imbalances, asset price inflation and broader welfare losses. In particular, low interest rates encourage financial leveraging, which can be problematic given the already-elevated levels of corporate indebtedness in the US (Chart 11), and raise the risk of "low rates beget low rates" as a bigger build-up in debt requires even lower interest rates in order to close the debt service gap (Juselius et al. (2016)). At the same time, the suppressed return of safe assets could pose challenges to insurance companies and pension funds (e.g. Antolin et al. (2011)), as well as retirees living off their savings.

Chart 11: Outstanding debt securities issued by US nonfinancial corporate businesses, as percentage of GDP



Note: Four-quarter rolling average nominal GDP is used as the denominator.
Sources: CEIC and HKMA staff calculations.

3. Further down the road, the flat Phillips curve also casts doubt on the desirability of central banks fixating at a static inflation target, such as 2%, which was set when the Phillips curve was steeper. As an extended period of "lower-for-longer" would likely be needed in pursuit of the target, this raises questions about the sacrosanctity of the target in the first place.

On the flip side, the risks of a cyclical rebound in inflation cannot be dismissed altogether. Research (e.g. Debelle et al. (1997)) finds that the Phillips curve may be nonlinear, turning steeper as the economy operates increasingly above potential. Indeed, according to the minutes of the July 2019 FOMC meeting, a number of participants highlighted the continued firming of the cyclical component of inflation. This points to the risk that further attempt to attain the 2% inflation target via monetary loosening could result in a stronger-than-expected surge in the cyclical component of inflation.

V. CONCLUSION

This paper synthesises findings from five areas of research to provide a coherent account for the flattening of the post-GFC US Phillips curve. While some of the cyclical factors (e.g. entry of new and part-time workers into full employment; cyclical rise in labour productivity) are likely transitory, other

contributing factors — such as population ageing, globalisation, automation and "Amazonisation" — are more structural in nature and are expected to exert a long-lasting impact on dampening inflation. As it stands, disinflationary structural forces have largely been offsetting cyclical inflationary pressures, resulting in the observed flattening of Phillips curve in recent years. That being said, inflation momentum appears to be strengthening more recently, and possible nonlinearities in the Phillips curve relationship would likely caution policymakers against the idea of pursuing aggressive monetary easing.

Regarding policy implications, a flattened Phillips curve may provide more leeway for the Fed to run a "high pressure economy" to reverse the adverse supply shock caused by the GFC, but the structural nature of many factors that result in a flattened Phillips curve also means that it will likely take more than an accommodative monetary policy alone for the Fed to attain its 2% inflation target. In the longer term, the Fed will also need to be cognizant of the adverse impact on financial stability arising from an extended period of "low-for-long" in a bid to reach its inflation target. Ultimately, the sacrosanctity of the 2% target would be called into question by a persistently flat Phillips curve.

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