



IMF Working Paper

Asia and Pacific Department

Price and Wage Flexibility in Hong Kong SAR

Prepared by Si Guo¹

Authorized for distribution by Alison Stuart

January 2017

IMF Working Papers describe research in progress by the author(s) and are published to elicit comments and to encourage debate. The views expressed in IMF Working Papers are those of the author(s) and do not necessarily represent the views of the IMF, its Executive Board, or IMF management.

Abstract

The paper assesses the price and wage flexibility in Hong Kong SAR. At the aggregate level, it compares Hong Kong SAR with the United States, the United Kingdom and Singapore by examining the three commonly used macroeconomic relationships among inflation, unemployment, wage growth, and output fluctuations. At the industry level, the paper compares the distributions of labor earnings and price growth in Hong Kong SAR and the United States. It further estimates a model of wage formation under downward nominal wage rigidity to compare the extent of wage rigidity in Hong Kong SAR and the United States. Overall, the comparisons show that broadly speaking, price and wage adjustments are more flexible in Hong Kong SAR than other economies.

JEL Classification Numbers: J31, E31

Keywords: flexibility, labor earnings growth, inflation

Author's E-Mail Address: sguo@imf.org

¹I am grateful to Thomas Helbling for helpful comments and Raymond Yuen for his help on data collection. I thank Anh Van Le and Xinhao Han for providing excellent research assistance.

Contents	Page
I. Introduction	3
II. Aggregate Evidence	4
A. Inflation vs. Output Fluctuations	4
B. Labor Earnings Growth vs. Unemployment.....	5
C. Unemployment vs. Output Fluctuations.....	5
III. Industry Level Evidence—Labor Earnings	6
A. Histograms and Skewness.....	6
B. Estimating Downward Rigidity.....	7
C. Consumer Prices.....	9
IV. Conclusion	10
References.....	18
Figures	
1. Inflation and Output Gap	11
2. Labor Earnings Growth and Inflation.....	12
3. Labor Earnings Growth and Unemployment Gap	13
4. Unemployment Gap and Output Gap	14
5. Distributions of Labor Earnings Growth	15
6. Distribution of Inflation	16
Tables	
1. Distribution1 of Earnings Growth: Skewness.....	7
2. Estimation Results	9
3. Distribution of Price Changes (All Items): Skewness	10
4. Distribution of Price Changes (Service Goods only): Skewness.....	10
Appendix: Data Used in Estimating the Model with Downward Wage Rigidity.....	17

I. INTRODUCTION

Over the business cycle, price and wage adjustments are important to help mitigate the fluctuations of real aggregates. This is especially true for Hong Kong SAR, which has a fixed exchange rate regime and hence cannot use exchange rate adjustment to absorb shocks.² There has been anecdotal evidence that suggests the price and wage system in Hong Kong SAR is more flexible than other major advanced economies. For example, Hong Kong SAR scores highly on ease of starting a new business.

In this paper, we assess the price and wage flexibility in Hong Kong SAR from aggregate and industry-level evidence. In particular, we compare Hong Kong SAR with the United States, the United Kingdom and Singapore, because the United States and United Kingdom are usually referred as countries with relatively flexible markets, and Singapore is often viewed as a small open economy which shares many similar features with Hong Kong SAR. Our aggregate evidence is disciplined by three commonly used macroeconomic relationships among inflation, unemployment, wage growth, and output fluctuations. Our industry-level evidence is three-fold: first, we compare the statistical properties of the distributions of industry-level earnings growth in Hong Kong SAR and the United States; second, we estimate an empirical model of wage formation under downward nominal wage rigidity to compare the extent of wage rigidity in Hong Kong SAR and the United States; third, we compare the distributions of price adjustments in both economies.

Our main finding is that the price and wage adjustments in Hong Kong SAR are as flexible as in Singapore, the United States or United Kingdom by most measures, and are even more flexible than the three benchmark economies by some measures. In particular, our aggregate evidence shows that Hong Kong SAR's economy is more flexible in terms of absorbing macro shocks by adjusting prices and wages. On industry level evidence, the comparison of the distributions of earnings growth shows that the adjustment of labor costs in Hong Kong SAR is at least as flexible as in the United States. Our estimated empirical model of wage formation, which takes into account several other relevant factors, also suggests that the downward nominal rigidity is less binding in Hong Kong SAR's labor market than the United States. On price changes, although price changes in the U.S. are more flexible in the sample with all items, the price adjustments of service items (which have more domestic components than other items) are more flexible in Hong Kong SAR.

Our conclusion is also in line with some previous studies. For example, Pauwels and Zhang (2008) compare the distribution of wage changes in Hong Kong SAR and the United States and comes to the conclusion that the extent of wage flexibility in Hong Kong SAR is similar to the United States. Cheng and Ho (2009) use a new Keynesian DSGE model to estimate the key parameters related to the nominal rigidity. They conclude that wages and prices in Hong Kong SAR are flexible relative to other economies such as Canada. Lai, Ha, and Leung (2002) show that prices and wages adjust more strongly in Hong Kong SAR than in Argentina.

² See Blanchard, Jaumotte, and Loungani (2013) for a general discussion of labor market flexibility and IMF advice in other advanced economies.

The rest of the paper is organized as below: Section II presents the aggregate evidence of price and wage flexibility in Hong Kong SAR, the United States and United Kingdom. Section III provides the industry-level evidence of wage flexibility in Hong Kong SAR. Section IV presents the comparison of price flexibility.

II. AGGREGATE EVIDENCE

In this section, we compare wage and price flexibility in Hong Kong SAR with Singapore, the United States and United Kingdom by using aggregate indicators. In particular, we test the three commonly used macroeconomic relationships: the Phillips curve, the positive correlation between inflation and output gaps, and Okun's Law. There are two main findings: in general, price indicators such as inflation and labor compensation respond more strongly to output fluctuations in Hong Kong SAR than in other economies, with the exception that the response of labor compensation (to the same scale of output fluctuations) is stronger in Singapore than in Hong Kong SAR. In addition, in all the four economies an increase in unemployment is associated with a decline in output growth (Okun's Law). But the elasticity (of unemployment with respect to output) in Hong Kong SAR is larger than Singapore and the United Kingdom (although smaller than the United States). Overall, these findings suggest that price and wage adjustments, which help mitigate macro shocks, are in general quite flexible in Hong Kong SAR, relative to the other three economies.

A. Inflation vs. Output Fluctuations

The first macroeconomic relationship that we study is between inflation and output gaps. More flexible price adjustments lead to less volatile cyclical output fluctuations. Figure 1 shows the scatter plot of inflation-output gap pairs in Hong Kong SAR, Singapore and the United States.³ For Hong Kong SAR, a 1-percent increase of the positive output gap corresponds to a 0.14 percent rise in inflation. This is marginally larger than the response in the United States (0.13 percent) and Singapore (0.11 percent). Based on this measure, Hong Kong SAR's price adjustment is slightly more flexible than in the United States and Singapore.

Because inflation can be caused by the increase in labor costs and other factors, we further compare the change of labor earnings corresponding to output fluctuations in Hong Kong SAR and the United States (Figure 2). We find that a 1-percent increase of the positive output gap corresponds to a 0.49 percent increase in the growth rate of labor earnings. This exceeds the response of inflation (0.34 percent).⁴ In contrast, in the United States the change of labor earnings in response to a 1-percent increase in output gaps is about 0.28 percent, which is more moderate than the change of

³ Inflation is defined as the quarter-on-quarter change of seasonally adjusted quarterly CPI index. The United Kingdom is not included in this subsection because an official seasonally adjusted quarterly CPI series is unavailable.

⁴ Inflation in this paragraph is calculated as the year-on-year growth of CPI index in order to be compared with year-on-year growth of labor earnings. Quarter-to-quarter growth of labor earnings growth is not reported because the official labor earnings series in Hong Kong SAR is not seasonally adjusted.

inflation (0.4 percent). These findings suggest, compared with the United States, the price adjustment in Hong Kong SAR is to a larger extent driven by the change in labor costs.

B. Labor Earnings Growth vs. Unemployment

In economies with more flexible labor markets, labor costs adjust more promptly to mitigate employment fluctuations. We test this theory by looking at the statistical relationship between the growth of labor earnings and the unemployment rate gap (a version of the Phillips curve) in Hong Kong SAR, Singapore, the United States and United Kingdom from 1990 to 2015. Figure 3 shows that a one-percent increase in the unemployment gap corresponds to a 1.8 percent drop in the growth rate of labor earnings. This drop is larger than the United States and United Kingdom (0.7 and 1.5 percent, respectively), although smaller than for Singapore (3.1 percent). This implies the adjustment of labor costs is more flexible in Hong Kong SAR than for the United States or United Kingdom but less flexible than Singapore.

C. Unemployment vs. Output Fluctuations

We further examine the relationship between unemployment and output. In theory, in an economy with a more flexible labor market, the elasticity of unemployment with respect to output tends to be larger, because the hiring and firing decision is more flexible. We test this theory by examining the historical relationship between the unemployment rate gap and the output gap⁵ (a version of the Okun's Law) in each economy from 1990:Q1 to 2015:Q4.⁶

We find that the change in unemployment associated with the same change in output fluctuations is larger in Hong Kong SAR than in Singapore or the United Kingdom (Figure 4). A 1-percent increase in the positive output gap (i.e., output above potential) corresponds to a 0.26 percent drop in the unemployment gap in Hong Kong SAR. In comparison, the change of the unemployment gap in response to a 1-percent increase in the output gap is smaller in the United Kingdom (0.23 percent) and Singapore (0.09 percent). This suggests that Hong Kong SAR's labor market is more flexible than Singapore and the United Kingdom. Some additional remarks are warranted here. First, the elasticity of unemployment with respect to output is larger in the United States than Hong Kong SAR. However, the result is possibly driven by the (much larger) volatility of Hong Kong SAR's output growth. Second, compared with the two previous macroeconomic relationships we examined, there is less consensus on the connection between the Okun coefficient (the elasticity between unemployment and output) and labor market flexibility.⁷ Therefore, given our findings in the

⁵ The unemployment and output gaps are defined as the cyclical components of quarterly unemployment rate and GDP series after applying the HP filter.

⁶ For United Kingdom, the sample is from 1995:Q1. This is because there has been a substantial change in the Okun coefficient (the elasticity of unemployment with respect to output) after 1995, as documented in Ball, Leigh, and Loungani (2013).

⁷ For example, Ball, Leigh and Loungani (2013) find that the OECD's employment protection legislation (EPL), an index of labor market rigidity, is an insignificant determinant of the Okun coefficient; However, by using the U.S.

examination of the other two macroeconomic relationships, we conclude that the Hong Kong SAR economy is relatively flexible, compared with the other three economies.

III. INDUSTRY LEVEL EVIDENCE—LABOR EARNINGS

In this section, we compare the flexibility of labor markets in Hong Kong SAR and the United States by examining the industry-level evidence.

A. Histograms and Skewness

In a labor market with downward wage rigidity, nominal wage cuts are limited. As a result, the cross-time distribution of wage growth should exhibit a corresponding pile-up of observations of near-zero earnings growth and a relatively short left tail. We can evaluate the degree of downward wage rigidity by statistically examining the distribution: the discontinuity of the density function around zero provides an indication of the distribution's concentration around zero; the symmetry of the distribution gives a measure of the relative size of tails.

We assess the extent of downward wage rigidity by examining the distribution of industry-level earnings growth in Hong Kong SAR. We choose to use “earnings” instead of “wage” as the main indicator, because bonus and compensation to extra hours are included in the earnings statistics and these are also likely to respond more to the business cycle.⁸ We document the *year-on-year* growth of nominal earnings by quarter because the official data is not seasonally adjusted. Our sample consists of 61 non-overlapping industries from 2000:Q1 to 2004:Q4 and 46 industries from 2005:Q1 to 2016:Q1 in Hong Kong SAR.⁹ For any given industry, the number of employees as a share of total employees is used as its sample weight.

Concentration around zero earnings growth

Figure 5.A and Figure 5.C show the histogram of the (unweighted and weighted) distribution of industry-level payroll (yoy) growth in Hong Kong SAR from 2000 to 2016:Q1. In both unweighted and weighed samples, the distribution does not present a substantial discontinuity around zero (i.e., the bar containing $[0, 1]$ is not much higher than the bar containing $[-1, 0]$). The distribution also has a long left tail, and about one-third of the observations are negative. These observations are consistent with the features of a flexible labor market.

How does the distribution of labor earnings growth look like in the United States? Our U.S. sample covers 31 industries, which represent about 84 percent of total nonfarm employment in 2015. The

state level data, Guisinger and others (2015) find that indicators of more flexible labor markets (e.g., unionization rate) is a significant determinant of the Okun coefficient.

⁸ However, we still use the term “downward wage rigidity” rather than “downward labor earnings rigidity.”

⁹ The change of the number of industries in the two sub-periods is caused by the change of industry classification from HISC 1.1 to HISC 2.0. Overall, our sample covers about 97 percent of total employees during 2000–04 and about 98 percent during 2005–16.

time horizon is from 2000:Q1 to 2016:Q1. Figures 5.B and 5.D show that the distribution of U.S. labor earnings growth exhibits more discontinuity around zero than Hong Kong SAR: the bar containing $[-1, 0]$ is substantially lower than the bar containing $[0, 1]$. This indicates the existence of downward wage rigidity. Another observation from Figure 5 is that the distribution of labor earnings growth is more dispersed in Hong Kong SAR than in the United States. This is probably a reflection of the more volatile business cycles in Hong Kong SAR.

Symmetry of the labor earnings growth distributions

We use “**skewness**” as the indicator of symmetry. Intuitively, downward wage rigidity implies that the distribution of labor earnings growth should be “positively skewed” (i.e., the right tail is longer than the left tail) because some negative adjustments may be constrained. By this measure, a more flexible economy should have smaller “skewness.”¹⁰

We made several changes to our sample. First, we restrict our comparison within the years with low inflation.¹¹ This is because the downward rigidity is relevant only when inflation is low enough (so that labor earnings face downward pressure). Second, because the skewness measure can be affected by sample outliers, we remove the top 1 percent or 5 percent of the sample before we calculate the skewness.

Table 1 presents the skewness of the weighted distributions of labor earnings growth in Hong Kong SAR and the United States. The skewness in Hong Kong SAR is on par with the United States, regardless of whether we define the top and bottom 1 percent or 5 percent of the sample as outliers. That is, the distribution of labor earnings growth in Hong Kong SAR is broadly as symmetric as the United States.

Sample selection	1-99 percentile	5-95 percentile
Hong Kong SAR	0.17	0.11
United States	0.12	0.12

1. low inflation years only. Smaller skewness implies less downward rigidity.

B. Estimating Downward Rigidity

Although the approach based on histograms is simple and straightforward, it only takes into account the information on labor earnings growth. Some other factors, such as the cyclical positions over the business cycles, inflation, and labor market conditions, may also affect the distribution of labor earnings growth. Without controlling for these factors, we cannot attribute all of the variations in labor earnings growth distributions to the difference in labor market flexibility.

¹⁰ See Nieuwerburgh and Veldkamp (2006) for more discussion about the skewness indicator and its application in analyzing the asymmetry of the U.S. business cycles.

¹¹ “Low inflation” years correspond to the years with annual inflation rates less than 2 percent.

In this section, we follow Kimura and Ueda (2001) to estimate an empirical model of nominal wage formation under downward wage rigidity. The main advantage of this approach is that it takes into account the impact of output fluctuations, inflation and labor market conditions on labor earnings. Our results show that the downward wage rigidity is less binding in Hong Kong SAR than the United States.

Our empirical model is common in the literature on downward wage rigidity (e.g., Schmitt-Grohe and Uribe, 2012; Eggertsson and Mehrotra, 2014). The most important assumption is that, in each period, some firms cannot fully adjust their wages: the change of their nominal wages is subject to a lower bound, \underline{d} .¹² Under this assumption, at time t , if the equilibrium wage growth in industry i under flexible wage setting is $dw^*(t)$, and the fraction of firms that are subject to the downward wage rigidity is x , the observed average nominal wage growth in industry i , $dw(i,t)$, should follow

$$\begin{aligned} dw(i,t) &= dw^*(i,t) && \text{if } dw^*(t) > \underline{d} \\ &= x \cdot dw^*(i,t) + (1-x) \cdot \underline{d} && \text{otherwise} \end{aligned} \quad (1)$$

That is, if the equilibrium wage growth under flexible wage setting is large enough so that the downward wage rigidity is not binding, the observed wage growth is exactly the same as the equilibrium wage growth. However, if the equilibrium wage under flexible wage settings is too small (this is usually the case in low inflation years), some firms are not able to fully lower their wages. As a result, the observed wage growth is higher than the growth of equilibrium wage under flexible wage settings. The coefficients x and \underline{d} measure the flexibility of wage adjustment: a larger x implies that a larger proportion of firms is capable of adjusting their wages; a smaller \underline{d} implies that firms are less likely to be constrained by downward wage rigidity.

In order to estimate x and \underline{d} , we have to specify the process of the unobservable equilibrium wage growth $dw^*(i,t)$. Similar with Kimura and Ueda (2001), we assume that

$$dw^*(i,t) = \alpha u(i,t) + \beta \text{inf}(t) + \gamma g(i,t) + \varepsilon(i,t). \quad (2)$$

where $u(i,t)$, $\text{inf}(t)$ and $g(i,t)$ stand for industry-level unemployment rates, aggregate inflation rates and industry level real GDP growth rates respectively.

We jointly estimate x , \underline{d} , α , β and γ from (1) and (2) for both Hong Kong SAR and the United States.¹³ Because (1) is not a linear system, nonlinear least square method is used in the estimation. The regression results are listed in Table 2. The signs of α , β and γ are as expected: the growth rates of labor earnings (dependent variable dw) is negatively correlated with unemployment rates, but positively correlated with inflation rates and real GDP growth rates. In fact, the regression results show that the growth of labor earnings in Hong Kong SAR responds more strongly to inflation and real GDP growth than the United States, which is consistent with the aggregate evidence presented in

¹² In the special case of $\underline{d}=0$, a firm cannot have negative wage adjustment.

¹³ The detail of the data used throughout this section is in the appendix.

Section II.

The more interesting results from Table 2 are the values of coefficients x and d . The estimated value of x is about 0.53 in Hong Kong SAR, implying that about half of the firms are able to adjust their wages over the course of one year. The estimate of d is about 0.58, which means the floor of **annual** wage growth in Hong Kong SAR is about 0.58 percent. How does it compare with the United States? While the estimated fractions of firms which can freely change their wages (the coefficient x) are similar in both economies, Hong Kong SAR has a much smaller floor of wage adjustment than the United States (0.58 percent vs. 2.04 percent). This suggests that the wage adjustment in Hong Kong SAR is **more** flexible than the United States.

	Hong Kong SAR	United States
Unemployment (α)	-0.13 [-0.13, -0.12]***	-0.13 [-0.13, -0.12]***
Inflation (β)	1.10 [1.09, 1.11]***	0.50 [0.50, 0.50]***
Industrial real GDP growth (γ)	0.1624408 [0.16, 0.17]***	0.0507812 [0.05, 0.05]***
Floor of earnings growth (d)	0.58 [0.47, 0.68]**	2.04 [2.00, 2.07]***
Fraction of firms changing earnings (x)	0.53 [0.51, 0.54]***	0.50 [0.49, 0.51]***
Constant	0.06 [0.01, 0.11]***	2.66 [2.65, 2.67]***

Note: The dependent variable is earnings growth rate. * ** and *** represent significance at 10%, 5% and 1% level, respectively. The values in the parenthesis are 95% confidence interval.

C. Consumer Prices

We further look at the flexibility of the adjustment of consumer prices in Hong Kong SAR and the United States. Our approach is to compare the distributions of price adjustment at micro level, which is similar with the approach we adopted for comparing labor market flexibility.

Our sample includes the quarterly price index data of Hong Kong SAR and the United States. from 2000:Q1 to 2016:Q2. It covers 81 items for Hong Kong SAR and 41 items for the United States, which represent about 81 percent of the consumption basket in Hong Kong SAR and 89 percent of the consumption basket in the United States.

Figure 6 shows the distribution of price changes at the item level in Hong Kong SAR and the United States. For Hong Kong SAR, although the frequency of having price changes fall into $[-1, 0]$ is substantially smaller than $[0, 1]$ (which suggests some extent of downward rigidity), the extent of discontinuity around zero is on par with the United States.

Table 3 presents the skewness of the distributions of price changes during low inflation years. Depending on whether we define the sample outliers as the top and bottom 1 percent or 5 percent of all observations, the skewness of sample for the United States is smaller or on par with Hong Kong SAR.

However, this does not necessarily imply that the price adjustment in Hong Kong SAR is more rigid than the United States: conceptually, the pace of consumer price adjustment is determined by domestic and foreign factors. The former includes labor costs (as well as other factors such as housing prices) and the latter includes factors such as import prices. A more positively-skewed Hong Kong SAR sample can simply reflect the effects of foreign factors which are not related to the rigidity of the domestic market (e.g., the consumption basket in the United States includes more fuel-related items which tend to have more frequent and sharp price adjustments).

In order to separate the impact of domestic and foreign factors, we also compare the distributions of price changes for the subsample with service items only. The rationale is that price changes of service items are more affected by domestic factors. Table 4 shows that after removing the nonservice items (which may be more affected by foreign factors), the skewness of price change distribution in Hong Kong SAR is smaller than the United States, regardless of how we remove the sample outliers. This implies that for service items, the price adjustment in Hong Kong SAR is likely to be more flexible than the United States. This is also consistent with our previous findings that Hong Kong SAR has a more flexible labor market.

Sample selection	1-99 percentile	5-95 percentile
Hong Kong SAR	-0.22	-0.31
United States	-0.41	-0.33

¹ Low inflation years only. Smaller skewness implies less downward rigidity.

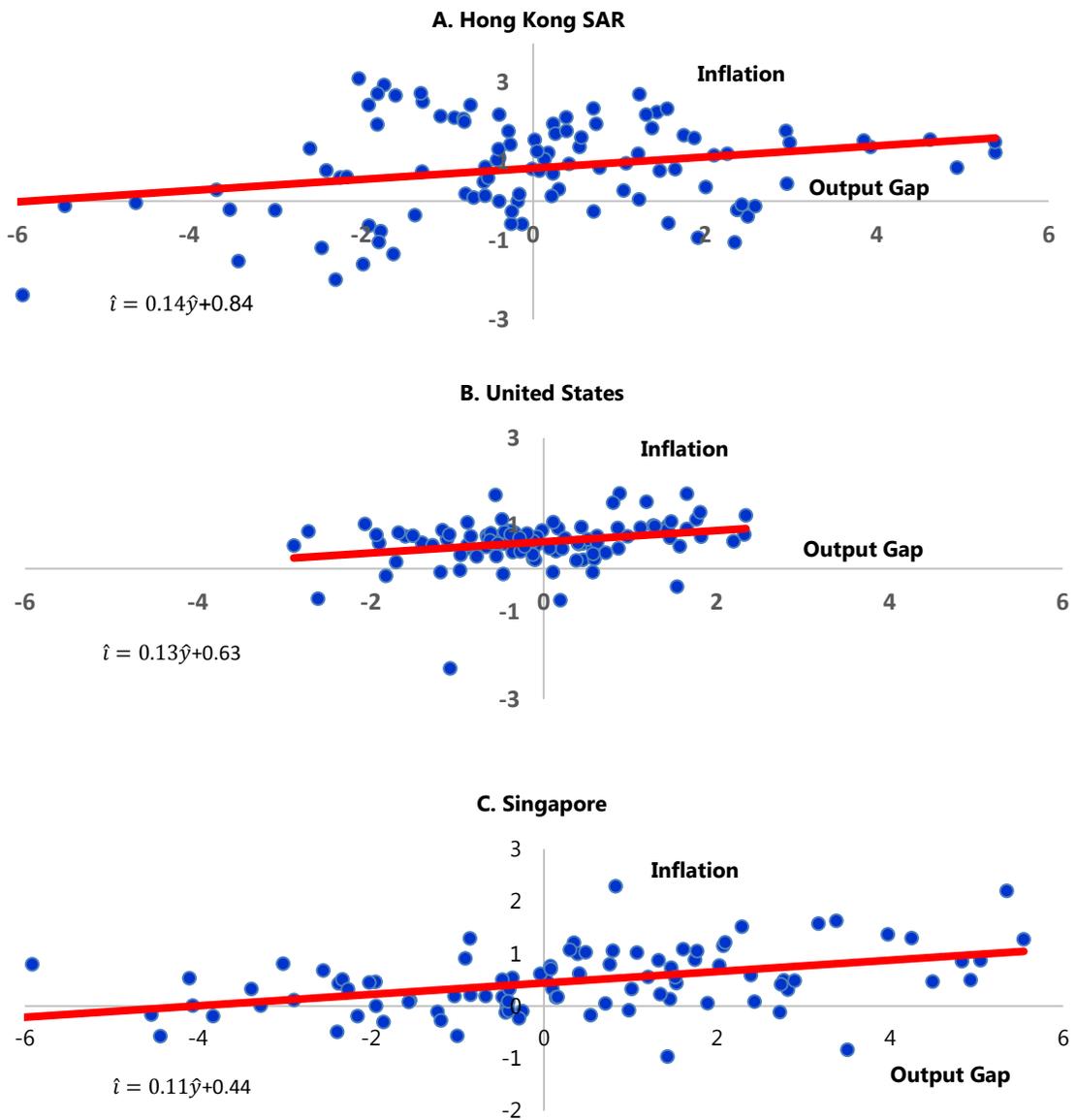
Sample selection	1-99 percentile	5-95 percentile
Hong Kong SAR	-0.48	-0.45
United States	-0.17	-0.35

¹ Low inflation years only. Smaller skewness implies less downward rigidity.

IV. CONCLUSION

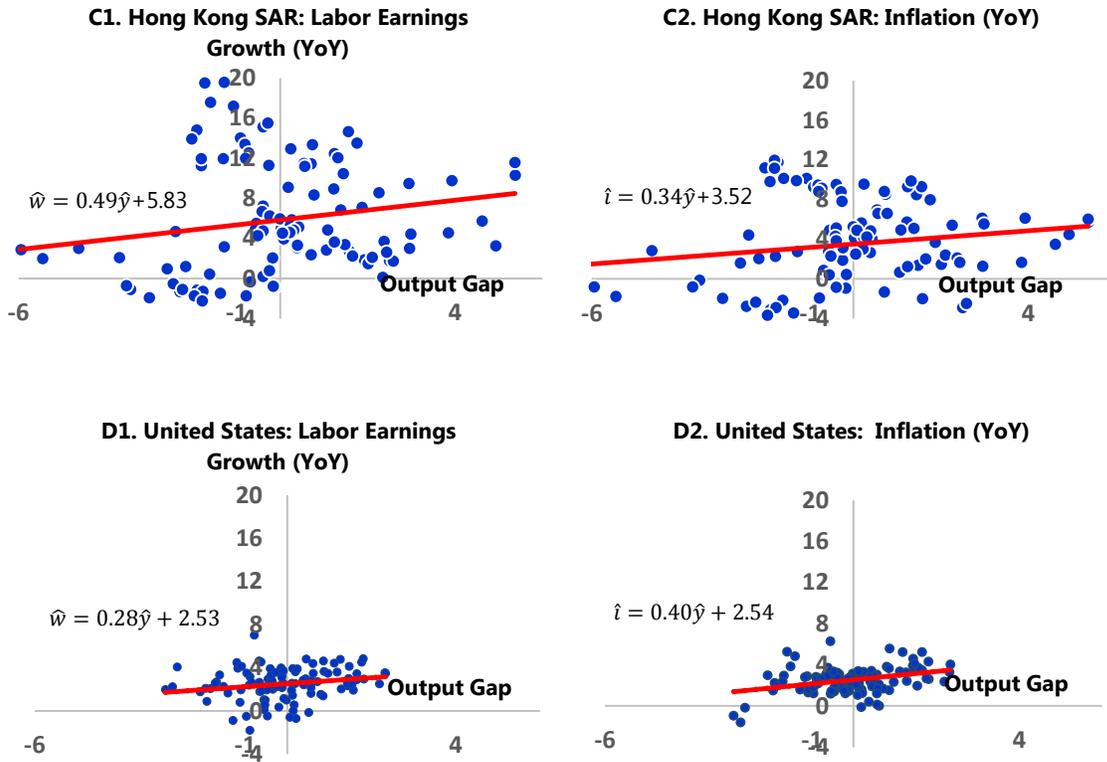
We compare the flexibility of wage and price adjustment in Hong Kong SAR with Singapore, the United States and the United Kingdom. Our aggregate evidence suggests that broadly speaking, price and wage adjust more strongly in Hong Kong SAR (than Singapore, the United States and United Kingdom), which helps stabilize real aggregates such as output and employment. Our industry level evidence also shows that the price and wage adjustments in Hong Kong SAR are relatively flexible: the distribution of labor earnings growth in Hong Kong does not concentrate at zero, and is not more positively skewed relative to the distribution of labor earnings growth in the United States; the estimates from our wage formation model suggests that downward wage rigidity is less binding in Hong Kong SAR; the price adjustments of service items (which have more domestic content than goods items) are more flexible in Hong Kong SAR than the United States.

Figure 1. Inflation and Output Gap



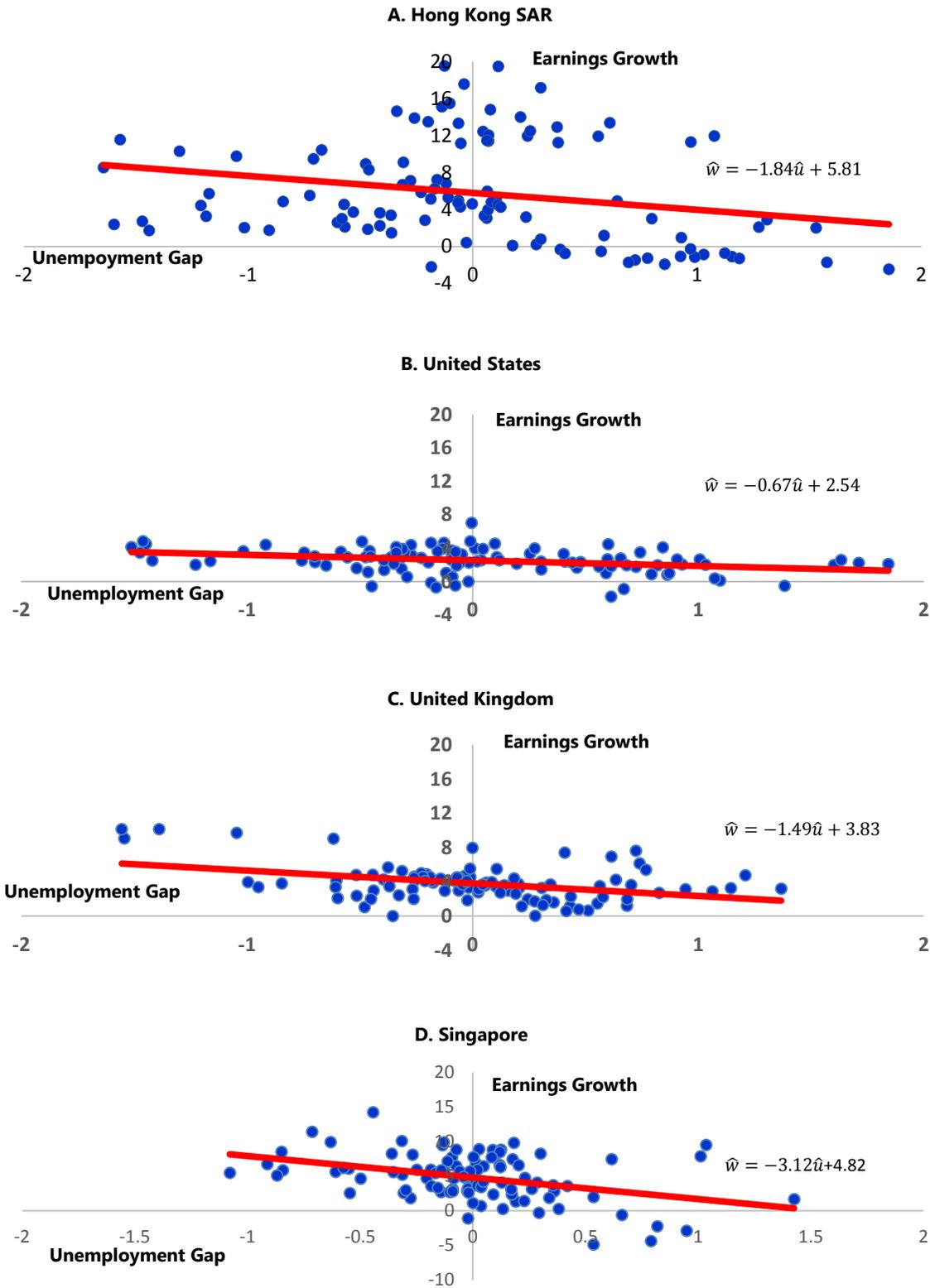
Sources: Haver; and IMF staff calculations

Figure 2. Labor Earnings Growth and Inflation



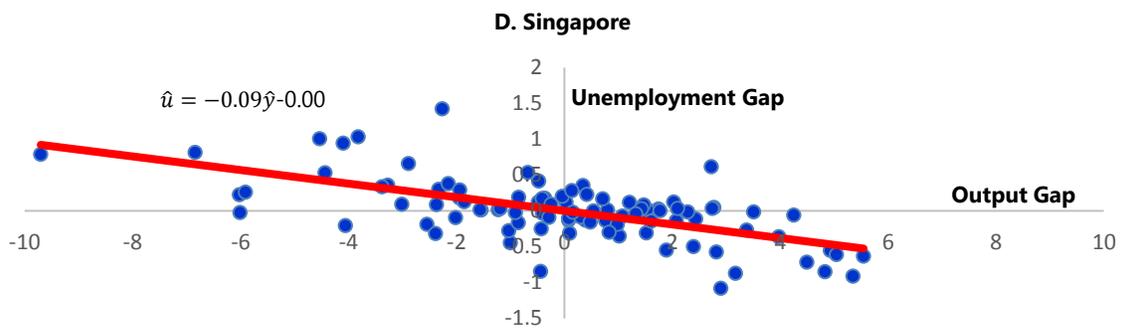
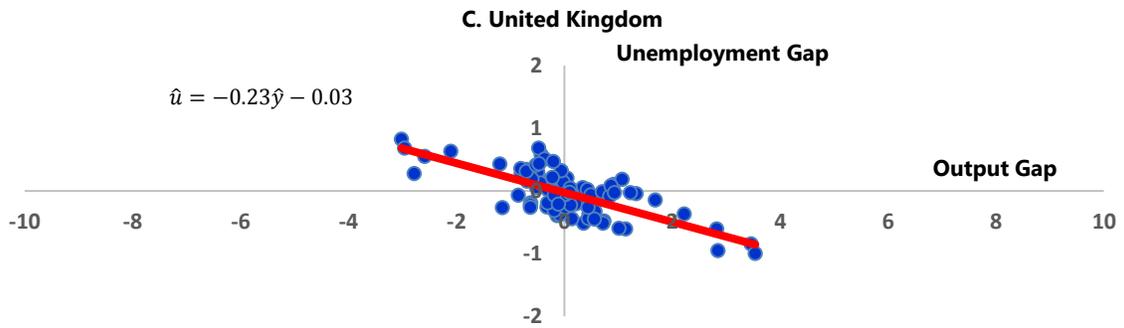
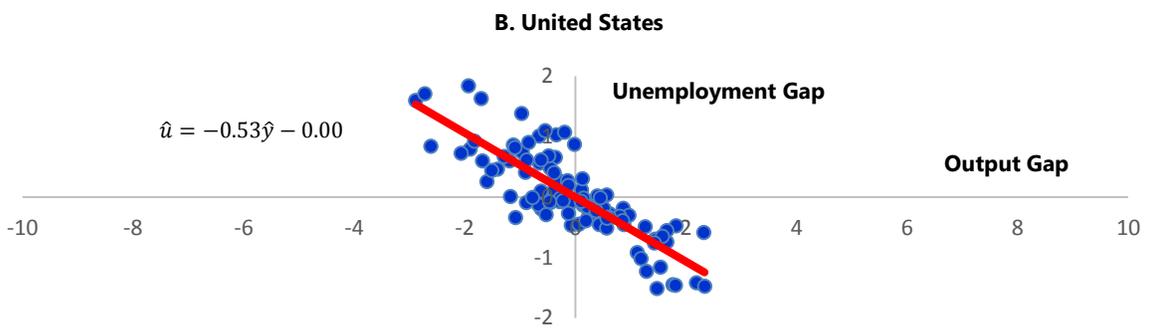
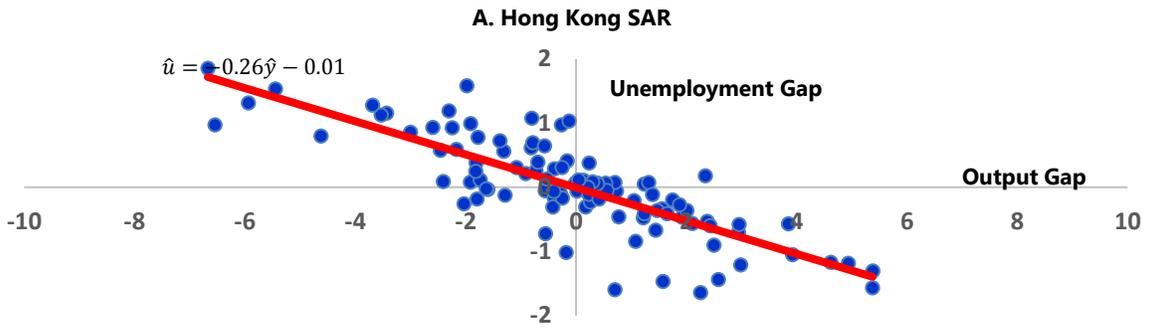
Sources: Haver; and IMF staff calculations

Figure 3. Labor Earnings Growth and Unemployment Gap



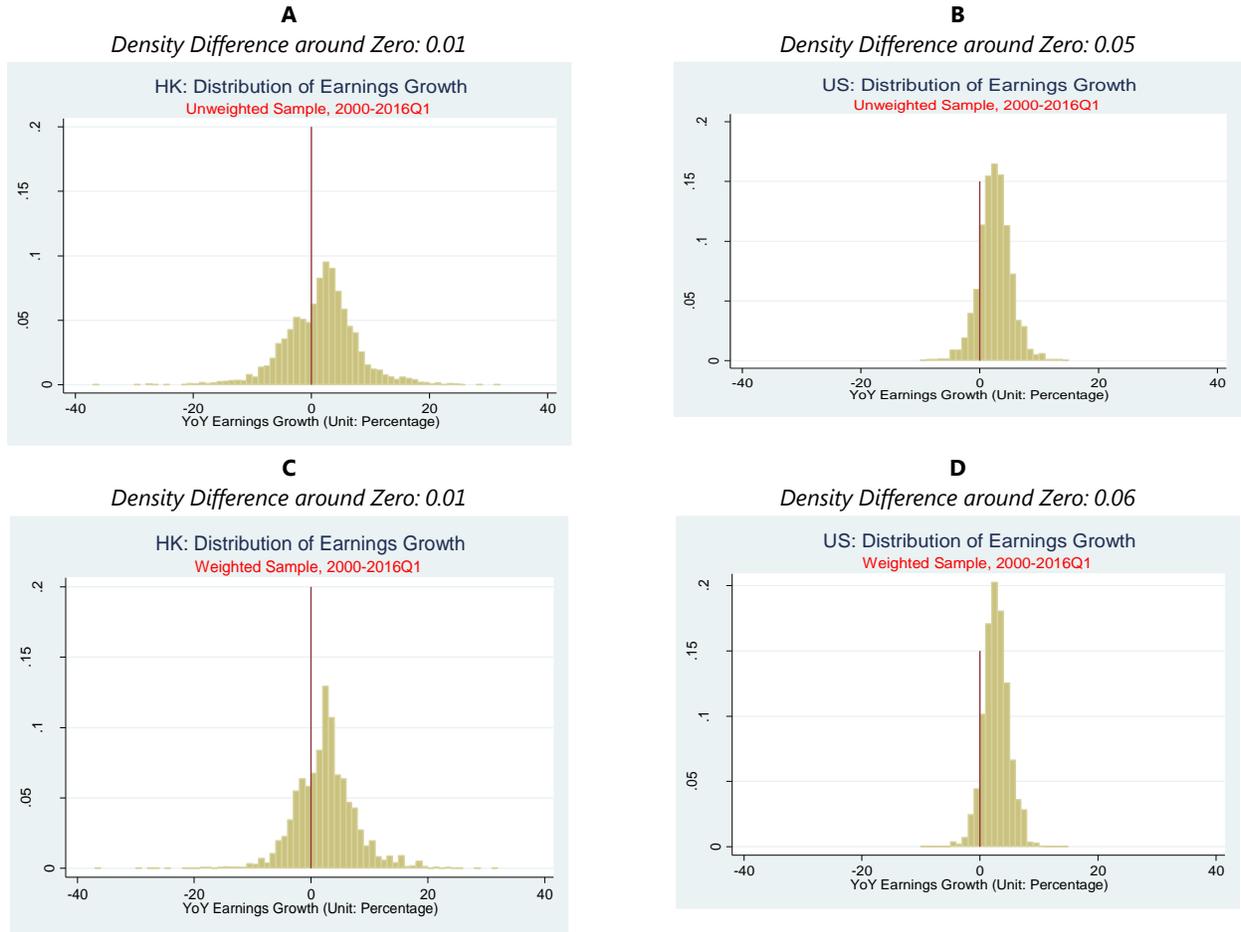
Sources: Haver; and IMF staff calculations.

Figure 4. Unemployment Gap and Output Gap

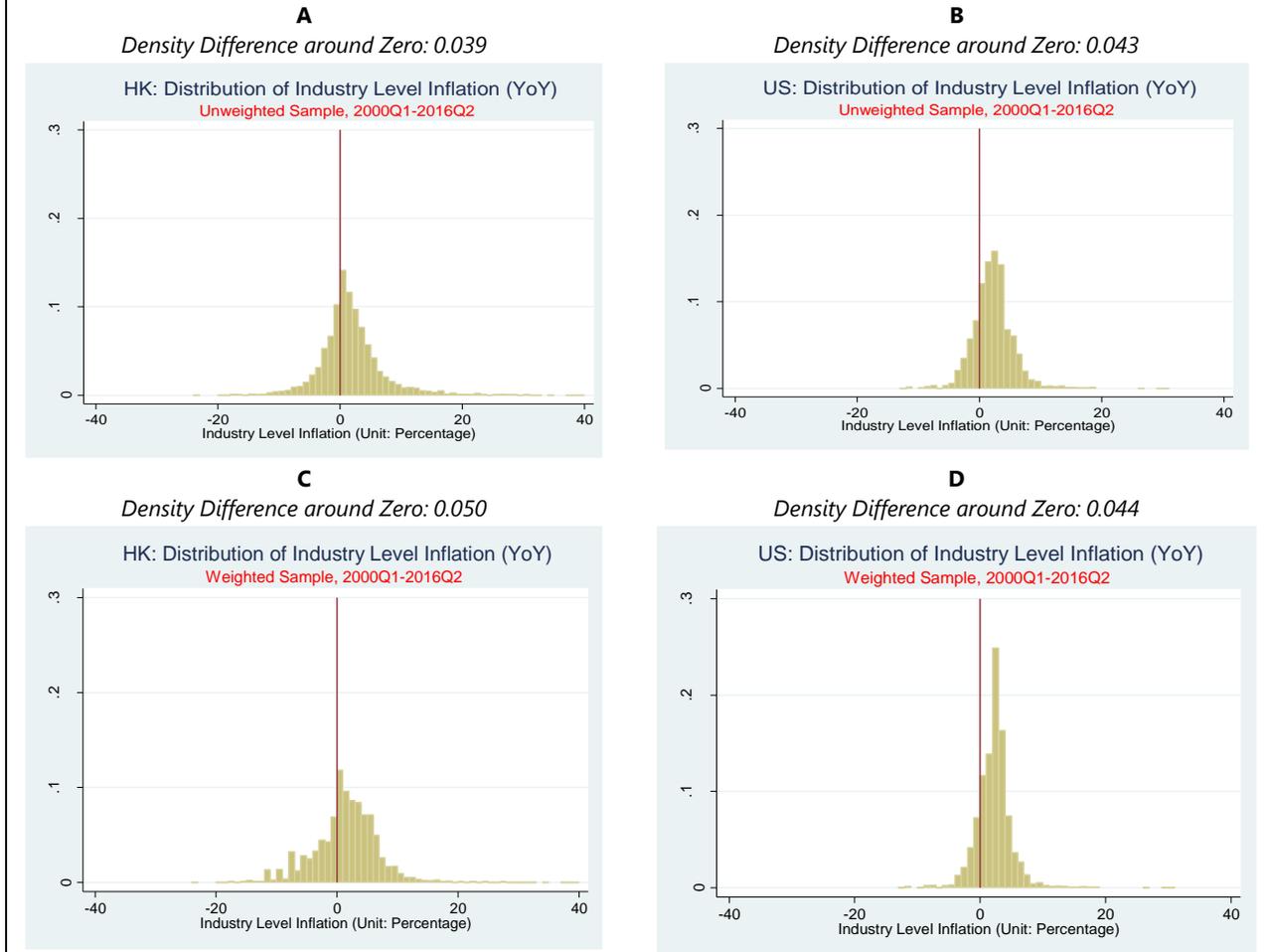


Sources: Haver; and IMF staff calculations.

Figure 5. Distributions of Labor Earnings Growth 1/



1/ "Density Difference around Zero" is defined as the difference between probability of labor earnings growth falling into (0%, 1%) and the probability of labor earnings growth falling into (-1%, 0%).

Figure 6. Distribution of Inflation 1/

1/ "Density Difference around Zero" is defined as the difference between probability of price change falling into (0%, 1%) and the probability of price change falling into (-1%, 0%).

Appendix: Data Used in Estimating the Model with Downward Wage Rigidity

Hong Kong SAR

All the data is from Census and Statistics Department of Hong Kong SAR via CEIC. The time horizon is from 2001:Q1 to 2016:Q1. The industry level wage growth $dw(i,t)$ is calculated as the (YoY) change of quarterly industry-level nominal average payroll index. We choose to use the YoY change instead of the QoQ change to eliminate seasonal factors. Similarly, aggregate inflation rates and industry-level quarterly real GDP growth series are also calculated as the YoY change of CPI index and industry-level real value-added. A total of 10 non-overlapping sectors/industries are included in the sample:¹⁴ (1) manufacturing (2) import and export trade (3) wholesale and retail trades (4) services and accommodation, transport, storage, postal & courier (5) information and communications (6) financial services and insurance (7) real estate (8) professional and business services (9) public administration (10) social and personal services. We use the share of real-value added in 2015 as the weight of each industry.

United States

The data of industry-level unemployment rate and labor earnings growth is from BLS via CEIC. The data of industry-level real GDP is from BEA. Inflation rate series is from Haver. The time horizon is from 2005:Q1 to 2016:Q1 because industry level real value-added data is only available from 2005. A total of 12 industries are included in the sample: (1) mining (2) construction (3) durable goods manufacturing (4) nondurable goods manufacturing (5) wholesale and retail trades (6) transportation and warehousing (7) information (8) finance, insurance, real estate, rental and leasing (9) professional and business services (10) education services, health care and social assistance (11) arts, entertainment, recreation, accommodation, and food services, and (12) other nongovernment services. We use the share of real-value-added in 2015 as the weight of each industry.

¹⁴ We only include the industries with accessible unemployment rate, payroll and real value-added series. Therefore, the number of industries included in the sample used in this section is smaller than in Section III.B.

References

- Ball, L., D. Leigh, and P. Loungani, 2013, “Okun’s Law: Fit at Fifty?” NBER Working Paper 18668 (Cambridge, Massachusetts: National Bureau of Economic Research).
- Blanchard, O., F. Jaumotte, and P. Loungani, 2013, “Unemployment, Labour-Market Flexibility and IMF Advice: Moving Beyond Mantras,” *VoxEU* (18 October). Available on the Internet: <http://voxeu.org/article/unemployment-labour-market-flexibility-and-imf-advice>.
- Cheng, M., and W.Y. Ho, 2009, “A Structural Investigation into the Price and Wage Dynamics in Hong Kong,” Working Paper 20/2009 (Hong Kong: Hong Kong Monetary Authority).
- Eggertsson, G., and N. Mehrotra, 2014, *A Model of Secular Stagnation*. Working Paper (Providence: Brown University).
- Guisinger, A., R. Hernandez-Murillo, M. Owyang, and T. Sinclair, 2015, “A State-Level Analysis of Okun’s Law,” Federal Reserve Bank of St. Louis Working Paper (St. Louis: Federal Reserve Bank of St. Louis).
- Kimura, T., and K. Ueda, 2001, “Downward Nominal Wage Rigidity in Japan,” *Journal of the Japanese and International Economies*, Vol. 15, No. 1, pp. 50–67.
- Lai, K., Ha, J., and C. Leung, 2002, “Comparing Flexibility in Argentina and Hong Kong,” *HKMA Quarterly Bulletin*, (May).
- Nieuwerburgh, S. V., and L. Veldkamp, 2006, “Learning Asymmetries in Real Business Cycles,” *Journal of Monetary Economics*, (May), pp. 753–72.
- Pauwels, L. L., and Z. Zhang, 2008, “How Flexible is the Labour Market in Hong Kong? Some Statistical Observations,” Research Notes No. 4/2008 (Hong Kong: Hong Kong Monetary Authority).
- Schmitt-Grohe, S., and M. Uribe, 2011, “Pegs and Pain,” NBER Working Paper No. w16847 (March). Available on the Internet: SSRN: <https://ssrn.com/abstract=1776782>