The natural rate of unemployment in Hong Kong: An update

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Abstract

This article provides an update on Hong Kong's natural rate of unemployment, as measured by the non-accelerating inflation rate of unemployment (NAIRU), with data up to 2022. The estimation is based on a structural regression model that allows interactions between price inflation, wage growth and unemployment rate. The results indicate that the NAIRU for Hong Kong remained broadly stable from 1994 to 2010, averaging 3.7% over that period before rising to 4.4% in 2012, then gradually falling to 2.8% in 2018 and hovering around 3.0% in the ensuing years.

香港自然失業率：更新

摘要

本文更新香港自然失業率，以非加速通脹失業率 (NAIRU) 來量度，數據截至 2022 年。這估算是基於一套結構回歸模型，在模型當中，物價通脹、工資增長和失業率之間能夠互動。結果顯示香港非加速通脹失業率在 1994 年到 2010 年期間大致維持平穩，平均每年為 3.7%，及後上升至 2012 年的 4.4%，其後逐漸下降至 2018 年的 2.8%，並於之後幾年徘徊於 3.0%水平。

I.   INTRODUCTION

Ever since William Phillips documented a negative relationship between wage inflation and unemployment in 1958[1], many follow-up studies have made similar observations. However, the well-known "Phillips curve" was not without controversy. In the late 1960s, Edmund Phelps and Milton Friedman argued that while workers may suffer from money illusion in the short run (misinterpreting nominal wage increases as real increases and thus being willing to work more), rational workers and employers ultimately take into account real wages instead of nominal wages when determining their labour supply and demand. Hence, in the long run, the unemployment rate should stand at a level—the "natural" rate of unemployment—that corresponds to the market real wage which adjusts to balance the supply and demand for labour[2]. In other words, the natural rate of unemployment is the rate of unemployment that prevails in the long run when output is at the full-employment level, with no trade-off between inflation and the unemployment rate. The natural rate only reflects unemployment from frictional and structural causes, without any cyclical component.

2.   Closely related to the natural rate of unemployment is the non-accelerating inflation rate of unemployment (NAIRU), which is the lowest unemployment rate that can be sustained without causing inflation to accelerate. According to Ball and Mankiw (2002), "the NAIRU is approximately a synonym for the natural rate of unemployment"[3]. In particular, the NAIRU acknowledges the Phillips curve as the result of the short-term non-neutrality of money, and it appears in macroeconomic frameworks where this non-neutrality creates a trade-off between inflation and unemployment. However, as the NAIRU is based on the idea of stable inflation over a shorter time horizon[4], it may diverge from the natural rate which reflects a long-run equilibrium[5]. For example, after a recession, the increase in labour demand amid

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[1]   Phillips, A. W. (1958). The relation between unemployment and the rate of change of money wage rates in the United Kingdom, 1861-1957. *Economica, 25*(100), 283-299. http://public.econ.duke.edu/~kdh9/Courses/Graduate%20Macro%20History/Readings-1/Phillips.pdf

[2]   Hoover, K. D. (n.d.). Phillips Curve. https://www.econlib.org/library/Enc/PhillipsCurve.html

[3]   Ball, L., & Mankiw, N. G. (2002). The NAIRU in theory and practice. *Journal of Economic Perspectives, 16*(4), 115-136. https://pubs.aeaweb.org/doi/pdfplus/10.1257/089533002320951000

[4]   In in the long run, the Phillips curve is vertical at the natural rate of unemployment. However, since this implies no trade-off between inflation and unemployment, Phillips curve-based estimates of the NAIRU are necessarily based on shorter time horizons (e.g., the unemployment rate consistent with stable inflation over the next one or two years).

[5]   Walsh, C. E. (1998). The natural rate, NAIRU, and monetary policy. *FRBSF Economic Letter* 1998-28. https://www.frbsf.org/economic-research/publications/economic-letter/1998/september/the-natural-rate-nairu-and-monetary-policy

economic recovery would result in a lower unemployment rate, while inflation may not accelerate right away if inflation expectations are slow to adjust in the short run. Alternatively, if labour productivity growth is faster than what workers expect, producers would be willing to hire more employees, resulting in a lower unemployment rate but with no immediate effect on wages and therefore prices in light of their sluggish adjustment in the short run. In both cases the NAIRU is temporarily lower than the natural rate of unemployment but would adjust upward as expectations catch up. As such, the NAIRU in the short run tends to fluctuate more than the natural rate[6].

3.   As a proxy for the natural rate of unemployment, the NAIRU is useful as an indicator for policy formation as the difference between the actual unemployment rate and the NAIRU could be used to gauge the state of the business cycle, the inflation outlook, and the direction of government policy[7]. For example, if the actual unemployment rate is lower than the NAIRU, it suggests that the economy is growing faster than its potential capacity (i.e. booming), which will put upward pressure on inflation; and vice versa. The government may consider implementing policies to stabilise inflation.

4.   This article aims to provide updated estimates of Hong Kong's natural rate of unemployment as measured by the NAIRU, largely following the basic setup of the structural regression model adopted in our office's 2014 technical paper (EABFU (2014) hereafter)[8], but extending the study period up to 2022. The structure of this article is as follows. **Part II** describes the estimation methodology. **Part III** presents the regression results of the structural model. **Part IV** explains the trend of NAIRU estimates between 1994 and 2022 and the underlying main factors. **Part V** concludes.

II.   METHODOLOGY

5.   The NAIRU estimation in this article largely follows the structural regression model adopted in EABFU (2014), where the model made reference to a system of

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[6]   Estrella, A., & Mishkin, F. S. (1999). Rethinking the role of NAIRU in monetary policy: Implications of model formulation and uncertainty. In *Monetary policy rules*, Chapter 9, 405-436. Chicago: University of Chicago Press. https://www.nber.org/system/files/chapters/c7421/c7421.pdf

[7]   See Ball and Mankiw (2002) and Walsh (1998).

[8]   Economic Analysis and Business Facilitation Unit. (2014). *How high is the natural rate of unemployment in Hong Kong? (A technical note)*. https://www.hkeconomy.gov.hk/en/pdf/wp/natural_unemp.pdf

equations set out by Adams and Coe (1990)[9]. The simultaneous equation model links up endogenous aggregate wage and price setting relationships while also taking into account exogenous factors that affect the labour market. As compared to simpler methods that rely on a single equation estimate of the expectations-augmented Phillips curve to relate the gap between actual and expected inflation to that between the actual unemployment rate and the NAIRU (for example, Llaudes (2005)[10] and Ruberl *et al.* (2021)[11]), the merit of the full structural approach is that it takes the relationship between wage growth, price inflation and the unemployment rate into account simultaneously in addition to relevant exogenous factors, while jointly estimating the NAIRU and potential output[12]. The resultant estimates of the NAIRU and potential output are consistent with each other and make full use of available information.

6.   Following Adams and Coe (1990), equations for price inflation[13], wage growth and the unemployment rate are estimated simultaneously, while the output (real GDP) equation is estimated separately to derive the output gap (the difference between actual output and potential output). The first equation relates consumer price inflation to endogenous variables like wage growth (adjusted for labour productivity) and the output gap and exogenous factors like the import price of foodstuffs. The second equation is for general inflation as measured by the GDP deflator, which is affected by consumer price inflation as an endogenous variable as well as change in terms of trade as an external exogenous shock. The third equation relates wage growth to consumer price inflation and the gap between the actual unemployment rate and the NAIRU, as

9   Adams, C., & Coe, D. T. (1990). A systems approach to estimating the natural rate of unemployment and potential output for the United States. *IMF Staff Papers*, *37*(2), 232-293. https://www.elibrary.imf.org/downloadpdf/journals/024/1990/002/article-A002-en.xml

10   Llaudes, R. (2005). *The Phillips curve and long-term unemployment*. European Central Bank Working Paper No. 441. https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp441.pdf

11   Ruberl, H., Ball, M., Lucas, L., & Williamson, T. (2021). *Estimating the NAIRU in Australia*. Treasury Working Paper No. 2021-01. https://treasury.gov.au/sites/default/files/2021-05/p2021-164397_nairu.pdf

12   A 2001 HKMA paper also used the structural regression model of Adams and Coe (1990) to estimate the NAIRU of Hong Kong.

     Peng, W., Cheung, L., & Fan, K. (2001). Sources of unemployment: Recent developments and prospects. *Hong Kong Monetary Authority Quarterly Bulletin*, 11/2001, 38-48. https://www.hkma.gov.hk/media/eng/publication-and-research/quarterly-bulletin/qb200111/fa02.pdf

13   While Adams and Coe (1990) adopted the rate of change in output price (private nonfarm business sector) to measure price inflation in the regression model, this study distinguishes consumer price inflation from general inflation (as measured by the GDP deflator) in modelling inflation, as Vere (2022) suggested that consumer prices and nominal wages track each other over the long term.

     Vere, J. (2022). Disentangling wages and consumer price inflation in Hong Kong. *Economic Letter* 2022/03, Office of the Government Economist. https://www.hkeconomy.gov.hk/en/pdf/el/el-2022-03.pdf

well as exogenous factors like the implementation of the Statutory Minimum Wage (SMW). The fourth equation relates the unemployment rate to endogenous variables such as the output gap and exogenous variables like unemployment benefits relative to wages and demographic factors. The last equation is an output equation, relating real output to labour and capital inputs. The details of the five equations are as follows.

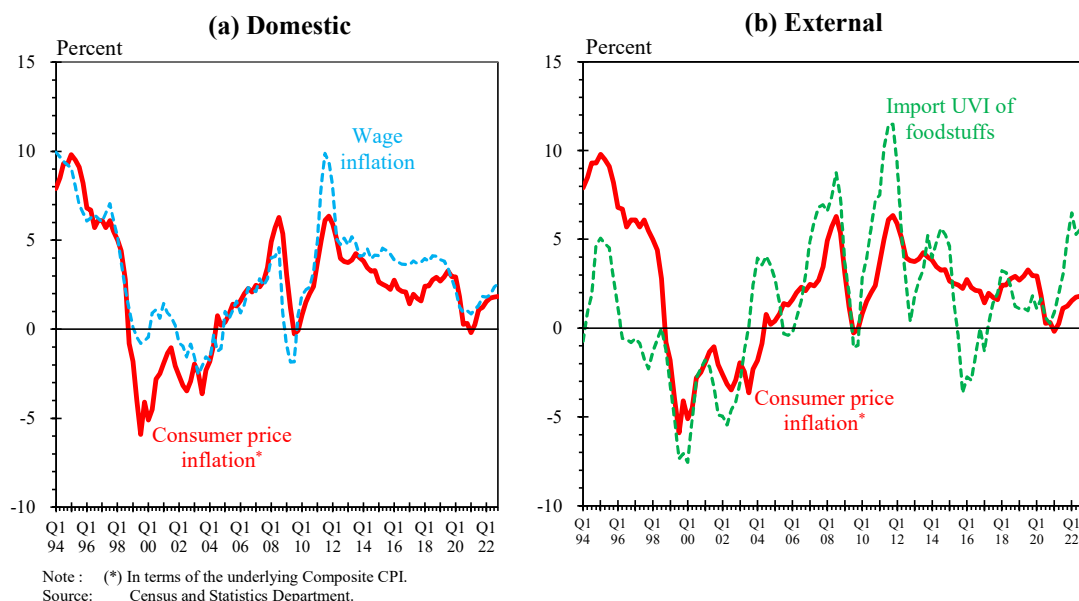**(1)   Underlying Composite Consumer Price Index (CCPI) inflation**

$$\Delta CPI = F\left(\Delta w - \Delta\left(\frac{Y}{N}\right), \quad \frac{Y}{Yp} - 1, \quad others\right) \tag{1}$$

where

ΔCPI	Refers to the rate of change in the underlying CCPI.
Δw	Refers to the rate of change in the nominal wage index.
$\Delta(Y/N)$	Refers to labour productivity growth, in which Y denotes real GDP and N denotes total employment.
Y/Y_p - 1	Refers to the output gap. Y denotes real GDP and Y_p denotes potential GDP[14].
Others	Includes overall vacancy rate of residential property flats, import unit value index (UVI) of foodstuffs, etc.

7.   The main endogenous variables in Equation (1) are wage growth in excess of labour productivity and the output gap. ***Chart 1(a)*** shows that, as expected (since workers ultimately demand compensation in real terms), wage growth *(Δw)* and consumer price inflation *(ΔCPI)* track each other over the long term. The output gap $(Y/Y_p - 1)$, which is used to gauge the current economic condition over the business cycle, is also expected to have a positive effect. As for exogenous variables, the overall vacancy rate for residential properties (*Vac*) is added, which is intended to capture the effect of private residential property rentals on consumer price inflation and hence its sign is expected to be negative. The change in the import price of food as measured by the import UVI of foodstuffs is to reflect the price pressures from external sources, with an expected positive sign (***Chart 1(b)***). As for the functional form F, it means that various forms of the explanatory variables (e.g. quarterly moving average, lag specifications, etc.) of Equations (1) to (5) will be tried when conducting the regressions, with a view to obtaining optimal specifications (with the coefficients being statistically significant and the signs being in line with economic theory).

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[14]   The potential output Y_P is derived from a separately estimated production function. Please refer to paragraphs 14 to 16 and Equation (5) for details.

Chart 1: Consumer price inflation and its underlying local and external factors

(a) Domestic

(b) External

Note :   (*) In terms of the underlying Composite CPI.
Source: Census and Statistics Department.

(2)   General inflation – GDP Deflator

$$\Delta GDPD = F\left(\Delta CPI, \quad \frac{Y}{Yp} - 1, \quad \Delta\left(\frac{P_x}{P_m}\right) \right) \qquad (2)$$

where

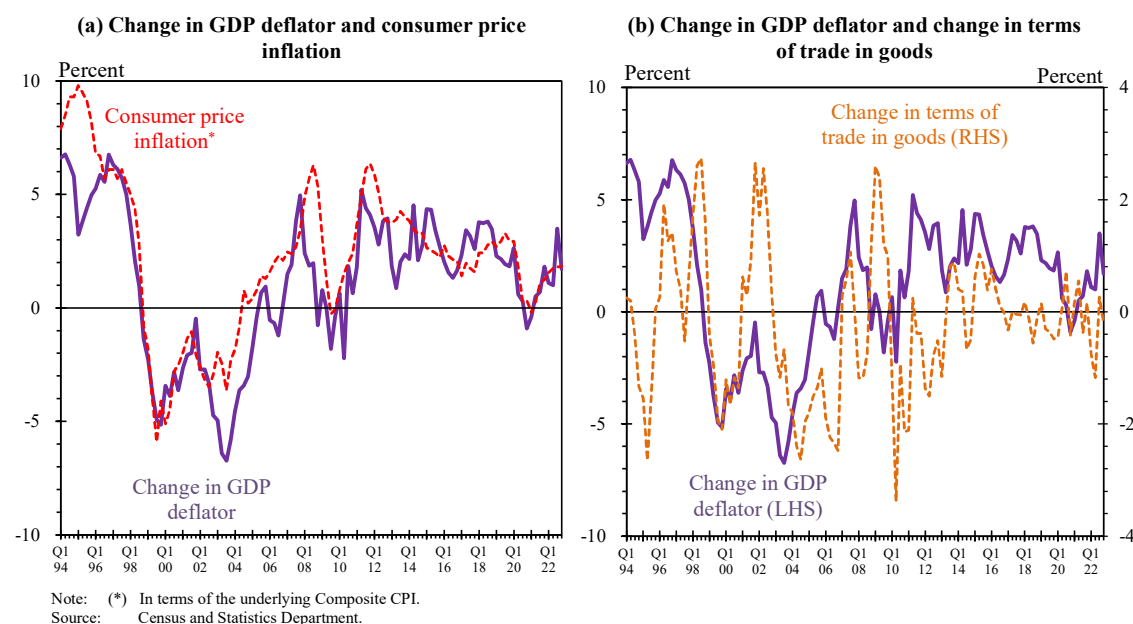|	
$\Delta GDPD$	Refers to the rate of change in the GDP deflator.
ΔCPI	Refers to the rate of change in the underlying CCPI.
$Y/Y_p - 1$	Refers to the output gap. Y denotes real GDP and Y_p denotes potential GDP.
$\Delta(P_x / P_m)$	Refers to the change in terms of trade in goods.

8.   The GDP deflator is a measure of changes in the prices of all new and domestically produced final goods and services. When estimating the change in the GDP deflator, apart from the changes in consumer price inflation and the output gap as explanatory endogenous variables, the change in terms of trade in goods (($\Delta(P_x / P_m)$) is included as an exogenous variable to capture the external trade shocks (e.g. exchange rate fluctuations), and its coefficient is expected to have a positive sign (***Chart 2***). In particular, as the net exports of goods and services (i.e. exports deducting imports) are taken into account in final GDP, the prices of exports and imports have positive and negative effects respectively on the GDP deflator[15].

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[15]   For details, please see Box 6.1 "The GDP deflator and terms of trade" of *the Third Quarter Economic Report 2007*.   https://www.hkeconomy.gov.hk/en/pdf/box-07q3-6-1.pdf

Chart 2: Movement of GDP deflator and its underlying local and external factors

(a) Change in GDP deflator and consumer price inflation

(b) Change in GDP deflator and change in terms of trade in goods

Note: (*) In terms of the underlying Composite CPI.
Source: Census and Statistics Department.

(3) Wage growth

$$\Delta \mathrm{w} = F\left(\Delta\mathrm{CPI}, \quad \mathrm{u} - u_n, \quad \Delta\left(\frac{Y}{N}\right), \quad D\_SMW \right) \tag{3}$$

where

Δw	Refers to the rate of change in the nominal wage index.
ΔCPI	Refers to the rate of change in the underlying CCPI.
$u - u_n$	Refers to the deviation of the (seasonally adjusted) unemployment rate (u) from its natural rate (u_n).
$\Delta(Y/N)$	Refers to labour productivity growth, in which Y denotes real GDP and N denotes total employment.
D_SMW	Is a time dummy, which equals 1 for the period of the implementation of the Statutory Minimum Wage (SMW) (i.e. Q2 2011 to Q1 2012) and the subsequent upratings (Q2 2013-Q1 2014, and so forth), and 0 otherwise.

9.   Apart from the expected positive relationship between consumer price inflation and nominal wages, Equation (3) captures the negative relationship between wage inflation and the deviation of the unemployment rate from its natural rate (as a measure of degree of tightness in the labour market) in the short run.   Labour productivity growth is expected to have a positive effect on wage growth by raising the marginal product of labour. As for the exogenous variable, the implementation of the SMW since May 2011 and its subsequent upratings, which are expected to have a positive impact on wage growth, are taken into account.

(4) Unemployment rate

$$u = F\left(\frac{Y}{Y_p} - 1, \ \Delta\left(\frac{w \times N}{Y \times GDPD}\right), \ \frac{CSSA}{NWI}, \ \sigma, \ c - \bar{c}, \ i - \bar{\iota}, \ Others\right) + demo\_factor \quad (4)$$

where

u	Denotes seasonally adjusted unemployment rate.
$Y/Y_p - 1$	Refers to the output gap. Y denotes real GDP and Y_p denotes potential GDP.
$\Delta\left(\dfrac{w \times N}{Y \times GDPD}\right)$	Measures the change in unit labour cost $((w \times N)/(Y \times GDPD))$.
$\dfrac{CSSA}{NWI}$	Measures the generosity of social security payments for unemployed persons.
σ	Refers to the dispersion of unemployment rate across sectors[16], which captures the extent of skills mismatch.
$c - \bar{c}, i - \bar{\iota}$	Refer to the GDP shares of consumption expenditure in domestic market (*c*) and building and construction (*i*) deviated from the corresponding long-term average ($\bar{c}$ and $\bar{\iota}$ respectively).
Others	Including *D_COVID19, D_COVID19×PCER,* and the share of non-wage labour costs to the compensation of employees.
demo_factor	Captures the impact of demographic factors (changes in labour force composition (age, gender and education level)).

10.   In Equation (4), the endogenous output gap $(Y/Yp - 1)$ as a cyclical variable is expected to have a negative impact on the unemployment rate. The coefficient of the change in unit labour cost $(\Delta((w \times N)/(Y \times GDPD)))$, another endogenous variable, is expected to be positive. With reference to prior studies[17], the ratio of CSSA payments relative to the nominal wage index $\left(\frac{CSSA}{NWI}\right)$, which captures the impact of the generosity of social security payments on unemployment, is added as an exogenous variable and its coefficient is expected to be positive. Another exogenous variable σ refers to the dispersion of the unemployment rate across sectors, which captures the extent of skills mismatch in the process of economic restructuring (***Chart 3***). Its coefficient is expected

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[16] $\sigma = \sqrt{\sum w_i \left(\frac{u_i}{\bar{u}} - 1\right)^2}$, where w_i is the labour force share of the *i*th sector.
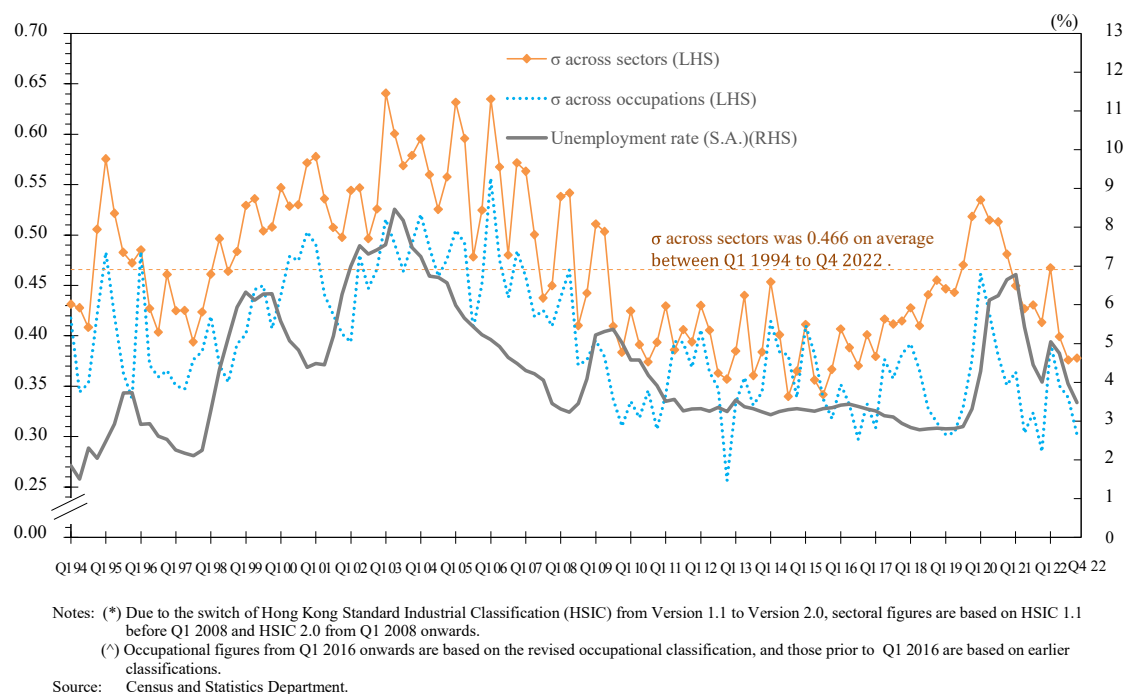
[17]   Adams and Coe (1990) regarded unemployment benefits and other factors (demographic factors, minimum wages and the degree of unionisation of the work force) as structural determinants of the unemployment rate. In addition, after reviewing the findings of other several prior studies, Szabó (2015) also concluded that more generous unemployment benefits relative to wages would increase the natural rate of unemployment.

Szabó, L. T. (2015). *Estimates of the Non-accelerating Inflation Rate of Unemployment (NAIRU) for Hungary.* MNB Working Papers No. 2015/5. https://www.econstor.eu/bitstream/ 10419/146626/1/843524685.pdf

to be positive[18].

Chart 3: The dispersion of the unemployment rate across sectors

Notes: (*) Due to the switch of Hong Kong Standard Industrial Classification (HSIC) from Version 1.1 to Version 2.0, sectoral figures are based on HSIC 1.1 before Q1 2008 and HSIC 2.0 from Q1 2008 onwards.
(^) Occupational figures from Q1 2016 onwards are based on the revised occupational classification, and those prior to Q1 2016 are based on earlier classifications.
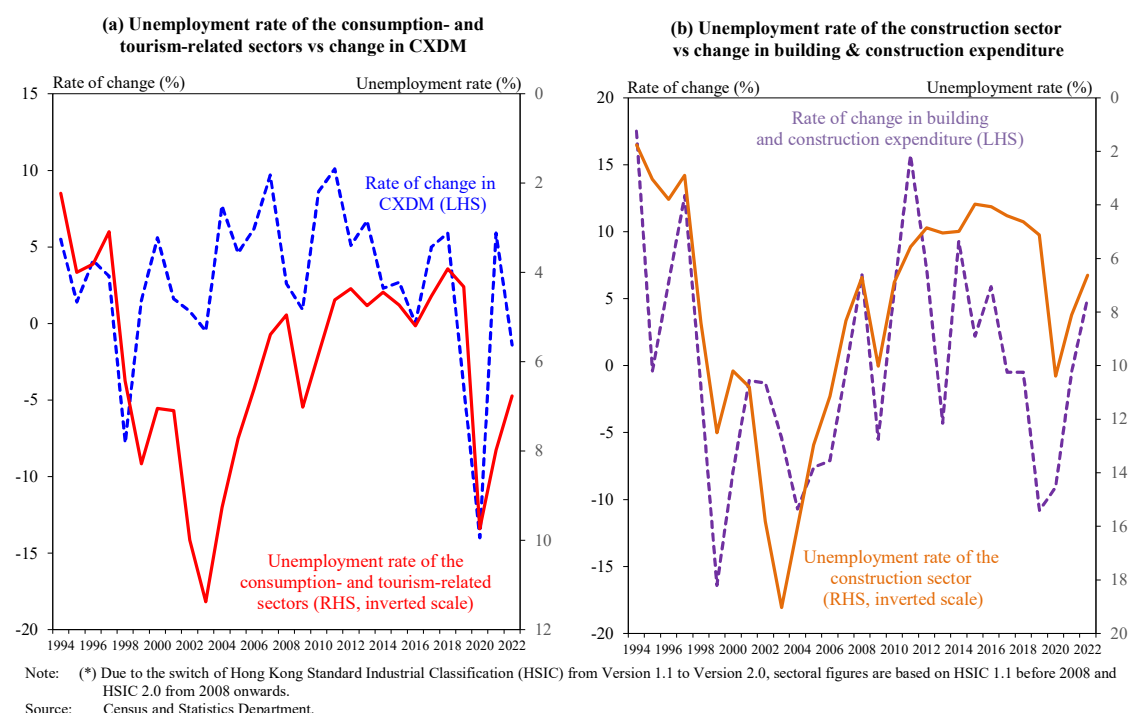Source: Census and Statistics Department.

11.   On the other hand, employment conditions of specific sectors, which are more labour intensive and employ a higher proportion of lower-skilled workers, tend to be more sensitive to the change in GDP components[19]. As shown in ***Chart 4***, the unemployment rate of consumption- and tourism-related sectors has a visible negative relationship with the changes in consumption expenditure in domestic market (CXDM), while that of the construction sector is also closely negatively related to the change in investment expenditure on building and construction. Including the deviations of the GDP shares of CXDM and building and construction expenditure from their long-term averages as exogenous variables, denoted by $c - \bar{c}$ and $i - \bar{\iota}$ respectively, is intended to capture these demand side factors' effects on unemployment rates.

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[18]   The impact of the COVID-19 was asymmetric across sectors, and the consumption- and tourism-related sectors and construction sector were particularly hit hard. As shown in ***Chart 3***, σ across sectors increased notably in Q1 2020 amid the onset of the COVID-19 epidemic, but it then largely trended downwards in 2021 and 2022 as the epidemic evolved. A similar pattern appears if the dispersion is calculated in terms of the unemployment rate across occupations.

[19]   For details, please refer to Ng (2020).
Ng, J. (2020). Relationship between sectoral employment and selected GDP components. *Economic Letter* 2020/04, Office of the Government Economist. https://www.hkeconomy.gov.hk/en/pdf/el/el-2020-04.pdf

Chart 4: Unemployment rates of selected sectors were closely related to changes in specific GDP components

(a) Unemployment rate of the consumption- and tourism-related sectors vs change in CXDM

(b) Unemployment rate of the construction sector vs change in building & construction expenditure

Note: (*) Due to the switch of Hong Kong Standard Industrial Classification (HSIC) from Version 1.1 to Version 2.0, sectoral figures are based on HSIC 1.1 before 2008 and HSIC 2.0 from 2008 onwards.

Source: Census and Statistics Department.

12.   Furthermore, an exogenous dummy variable for COVID-19 (*D_COVID19*, with expected positive sign) and its interaction term with the GDP share of private consumption expenditure (*D_COVID19×PCER*, with expected negative sign) are added to capture the impact of the sudden shock to the economy in light of the outbreak of the COVID-19 pandemic in 2020 and some recovery of the economic activities in 2021 and 2022. The share of non-wage labour costs (which include employers' contributions to provident funds and retirement funds such as Mandatory Provident Fund schemes; as well as payments in-kind like the net cost of providing housing, food, transport and other goods and services to employees) is also added, which is expected to have a positive impact on the unemployment rate as a structural factor.

13.   Separately, *demo_factor,* an exogenous structural variable*,* captures the demographic impact through changes in the age-gender-education composition of labour force[20], is incorporated. As unemployment tends to be lower among older

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[20] This follows the method illustrated in Adams and Coe (1990). In short, the impact of the demographic factors is the difference between the actual unemployment rate and the adjusted unemployed rate constructed with constant labour market shares for a given quarter (which is a weighted average of unemployment rates of various age-gender-education subgroups weighted by the corresponding share of labour force composition in 1997). 1997 is taken as the base year considering that Hong Kong's labour market worsened sharply between 1998 and 2003, along with a prolonged period of economic downturn over the period caused by the Asian Financial Crisis. Nonetheless, the effect of

workers, its sign is expected to be negative and the effect would become more pronounced in the past decade in light of continued population ageing.

(5) The production function

14.　　As noted by Adams and Coe (1990), if the natural rate of unemployment is estimated or assumed, potential output can be estimated solely based on Okun's Law, which links the gap between actual and potential output (Y - Y_p) to the gap between the actual and the natural unemployment rate (u - u_n).　However, this method does not take into account the structural determinants of labour and capital inputs, and it ignores the endogeneity of the unemployment gap (u - u_n).　An alternative is to use a production function to model output explicitly in terms of inputs, which is expressed as follows:

$$\ln(Y) = F\left(ln\left((1-u)L\right),\ ln(B),\ ln(M),\ CEPA,\ ln(\Delta Y / \overline{\Delta Y})\ \right) \tag{5}$$

where

Y	Denotes real GDP.
u	Refers to the unemployment rate.
L	Refers to the total labour force.
B	Refers to occupied building stock.
M	Refers to machinery stock.
CEPA	Is a variable for the Mainland and Hong Kong Closer Economic Partnership Arrangement (CEPA), which equals 0 through 2004, 1 in 2005, and 2 in 2006 and later.
$ln(\Delta Y / \overline{\Delta Y})$ and lags of $ln(\Delta Y / \overline{\Delta Y})$	Proxies for the overall intensity of usage of factor inputs[21]. ΔY is the annual rate of change in Y, and $\overline{\Delta Y}$ is the 11-year centred moving average of the rate of change.

A series of geometrically distributed lag values of $ln(\Delta Y / \overline{\Delta Y})$ is added,　i.e. $\left(\frac{1}{\sum_{i=1}^{CL}(i)}\right) \sum_{i=1}^{CL}\left((CL - i + 1) \times lag\ (i)\ of\ ln(\Delta Y / \overline{\Delta Y})\right)$ and CL denotes the no. of lag terms chosen.

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demographic factors registered a similar trend over the study period no matter which year is chosen as the base year.

[21]　Measures of intensity of usage in the production function are included because some unexpected variations in output can be absorbed in the short run by adjusting the usage intensity of the factor inputs instead of aggregate labour and/or capital inputs.

15.   Quarterly potential output is obtained from the estimated parameters of Equation (5)[22], assuming full employment and also normal usage intensity of factor inputs, i.e. when the unemployment rate is at its natural rate [23] and $\Delta Y / \overline{\Delta Y} = 1$.   The resulting output gap based on estimated potential GDP is then incorporated as an input variable into the above structural equation model (Equations (1) to (4))[24]. By definition, the NAIRU corresponds to the situation when wage growth and inflation are both steady (i.e. non-accelerating), while GDP is at its full potential level, net of all cyclical factors. Applying the above conditions, the NAIRU can be estimated.

16.   Since the NAIRU is an input variable through $\left((1 - u_n) \times L\right)$ in the production equation for estimating potential GDP while the resulting output gap is incorporated into the structural model to derive the NAIRU, an iterative procedure is carried out until the resulting estimates of the NAIRU and the output gap converge in successive runs.

III.   REGRESSION RESULTS

17.   The estimated coefficients of Equations (1) to (4) based on the three-stage least squares method are shown in ***Table 1***. ***Annex Chart 1(a)-(d)*** on actual and simulated values of dependent variables indicate that the model as a whole is able to capture the past trend quite well, while the coefficients of explanatory variables are statistically significant and their signs are in line with economic reasoning as described in **Part II**.

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[22] The production function is estimated using data from 1985 to 2022. The estimated parameters are all correctly signed (corresponding *t-statistics* are in parentheses):

	ln(L)	ln(B)	ln(M)	CEPA	$\ln(\Delta Y / \overline{\Delta Y})$	Lags of $\ln(\Delta Y / \overline{\Delta Y})$
ln (Y)	0.1627	0.4946	0.2035	0.0104	0.8261	5.0615
	(3.140)	(5.464)	(6.258)	(7.419)	(42.335)	(20.848)

   The autoregressive lag terms of ln(Y) have been incorporated into the estimation.

[23] To derive the output gap first, a certain start value for the natural rate of unemployment will be assumed.

[24] The estimated coefficients in footnote 22 will be multiplied with the corresponding quarterly variables to estimate the quarterly potential output.

Table 1: Regression results of Equations (1) to (4)

| Variables	(1) ΔCPI	(2) $\Delta GDPD$	(3) Δw	(4) U
ΔCPI		0.6438 (9.401)	0.5309 (10.090)	
Change in unit labour cost $(\Delta w - \Delta GDPD - \Delta(Y/N))$				0.1560 (7.086)
Δw	0.1828 (3.282)			
$u - u_n$			-0.2408 (-2.606)	
Change in labour productivity $(\Delta(Y/N))$	-0.1828 (-3.282)		0.4558 (7.043)	
Output gap $((real\ GDP/potential\ GDP) - 1)$	0.2723 (9.056)	0.1430 (3.442)		-0.1454 (-6.484)
Overall vacancy rate	-0.0096 (-4.587)			
Change in import price of food	0.1509 (3.661)			
Change in terms of trade $(\Delta(P_x/P_m))$		0.3198 (7.869)		
Dummy for SMW and uprating			0.0197 (4.923)	
CSSA/nominal wage index				0.0064 (1.723)
σ (dispersion of unemployment rates across sectors)				0.0406 (3.377)
$c - \bar{c}$				-0.1076 (-5.038)
$i - \bar{\iota}$				-0.0011 (-8.816)
Dummy for COVID-19				0.2342 (4.439)
Dummy for COVID-19*PCER				-0.3389 (-4.259)
Non-wage labour cost				0.7202 (4.485)
R-squared	0.8745	0.7997	0.8345	0.8584

Notes: Figures in parentheses refer to t-statistics.
A time dummy for the Asian financial crisis is added in Equation (1), a time dummy for 2013 is added in Equation (2), and a time dummy for 2003 SARS is added in Equation (4).

IV.   NAIRU ESTIMATES

18.   Applying the steady state conditions[25] to the regression model, we can obtain the estimated NAIRU as shown in **Chart 5**[26].

Chart 5: NAIRU estimates from 1994 to 2022 (annual average)
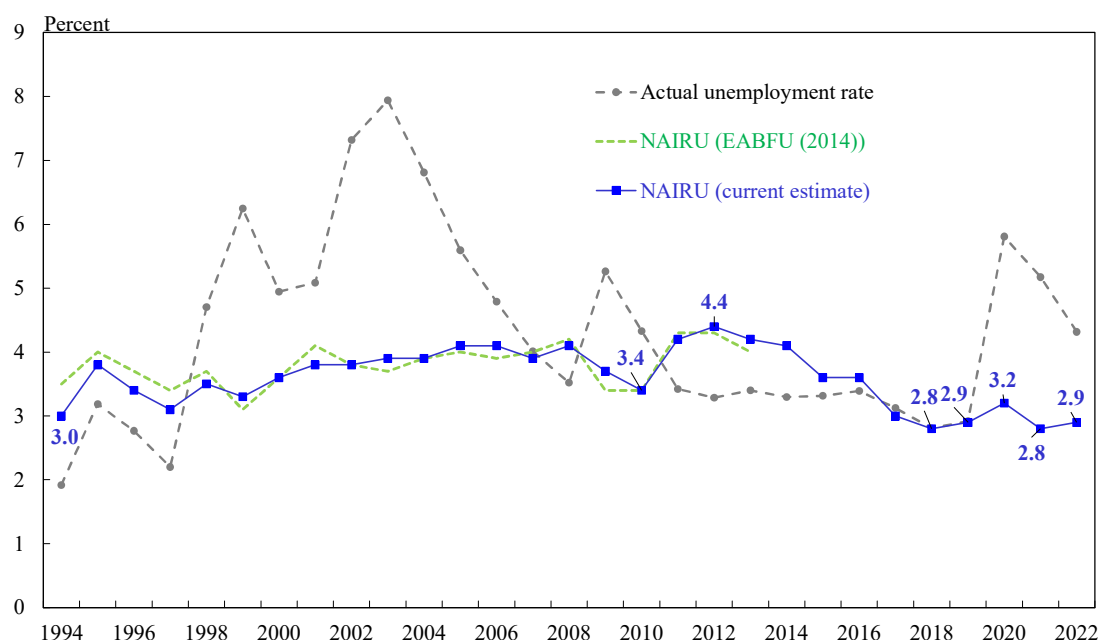
19.   While the estimated NAIRU held largely stable from 1994 to 2010, averaging 3.7% over this period, it rose in the following two years to 4.4% in 2012. This was mainly due to the implementation of the SMW and the higher share of non-wage labour

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[25] $\Delta CPI_t = \Delta CPI_{t-1}; \Delta GDPD_t = \Delta GDPD_{t-1}; \Delta w_t = \Delta w_{t-1}; u_t = u_n; Y_t = Y_p;$

$N_t = N_p = L_t(1 - u_n); VAC_t = \overline{VAC}, \text{i.e. long} - \text{term average}; \Delta\left(\frac{P_x}{P_m}\right) = 0;$

c = 10-year moving average of the GDP share of CXDM and i = 10-year moving average of the GDP share of building and construction expenditure.

[26]   As illustrated in **Part II**, the effect of demographic factors (changes in the composition of labour force by age, gender and education level) is separately estimated and incorporated directly (the difference between the actual and demographically adjusted unemployment rate) into the structural model. As shown in **Annex Chart 2**, along with the persistent population ageing in Hong Kong, the effect has become increasingly negative over time.   The more significant effects in 2020-2022 were mainly attributable to more visible decline in labour force of youths aged 15-24 and hence the smaller shares to the total labour force over the period. This was likely due to the distortion caused by the COVID-19 pandemic and other issues at that time. Nonetheless, labour market conditions continued to improve through most of the course in 2022 amid the receding epidemic, with the seasonally adjusted unemployment rate falling from the high of 5.5% in Feb - Apr 2022 to 2.9% in Q2 2023. The distortion should therefore be temporary in nature and gradually disappearing. In this connection, the effect of the demographic factors for the period of 2020-2022 is set to follow the trend before the epidemic when estimating the NAIRU over the period.

costs in private sector's compensation of employees. As discussed in Adams and Coe (1990), if increases in non-wage labour costs are not offset by wages, this would lower employers' profits but raise the NAIRU along with the increase in total compensation to employees[27]. Given that the actual unemployment rate remained low in 2012 (3.3%) and the ensuing years (it ranged from 2.8% to 3.4% during 2013-2019), this suggests that the labour market could quickly absorb the upward pressure of SMW-related factors.

20.   The NAIRU estimates then fell gradually to 2.8% in 2018 and hovered around 3% in the ensuing years. One contributory factor was that the ratio of CXDM to real GDP largely saw increases over the period as compared to 10 years ago. For instance, the share of CXDM to real GDP was 71.1% in 2013 and stayed at around 70% up to 2019, higher than that in 2003 (60.6%) and the average over 2003-2009 (about 60%) by around 10 percentage points. This was partly related to the higher ratio of expenditure on consumer goods to real GDP and partly due to the higher ratio of expenditure of non-residents in the domestic market to real GDP (amid the expansion in inbound tourism after the extension of the Individual Visit Scheme under CEPA) than their respective ratios 10 years ago. As discussed in paragraph 11, the increase in demand for consumer goods and services in the domestic market would induce the expansion of related labour intensive sectors such as the retail, accommodation and food services sectors[28], in which employers would thereby be willing to hire more staff[29]. Separately, another contributory factor was the decreasing share of non-wage labour costs to the private sector's compensation of employees, mainly due to the relatively smaller increase (as compared to wage growth) or even decline in employers' costs in providing in-kind benefits (including housing, food, transport and other goods and services) to employees.

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[27] Adams and Coe (1990) further explained that increases in non-wage labour costs might bring about higher unemployment (NAIRU) when inflation is to be kept stable given that employers may be less willing to hire in light of lower profits / profit expectations and may spend more time to screen suitable job candidates in order to avoid hiring those who were likely to stay with the firm for a relatively short time. This would tend to increase frictional unemployment.

[28] For instance, the consumption- and tourism-related sectors hired 5.3 employees per one million dollar of value added in 2021, which was much higher than the ratio of 1.3 for the economy as a whole.

[29] The number of employed persons engaged in the retail, accommodation and food services sectors increased by 7.2% from Q2 2012 to Q2 2019.

V.   CONCLUSION

21.   This article estimates the NAIRU from 1994 to 2022 based on a structural regression model. The estimation results show that the NAIRU was broadly stable during 1994-2010, with an annual average of 3.7%, before rising to 4.4% in 2012. The NAIRU then declined gradually to 2.8% in 2018 and hovered around 3% in the ensuing years. The downward movement was, to a certain extent, attributable to a higher share of consumption expenditure in the domestic market to real output in the recent decade. Moreover, the lower share of non-wage labour costs (mainly reflected in employers' costs in providing in-kind benefits to employees) to the private sector's compensation of employees also played a role.
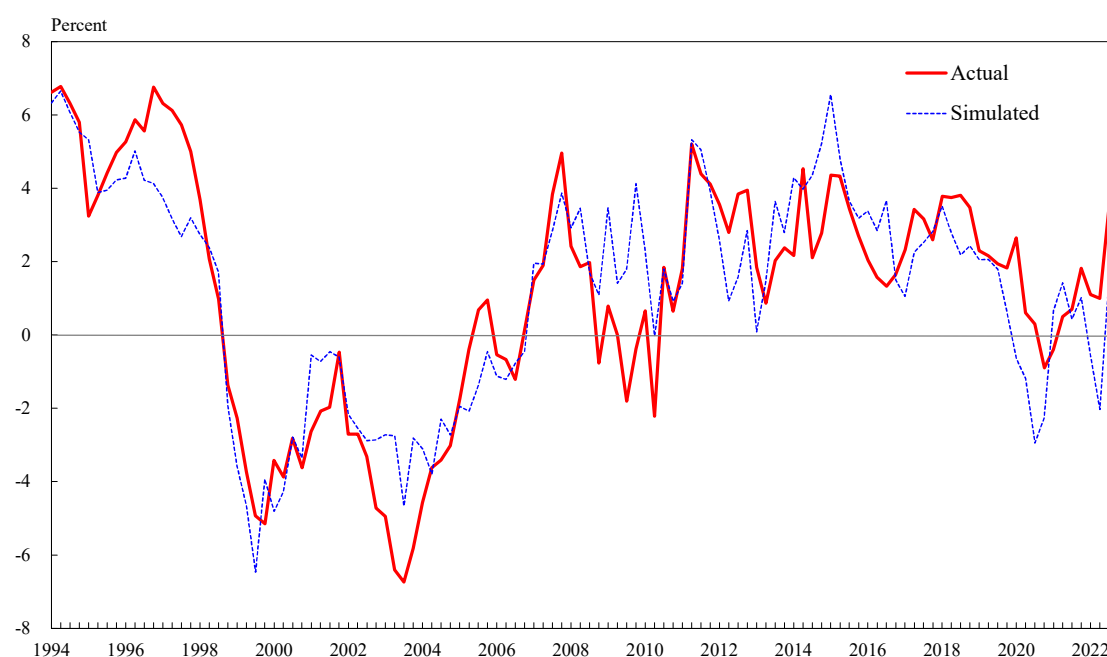

ANNEX

Annex Chart 1a: Change in CCPI: Actual vs simulated
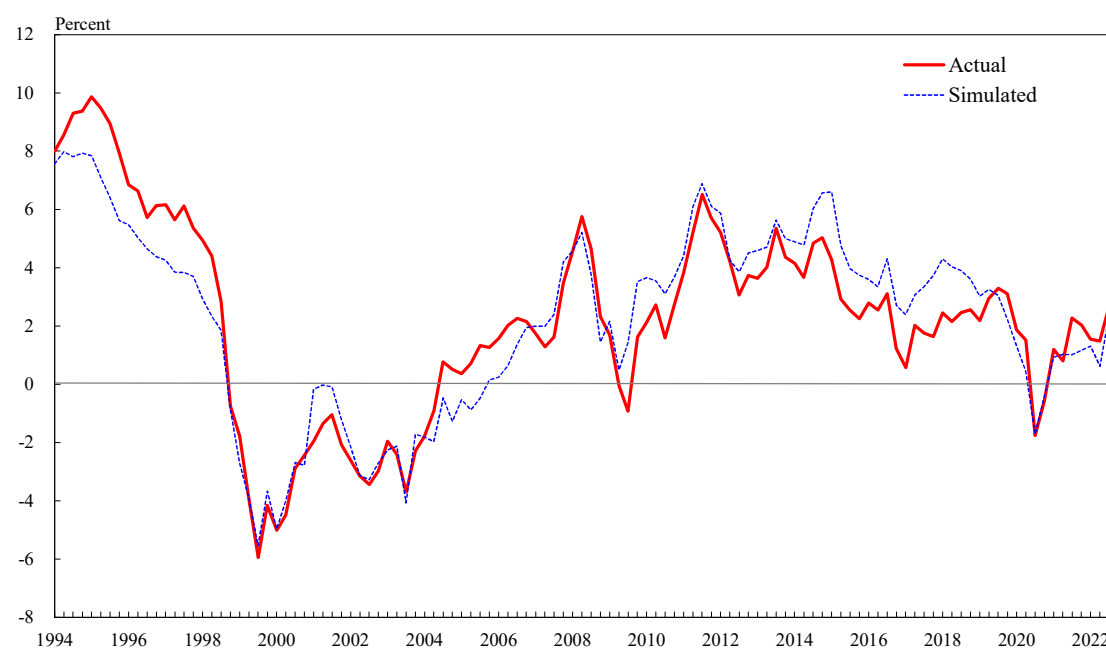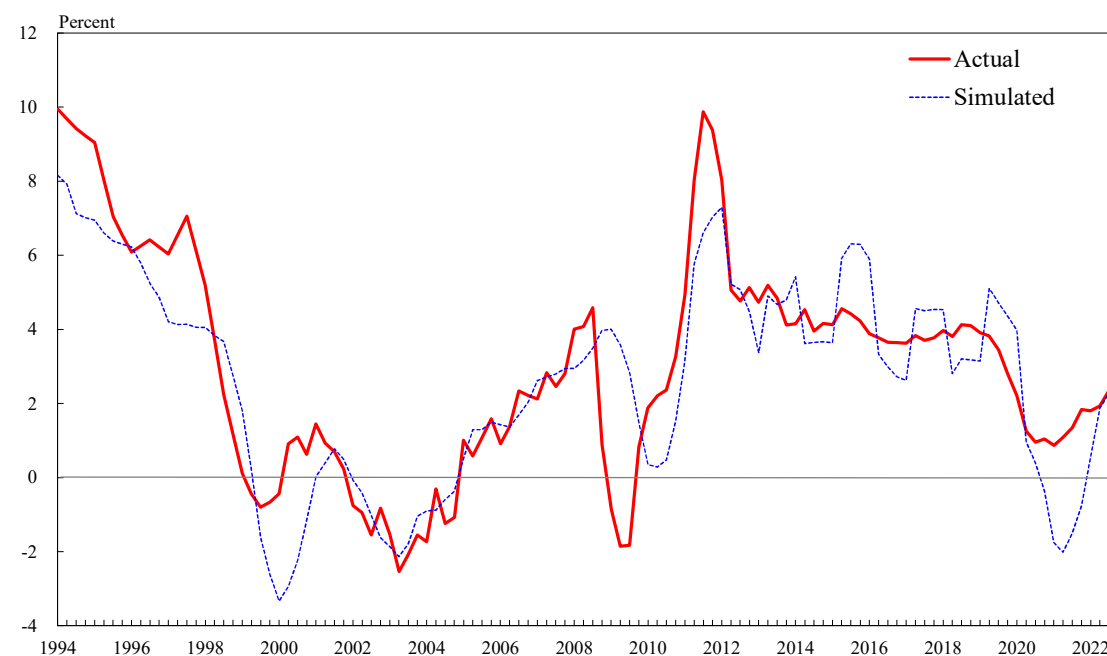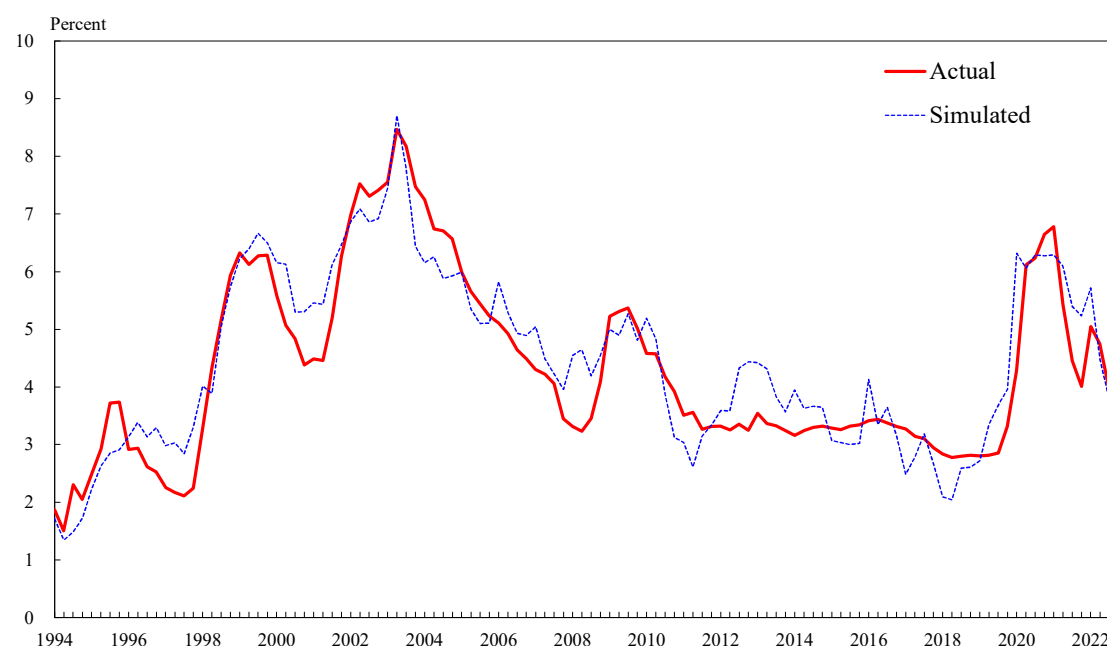
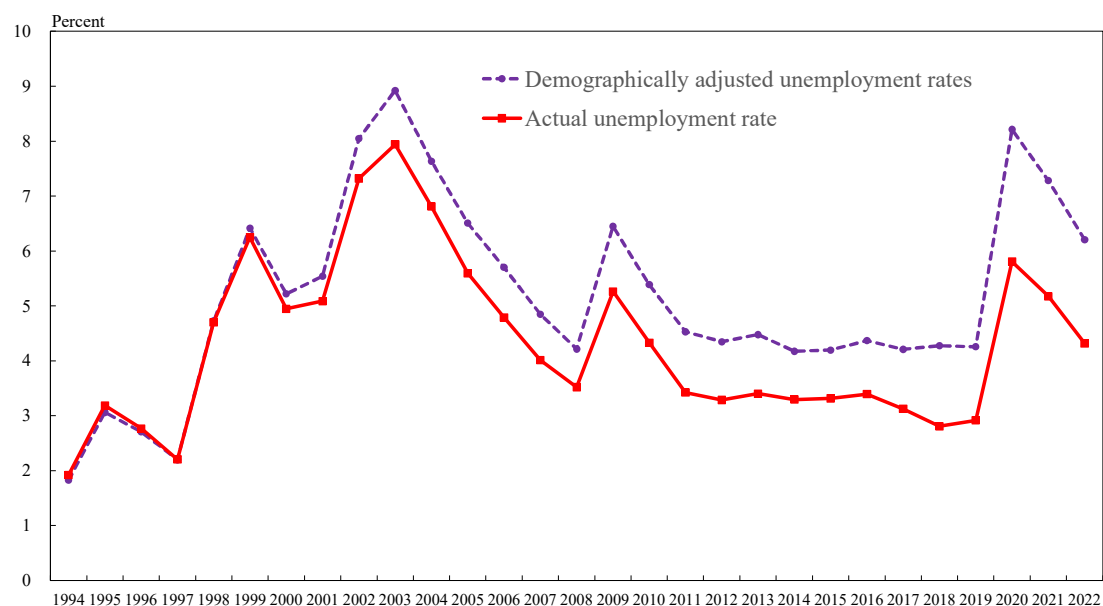**Annex Chart 1b: Change in GDP deflator: Actual vs simulated**

Annex Chart 1c: Wage growth: Actual vs simulated

Annex Chart 1d: Seasonally adjusted unemployment rate: Actual vs simulated

Annex Chart 2: The actual and demographically adjusted unemployment rate

Note: The adjusted unemployed rate for a given quarter is compiled by standardising the composition of labour force by the demographic factors concerned in that quarter to the corresponding composition in 1997.