Inflation and Cost of Living in Singapore and Asia:
Post-Pandemic Implications

Thursday April 29, 2021, 9:00 a.m. – 12 noon

Welcome and Opening Remarks 9:00 a.m. – 9:15 a.m.

Mr. Stephan Danninger was appointed Director of the IMF – Singapore Regional Training Institute in August 2017. Prior to taking on the position, he worked for 17 years at the IMF headquarters in Washington D.C. During this period, he led projects and teams in various capacities, including the macroeconomic analysis and forecast for Germany, Japan and the United States. He also worked in the IMF’s Research Department and published in various academic journals on topics related to growth, inflation, trade, fiscal policy, financial spillovers and labor market issues. Mr. Danninger is an Austrian national and holds a PhD in Economics from Columbia University, New York.

Mr. Edward Surendran Robinson is Deputy Managing Director of the Economic Policy Group (EPG) and Chief Economist, MAS. He currently heads the EPG which formulates Singapore’s monetary policy and conducts macro-financial surveillance. The Group also undertakes research on broader economic and financial issues facing the domestic and external economies. He has a particular interest in macroeconometric modeling and continues to be engaged in the developmental work for the suite of MAS models, which are used for both price and financial stability analysis. He has also been involved in other areas of economic policy work including in various inter-governmental work groups and served as a Board Member of the Competition Commission of Singapore.

Session 1: Inflation in Industrial Economies 9:15 a.m. – 10:30 a.m.
Moderated by Mr. Stephan Danninger

Dr. Aurobindo Ghosh is an Assistant Professor of Finance Education at the Lee Kong Chian School of Business in Singapore Management University. Dr Ghosh is the Program Director for the Citi-SMU Financial Literacy Program for Young Adults leading the development, design, digitization and gamification of learning content development in Financial Literacy.

As the Founding Principal Investigator and Creator for the DBS-SKBI Singapore Index of Inflation Expectations (SInDEx), Asst Prof Ghosh conceptualized and developed the Behaviorally Adjusted CPIEx indices of Inflation Expectations in research collaboration with the Monetary Authority of Singapore supported by DBS. He has published and won awards for theoretical and applied academic research and Business Case Studies in different areas in Financial Economics. He is an editor of a forthcoming book on Managing Complexity and Covid19: Life, Liberty Or the Pursuit of Happiness. Asst Professor Ghosh is a frequent commentator on financial economic news and inflation and has been featured in various print and electronic news outlets.

Mr. Thomas Lam has approximately two decades of experience in the financial industry, with expertise ranging from covering the global economy, deciphering financial markets, including macro forecasting, to advising on investment strategy. He commenced his career in New York, initially at a large money-center bank and then at a hedge fund. Thereafter, Tom joined a banking institution in Singapore as a senior economist, positioning traders for high-frequency adjustments and guiding upper management on longer-term strategy. Subsequently, as chief economist at a financial institution, he established a global-focused research team, tending to a broad array of buy-side clients regionally and contributing to the investment banking business. He is currently a principal researcher at Sim Kee Boon Institute for Financial Economics, a think-tank within Singapore Management University.

Tom has been ranked consistently among the world’s top five most accurate economists on forecasting the US economy overall by Bloomberg from 2013 through April 2017 (placed third, last published). Formerly, he was also recognized as the second best US forecaster worldwide during the Global Financial Crisis. Additionally, he has been widely publicized as one of “Wall Street’s Most Prophetic Economists”. Moreover, he was exclusively identified by Bloomberg to have accurately predicted the onset of the 2009 US recovery 16 months ahead of the official announcement.
DBS-SKBI Singapore Inflation Expectations (SInDEx) Survey (2011-2021): 10 Years of Inflation Expectations*

Dr. Aurobindo Ghosh
Asst Prof of Finance Education and Principal Investigator, DBS-SKBI SInDEx
Lee Kong Chian School of Business
SINGAPORE MANAGEMENT UNIVERSITY

Primer on Inflation Expectations

• **Inflation expectations form a key influence** that affect the behavior of households, businesses and consequently the decision of the policymakers in designing economic policies to “nudge” behavior of investment and consumption.

• The major hurdle in **controlling inflation is its measurement and expectations**. It is now widely accepted by both academic and practice professionals that survey-based measures play an important role in such policy analysis among others.

• However, the **major shortcomings of survey-based measures are personal perceptions** can get swayed due to different factors.

• We want to identify such factors to evaluate how to better understand **how consumers and businesses make decisions** vis-à-vis their expectations of inflation, to help influence policy.
**DBS-SKBI SInDEx: Why do policymakers need a Measure for Inflation Expectations of Consumers?**

- **DBS-SKBI Singapore Index of Inflation Expectations (SInDEx)** started in 2011 in collaboration with SMU-SKBI and other private partners, subsequently funded by MOE Tier 1 Grant under Assistant Professor Aurobindo Ghosh at LKCSB, SMU before SKBI and DBS co-funded it in 2019.

- The **ONLY index of its kind** in Singapore and in its 10th year. SMU research team partnered with researchers in **MAS and Behavioral Insights Team** to update the questionnaire to address any improvements that can be made.

- **Effective and well “anchored” monetary policy depends on future expected inflation** based on model and survey-based measures. However, **effective communication** is quite challenging (Bernanke, 2007)

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**Results from the 39th wave of the DBS-SKBI SInDEx Survey: One-Year-Ahead Expectations**

<table>
<thead>
<tr>
<th></th>
<th>March 2021</th>
<th>December 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPIEx</td>
<td>2.7</td>
<td>2.3</td>
</tr>
<tr>
<td>CPIEx Core</td>
<td>2.7</td>
<td>2.5</td>
</tr>
<tr>
<td>SInDEx1</td>
<td>2.7</td>
<td>3.3</td>
</tr>
<tr>
<td>Subgroup Core</td>
<td>2.6</td>
<td>2.1</td>
</tr>
</tbody>
</table>

- In Mar 2021, CPIEx Inflation Expectations (Headline) inched up to 2.7% from 2.3% in December 2020
- This is **lower than longer term average of 3.4% (2012-2018)**
- **CPIEx Core Inflation Expectations** (w/o accommodation and private road transport) **was 2.7% in Mar 2021** (compared to 2.5% in Dec 2020)
- As a comparison **subgroup who owns accommodation and use public transport**, effectively face core inflation, polled 2.6 in Mar 2021 (from 2.1 in Dec 2020). **SInDEx1**, a composite index, also inched up to 2.6 from 2.1 in Dec 2020.
Results from the 39th wave of the DBS-SKBI SInDEx Survey: Five-Year-Ahead Expectations

<table>
<thead>
<tr>
<th>CPIEx</th>
<th>March 2021</th>
<th>December 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPIEx</td>
<td>3.4</td>
<td>3.2</td>
</tr>
<tr>
<td>CPIEx Core</td>
<td>3.3</td>
<td>3.1</td>
</tr>
<tr>
<td>SInDEx</td>
<td>3.3</td>
<td>3.1</td>
</tr>
</tbody>
</table>

- In Mar 2021, Five-year-ahead CPIEx Inflation Expectations (Headline) inched up to 3.4% from 3.2% in December 2020.
- This is lower than longer term average of 4.2% (2012-2018).
- CPIEx Core Inflation Expectations (w/o accommodation and private road transport) was 3.3% in Mar 2021 (compared to 3.1% in Dec 2020).
- As a comparison benchmark, a composite index with lower weights for more volatile components SInDEx polled 3.3 in Mar 2021 (from 3.1 in Dec 2020).
**DBS-SKBI SInDEx: What are the drivers of bias?**

- Median One-Year-Ahead Inflation Expectations is **higher** for individuals who are married, citizens, high real estate expectations, high current inflation, feels higher uncertainty, higher future investment in equity, while **lower** for those who are older, unemployed, longer stay, makes decisions, follow media and expect increment.

- Additionally, the bias measured by difference of median expectation between individuals and experts (SPF) is affected by age (-), marriage (+), citizen (+), length of stay (-), decision maker (-), expect increment (-), high real estate (+), current inflation (-), uncertainty (+), future investment (+) and unemployment (-).

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**Sample Questions for Reducing Bias:**

The charts below show quarterly data on inflation and GDP growth rates of the Singapore economy since 2012.

Please review the charts in Figures 1-3 and together with any other information that you might know or heard, give us your best guess for the following annualized rates for Quarter 1 2019 (one-year-ahead average January-March 2019) and for Quarter 1 2023 (five-year-ahead average January-March 2023) in the space provided, in percentage terms.

a) 1-year-ahead Headline CPI All Item Rate [______]%
b) 1-year-ahead Inflation less Housing and Pvt Road Transport [______]%  
c) 1-year-ahead ahead Food Inflation [______]%

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*Source MAS, DOS*
### Behaviorally Adjusted CPIEx and Components

- When we adjust for behavioural biases, we see an uptick in inflation expectations, both in raw (reported) and trimmed median (response<10%) expectations.

- Overall Mar 2021 estimates give
  - Adj. CPIEx at 3.0, same as December 2020.
  - Adj. CPIExCore at 3.0, slight increase from Dec 2020.

- When aggregated for components, Wtd. Adj. CPIEx drops to 3.1% which is slightly lower than Dec 2020, whereas the Wtd. Adj. Core to 3.2% slightly higher from Dec 2020.

### Inflation Component

<table>
<thead>
<tr>
<th>Inflation Component</th>
<th>Raw Median</th>
<th>Trimmed Median</th>
<th>Weights (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food</td>
<td>3.00</td>
<td>2.00</td>
<td>21.1</td>
</tr>
<tr>
<td>Transport</td>
<td>3.00</td>
<td>2.00</td>
<td>17.1</td>
</tr>
<tr>
<td>Housing/Utils</td>
<td>3.00</td>
<td>2.00</td>
<td>24.8</td>
</tr>
<tr>
<td>Healthcare</td>
<td>4.00</td>
<td>3.00</td>
<td>6.6</td>
</tr>
<tr>
<td>Education</td>
<td>3.00</td>
<td>2.00</td>
<td>6.6</td>
</tr>
<tr>
<td>Recreation</td>
<td>4.00</td>
<td>2.00</td>
<td>7.9</td>
</tr>
<tr>
<td>Clothing &amp; footwear</td>
<td>3.00</td>
<td>2.00</td>
<td>2.1</td>
</tr>
<tr>
<td>Household durables/services</td>
<td>3.00</td>
<td>2.00</td>
<td>4.9</td>
</tr>
<tr>
<td>Communications</td>
<td>3.00</td>
<td>2.00</td>
<td>4.1</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>4.00</td>
<td>2.30</td>
<td>4.8</td>
</tr>
<tr>
<td>Adj CPIEx1</td>
<td>3.00</td>
<td>2.00</td>
<td>100</td>
</tr>
<tr>
<td>Wtd. Adj. CPIEx1</td>
<td>3.11</td>
<td>2.08</td>
<td>100</td>
</tr>
<tr>
<td>Adj. Core CPIEx</td>
<td>3.00</td>
<td>2.00</td>
<td>100</td>
</tr>
<tr>
<td>Wtd. Adj. Core CPIEx</td>
<td>3.17</td>
<td>2.12</td>
<td>100</td>
</tr>
</tbody>
</table>

Perceived impact of Covid19 on Healthcare Inflation

We find that there has been some impact on healthcare inflation, **average seem to have no impact in September 2020 (left) and but a positive impact March 2021 (right). We do not find any change healthcare in consumption basket due to Covid19 disruptions (Cavallo, 2020).**

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Impact of Covid19 on Food and consumption basket

We find that there has been a divergent impact on food prices, even though average seem to have no impact between September 2020 (left) and March 2021 (right). We also do not find any change in food in consumption basket due to Covid19 supply dislocations, even though transport, recreation and culture and footwear and clothing baskets reduced to a limited extent temporarily in Sep 2020 (Cavallo, 2020).

DEEPER LOOK AT CONSUMER PRICE INDEX (CPI):

The Laspeyre's index (Laspeyre, 1871) is given by

\[ CPI_i = \frac{\sum_{j=1}^{n} p_{0j}q_{0i}}{\sum_{j=1}^{n} p_{0j}q_{0j}} = \frac{\sum_{j=1}^{n} p_{0j}q_{0i}}{\sum_{j=1}^{n} p_{0j}q_{0j}} \]

where for the \( i \)th commodity or service the prices \( p_{0i} \) and the quantities \( q_{0i} \) are for the current (period \( k=1 \)) and base periods (\( k=0 \)).

\[ s_{0i} = \frac{p_{0i}q_{0i}}{\sum_{j=1}^{n} p_{0j}q_{0j}} \]

is the expenditure weight of the \( i \)th item in price and quantity at period 0, the reference period.

Diewert (1987, p. 6231) also claims that both the Laspeyre's and the Paasche indices (Paasche, 1874) can “...approximate the superlative indexes to the first order at an equal price and quantity point...”

- Laspeyre’s index over estimates the true CPI
- Paasche’s index under estimates the true CPI
- Fisher’s “ideal index” (geometric mean of Laspeyre’s and Paasche’s index) was proposed and was proved to be a superlative and exact index (Diewart, 1976, 1987)

Assumptions as a Cost of Living index:

- Quantities remained unchanged even when the prices change
- This violated the law of demand (ceteris paribus) unless the demand was goods is inelastic (which is true for some components overall but not all)
- In the context of CPI constructed in Singapore (DOS, 2019), this assumption of inelastic demand is not sustainable for over 600 items, 6800 brands of items or for 140 items in Economic Intelligence Unit (EIU WCOL)
**True Index of Cost-of-Living**

- True index of cost of living can be obtained by dividing the cost of living at one period by the cost of living in the other period, provided the standard of living (or the general status of want-satisfaction or utility) remains the same for the family (Konus, 1939).

- This index shows the relative change occurring in the monetary cost of those consumers' goods which are necessary for the maintenance of a certain standard of living (Konus, 1939).

- Simplifying assumption: The cost-of-living index is more of an **economic** interpretation rather than a statistical one.

- Main assumption is that the consumption of goods and services reacts continuously due to changes in prices and the pattern of change in quantity consumed is stable (ergodic) and changing geometrically over time between two surveys of household expenditures.

- Under the simplifying assumption, relative cost of living is the ratio if the expenditures on two baskets that give similar levels of satisfaction.

- Hence, we propose a more encompassing and dynamic measure of inflation as a cost of living where we address the changing consumption patterns over time in response to changes in price (Aoki and Kitahara 2010 and Sutoris, 2020).

**Framing Cost of Living as a weighted index:**

\[
CLI_t = \frac{\sum_{i=1}^{n} \sum_{j=1}^{k} p_i q_{ti} / \sum_{j=1}^{k} p_i q_{tj}}{\sum_{j=1}^{k} p_j q_{tj}} = \frac{\sum_{i=1}^{n} \sum_{j=1}^{k} p_i q_{ti} k_{01i} / \sum_{j=1}^{k} p_j q_{tj}}{\sum_{j=1}^{k} p_j q_{tj}}
\]

where \(k_{01i}\) is the ratio of the quantity consumed in the current period and the base period.

- As attractive as it may seem to look at the formula, it is nearly impossible to calculate unless we have the exact composition of the basket every year, in particular the quantities of goods and services consumed.

However, to make it operational, we will replace the \(k_{01i}\) with an approximation with the assumption that quantities of good consumed changes geometrically over the duration between two periods of the household economic survey in 2014 and 2019 (HES 2017/2018).

\[
CLI_t = \frac{\sum_{i=1}^{n} \sum_{j=1}^{k} p_i q_{ti} / \sum_{j=1}^{k} p_i q_{tj}}{\sum_{j=1}^{k} p_j q_{tj}} = \frac{\sum_{i=1}^{n} \sum_{j=1}^{k} p_i q_{ti} k_{01i} / \sum_{j=1}^{k} p_j q_{tj}}{\sum_{j=1}^{k} p_j q_{tj}}
\]

where \(k_{0m} = \left(\frac{q_{ti}}{q_{t0}}\right)^m\) and \(m = 1, 2, 3, 4, 5\) is the number of years after the base year.
How does the CLI relate to the CPI?

\( \hat{k}_{01i} \) is fixed for all commodities or services, then the average value \( \hat{k}_{01i} \), say \( \hat{k}_{01} \), or more precisely \( \hat{k}^m_{01i} \), \( m=1,2,3,4,5 \) depending on number of years after the base year can be used as a rate multiplier of the CPI to get the CLI, this would be the average ratio of the quantity indices for period 0 and 1. In that case, we have the following relationship

\[
CLI = \frac{\sum_{i=1}^{n} p_i q_{i0}}{\sum_{j=1}^{m} p_{0j} q_{0j}} = \frac{\sum_{i=1}^{n} p_i q_{i0} \hat{k}^m_{01}}{\sum_{j=1}^{m} p_{0j} q_{0j}}
\]

\[
= \sum_{i=1}^{n} \frac{p_i}{p_{0i}} \left[ \frac{p_{0i} q_{0i} \hat{k}^m_{01}}{\sum_{j=1}^{m} p_{0j} q_{0j}} \right] = \hat{k}^m_{01} \sum_{i=1}^{n} \frac{p_i}{p_{0i}} \left[ \frac{p_{0i} q_{0i} \hat{k}^m_{01}}{\sum_{j=1}^{m} p_{0j} q_{0j}} \right]
\]

\[
= \hat{k}^m_{01} CPI_L,
\]

where \( \hat{k}^m_{01} = \left( \frac{q_i}{q_{0i}} \right)^{0.2m} = \hat{k}^m_{01} \)

and \( m = 1,2,3,4,5 \) is the number of years after the base year.

**DATA: Estimating the CPI-All Item and the Cost-of-Living Index (CLI)**

- Price data available through the Economic Intelligence Unit (EIU) City database that includes the prices from 2010 onwards
- Two sets of price data are available: supermarket and mid-priced store: we conclude from the results that the mid-priced store prices reflect market more accurately
- Weights are calculated using 2017/18 HES for CPI and CLI calculation
- As we do not have the most current value of \( k_{01} \), we will be using the proxy which is the ratio of the commodities between subsequent Household Economic Surveys (HES, 2017/18 and 2012/13)
THANK YOU!

Inflation in Industrial Economies

Thomas Lam*
Sim Kee Boon Institute for Financial Economics (SKBI)
29th April 2021

*The views expressed herein are mine and do not reflect the views of SKBI or SMU
Alike or Less Alike?

![Average Cross-Correlation of Inflation](image1)

Source: FRED, Haver Analytics and Author’s calculations

“17 Advanced Economies

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4/29/2021

Undershooting or Overshooting?

![Average Frequency Above the Mid-Point (2010-2019)](image2)

Source: Websites of central banks, FRED, IMF and Author’s calculations

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4/29/2021
Whose Inflation Expectations?

P=Professional Forecaster Survey
H=Household Survey
M=Market-based Proxy

Root-Mean-Squared-Error (1999-2009)

Source: Bloomberg, SPF, FRED, BoE, SKBI, Fed, MAS, RBA, UniMelb and Author’s calculations

Notes:
1. 2011-2018 and combination of full-year average/four-quarter ahead for P
2. **Composite Measure of Inflation Expectations (CMIE)
3. The charts depict the RMSEs of four-quarter ahead inflation forecasts in %-points

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4/29/2021

An Experimental Measure for the US

Composite Measure of Inflation Expectations (CMIE)

Source: Fed and Author’s estimation

(1): Longer-run inflation goal of 2%
(2): “Symmetric” inflation objective
(3): “Flexible average inflation targeting”

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Takeaways and What-ifs

1. Crucial to distinguish between headline and core inflation, even among advanced economies, as recent fluctuations appear less synchronous.

2. The natural tendency for inflation to overshoot seems weaker, at least in most advanced economies with explicit goals or targets, in recent years.

3. Measures of inflation expectations, while not fungible, tend to exhibit different degrees of forecasting accuracy; hence, a composite measure is a promising alternative.

- Hybrid and atypical inflation forecasting frameworks?
- Tradeoff between price and financial stability?
- Emerging inflation bias and psychology?

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4/29/2021
Inflation Broadly Contained Amid an Uneven Recovery

APRIL 27, 2021

Divergent recovery continues

<table>
<thead>
<tr>
<th></th>
<th>World</th>
<th>Asia</th>
<th>Asia AE</th>
<th>EMDE Asia</th>
<th>China</th>
<th>Japan</th>
<th>Korea</th>
<th>India</th>
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<th>AUS-NZ</th>
<th>PICs and Small States</th>
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<td>-1.5</td>
<td>-2.9</td>
<td>-1.0</td>
<td>2.3</td>
<td>-4.8</td>
<td>-1.0</td>
<td>-8.0</td>
<td>-3.3</td>
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<td>-0.1</td>
<td>0.5</td>
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<tr>
<td>Cumulative losses 2020 - 2021 from Pre COVID Forecast</td>
<td>-4.3</td>
<td>-4.3</td>
<td>-2.1</td>
<td>-4.8</td>
<td>-1.2</td>
<td>-2.9</td>
<td>-2.3</td>
<td>-9.2</td>
<td>-8.9</td>
<td>-3.0</td>
<td>-14.0</td>
</tr>
</tbody>
</table>

Source: IMF World Economic Outlook, April 2021.
The pandemic generated unprecedented economic costs

GDP Losses Relative to Pre-COVID, Asian Economies
(Current projected 2025 level relative to pre-COVID forecast, percent difference)

Asia: Change in employment by Industry
(percentage points; change 2019 Q4 v/s 2020Q4)

Sources: Haver Analytics; and IMF staff calculations
Asia refers to Australia, Hong Kong SAR, Indonesia, Japan, Korea, Malaysia, New Zealand, Singapore, Taiwan Province of China, Thailand, The Philippines, and Vietnam. Data are seasonally adjusted, based on December 2020 data (or latest available). Essential industries refer to agriculture, utilities, transport, information and communication, and health and public administration; social industries refer to wholesale and retail, hotels and restaurants, and arts and entertainment; teleworkable industries refer to finance, business and professional services, and education; and non-teleworkable industries refer to mining, manufacturing, and construction.

Global inflation contained despite rebound in oil prices

Commodity price indices
(index; Jan 2020 = 100)

Sources: Bloomberg, L.P.; and IMF staff calculations

CPI inflation
(percent year over year)

Sources: Bloomberg, L.P.; and IMF staff calculations
Inflation in Asia remains broadly subdued

Decomposition of change in 10y Yield
(percent, since 11 Feb 2021)

Sources: Bloomberg LLP and IMF Staff Calculations.

Risk-neutral
Term-premium
10y Bond yield change

Inflation less sensitive to unemployment gap

Advanced Asia: Phillips Curve and Automation

$\hat{\theta}_1 = 1.865^{***} + \text{Pinv} \times 3.173^{***}$

Time and country fixed effects
$R^2 = 0.647$

Relative price of investment goods
Slope of Phillips Curve

Higher automation

Emerging Asia: Phillips Curve and Integration into Global Value Chains (GVCs)

$\hat{\theta}_1 = 1.077^{***} + \text{Foreign VA} \times (-0.0267^{**})$

Time and country fixed effects
$R^2 = 0.66$

Share of Foreign Value-Added in Exports (Tiva)
Slope of Phillips Curve

Higher GVC integration

Sources: April 2018 Regional Economic Outlook: Asia Pacific, IMF staff estimates.
Note: Emerging Asia excludes China and India. The Phillips Curve slope estimates for these two countries are less reliable given difficulties in measuring the unemployment gap in countries with large informal sector (India) and state-owned enterprises (China).
Thank you!
Inflation is ticking up

![CPI inflation momentum graph](chart)

Source: CEIC, DBS

Inflation is ticking up in Asia too

![CPI inflation momentum graph](chart)

Source: CEIC, DBS
Is it all base effect?

CPI inflation momentum in Asia

Source: CEIC, DBS

Tracking food inflation

Sources: IMF Commodity Price Database, DBS

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Tracking food-related inflation

![Chart showing Fertilizer and Palm oil inflation from 2015 to 2021.](chart_image)

Sources: IMF Commodity Price Database, DBS

Tracking metals inflation

![Chart showing Base and Precious metals inflation from 2015 to 2021.](chart_image)

Sources: IMF Commodity Price Database, DBS
Tracking energy

![Energy Chart]

%yoy

-100.0 -50.0 0.0 50.0 100.0 150.0


Sources: IMF, DBS

Tracking freight costs

![Freight Costs Chart]

Baltic Dry Freight Index vs China Manufacturing PMI

Source: Bloomberg

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