Private Consumption Indicator (PCI)
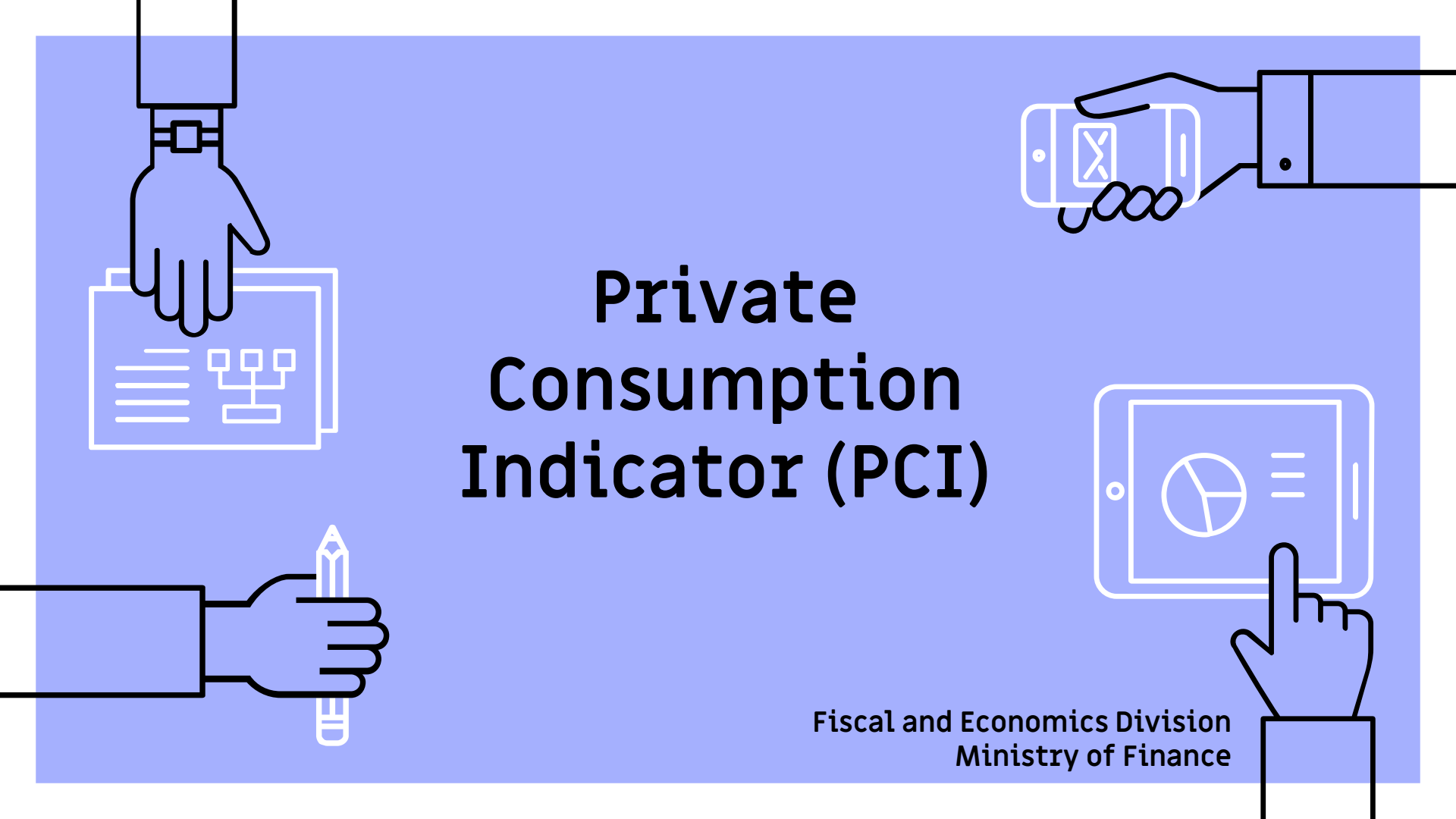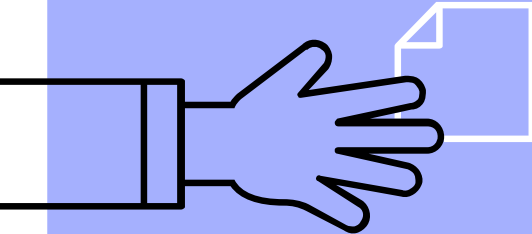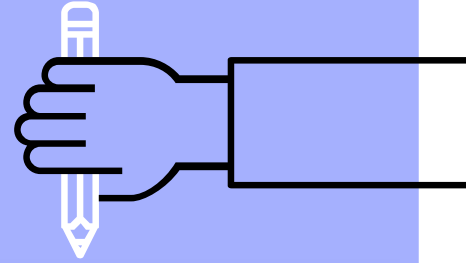
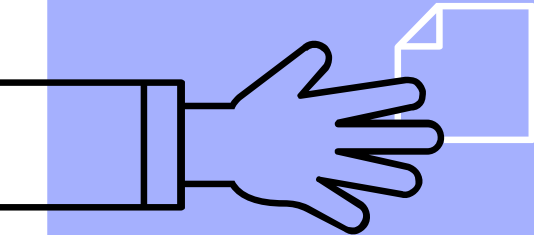**Fiscal and Economics Division**
Ministry of Finance

Outline

1. Introduction
2. Model usage
3. Forecast accuracy
4. Results
5. Way Forward

Introduction
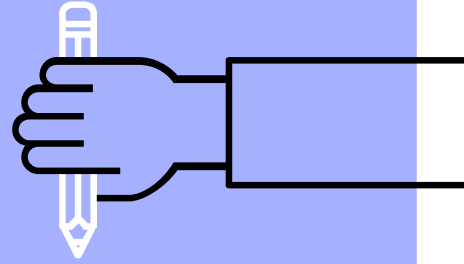
Let's start with the first set of slides

PCI Cycle

01

02

03

Policy input

Collection of Indicators
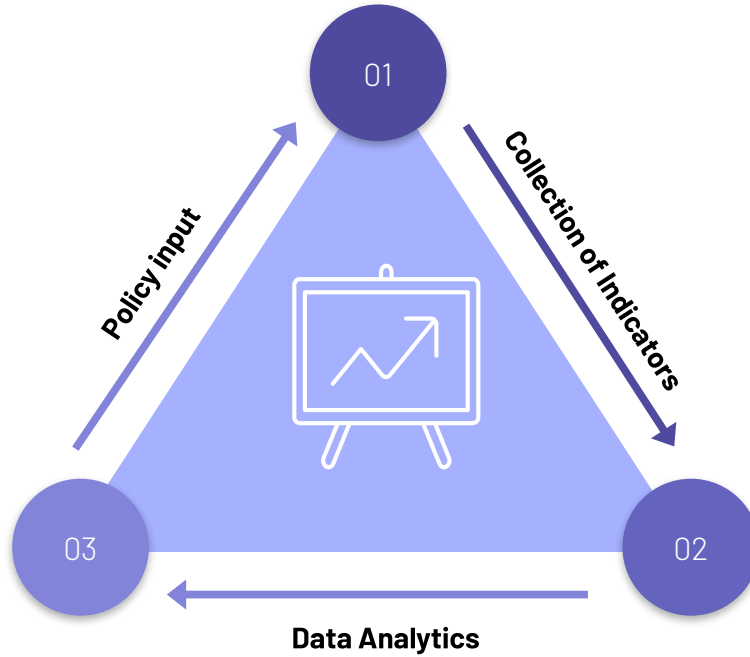
Data Analytics

Collection of Indicators

▷ Excel with monthly data/ higher frequency (structured data)

Data Analytics

▸ Transforming data into valuable asset

▸ Using various econometrics and machine learning as well as deep learning (in future) approach

Policy Input

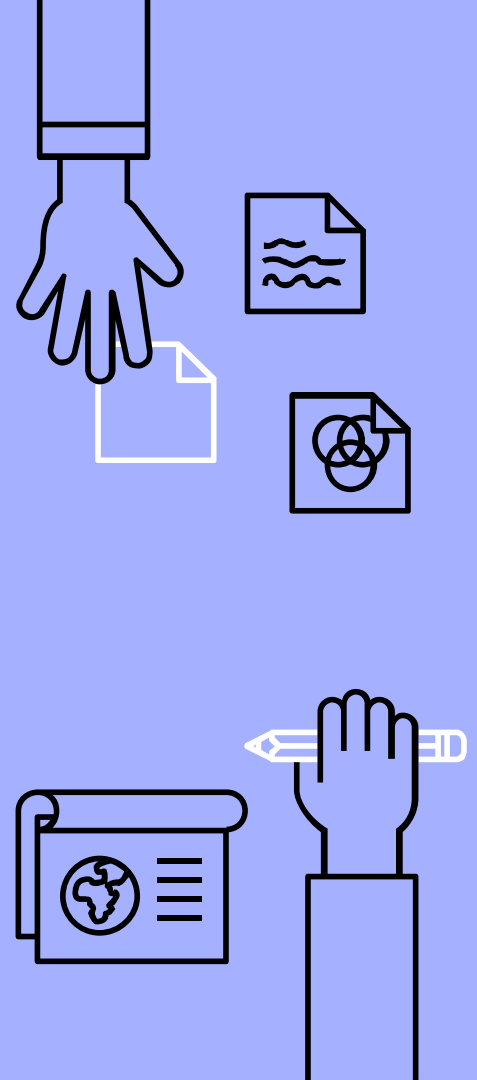▸ Visualisation (table/ interactive charts & dashboard/ apps in future)

▸ Policy brief

Introduction

Share of private consumption to Malaysian economy

Private consumption constitute the largest contributor to the Malaysian economy, more than 55%.

Private consumption growth

Ranging from 6.5% to 8.9% between 2018Q1 and 2020Q1.

Share of private consumption to Malaysian economy

	2018Q1	2018Q2	2018Q3	2018Q4	2019Q1	2019Q2	2019Q3	2019Q4	2020Q1
GDP	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Private Consumption	56.5	56.6	59.0	55.6	58.2	58.2	60.5	58.0	61.7
Public Consumption	11.1	11.8	11.6	15.0	11.3	11.3	11.3	14.7	11.8
Private Investment	18.0	20.2	17.9	13.3	17.3	19.5	17.2	13.4	16.8
Public Investment	7.2	5.9	6.9	9.3	6.0	5.2	5.6	8.3	5.2
Export	68.5	66.9	67.3	66.7	65.5	64.2	63.1	62.2	60.5
Import	60.5	61.5	61.1	59.7	56.9	57.3	56.5	56.2	55.1
Inventories	-0.9	0.1	-1.6	-0.3	-1.5	-1.2	-1.2	-0.4	-0.9

Private consumption growth

|	2018Q1	2018Q2	2018Q3	2018Q4	2019Q1	2019Q2	2019Q3	2019Q4	2020Q1
GDP	5.2	4.7	4.4	4.8	4.5	4.8	4.4	3.6	0.7
Private Consumption	6.5	7.9	8.9	8.4	7.7	7.8	7.0	8.1	6.7
Public Consumption	0.2	2.9	5.0	3.9	6.3	0.3	1.0	1.2	5.0
Private Investment	1.1	5.6	5.0	5.9	0.6	1.5	0.4	4.3	-2.3
Public Investment	-1.2	-10.0	-2.7	-6.0	-13.7	-7.8	-14.6	-8.0	-11.3
Export	2.3	2.0	0.5	2.9	0.1	0.5	-2.1	-3.4	-7.1
Import	-2.0	3.7	2.3	2.0	-1.6	-2.3	-3.5	-2.4	-2.5
Inventories	-242.8	-116.4	84.8	-132.2	75.3	-2009.0	-20.5	31.7	-35.5
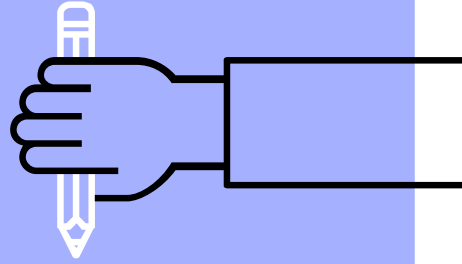
Model usage

Continue with the second set of slides
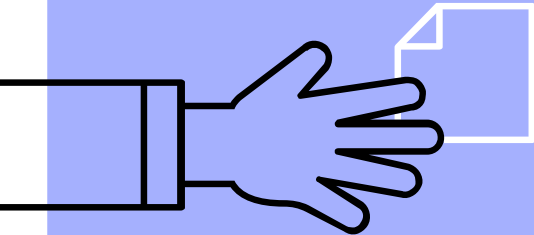
Model Framework

PCON = f(FS, ICG, SOPC, LOWT)

Where

▸ PCON is real private consumption

▸ FS is food sales

▸ ICG is import of consumption goods

▸ SOPC is sales of passenger vehicles

▸ LOWT is loan to wholesale and distributive trade
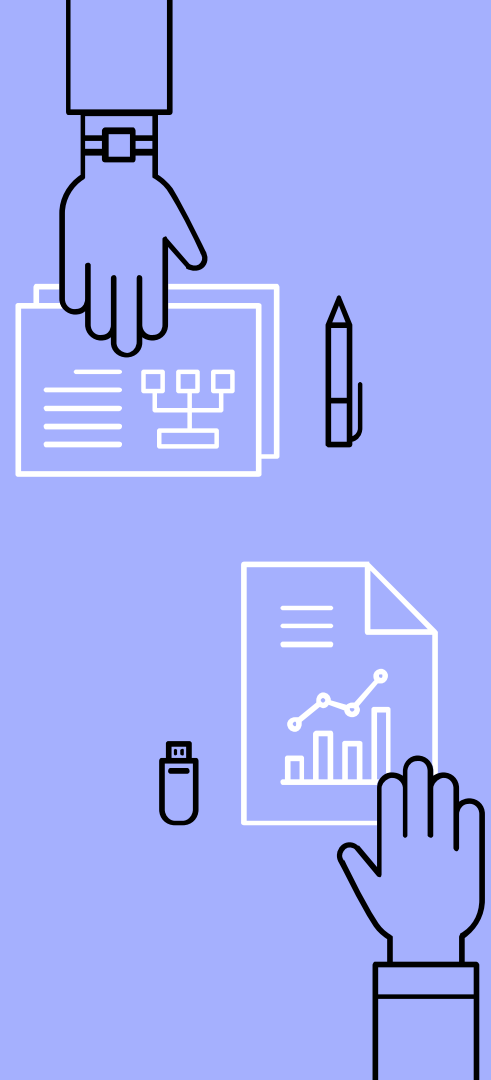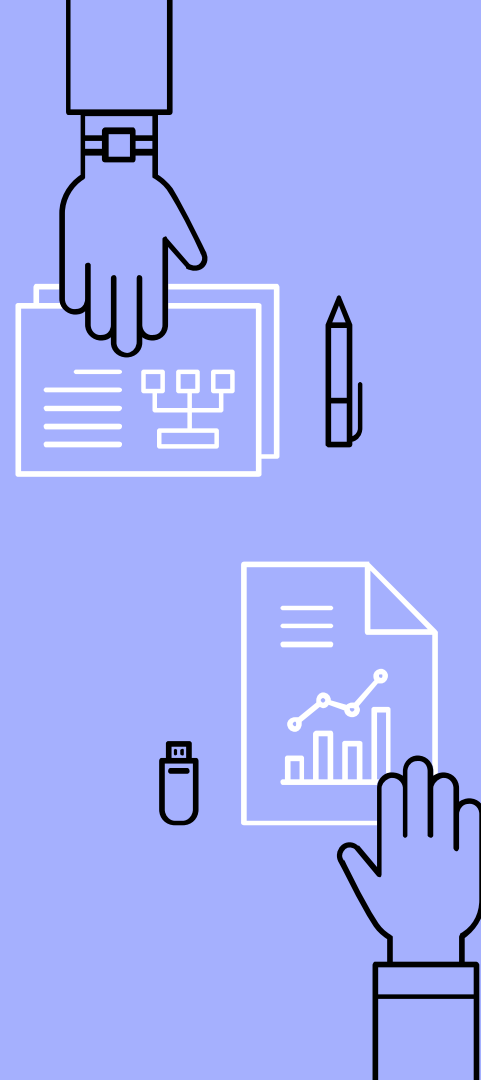
Data collection

- ▹ Department of Statistics Malaysia (DOSM)
- ▹ Malaysia Automotive Association (MAA)
- ▹ PCON is in quarterly frequency
- ▹ Others are in monthly frequency

Unrestricted Error Correction Model (UECM)

Quarterly frequency

▹ Stationarity (ADF and PP tests)

▹ Cointegration tests (Bounds test)

▹ Long run estimates (equilibrium adjustment)

▹ Short run estimates

Mixed Data Sampling Regression (MIDAS)

Quarterly – monthly frequency

▹ Dealing with mixed-frequency data

▹ Able to solve the problem of parameter proliferation

▹ While preserving some timing information

Mixed Frequency Vector Autoregressions (MFVAR)
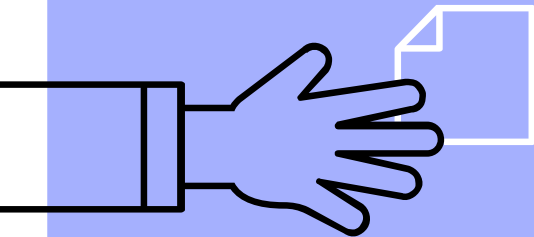
Quarterly – monthly frequency

▹ System approach that jointly explains indicators and predictant without imposing a-priori restrictions on the dynamics

▹ Can be an advantage when few variables are modelled and the dynamics is limited

▹ VAR provides a good approximation to the data generating process (DGP)
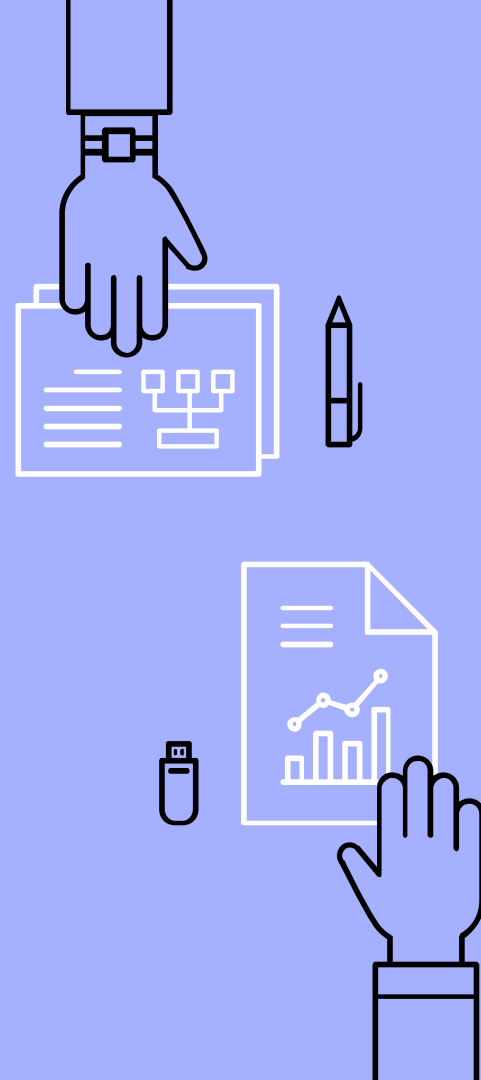
Forecast accuracy
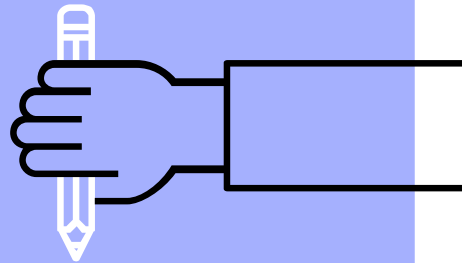
Continue with the third set of slides

Forecast error measurement

Based on error

▹ Smaller error gives better accuracy

$$e_t = y_t - \hat{y}_t$$
$$e_t = \text{forecast error}$$
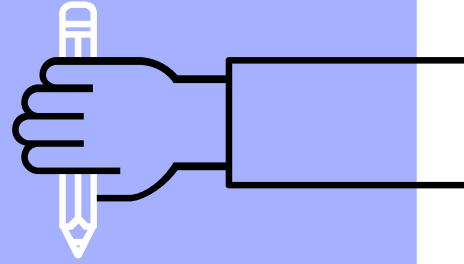$$y_t = \text{true value}$$
$$\hat{y}_t = \text{forecast value}$$

Root Mean Square Error

▸ Standard deviation of the residuals
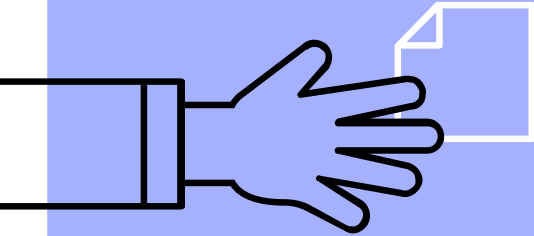
▸ Measures how much error there is between two data sets

$$RMSE = \left(\left[\sum_{t=1}^{n} \frac{\left(F_t - X_t \right)^2}{n} \right] \right)^{1/2}$$

Results

Continue with the fourth set of slides

Able to track up to 8 lags before

|	2018Q1	2018Q2	2018Q3	2018Q4	2019Q1	2019Q2	2019Q3	2019Q4	2020Q1
ACTUAL	6.5	7.9	8.9	8.4	7.7	7.8	7.0	8.1	6.7
UECM	5.6	4.7	7.8	8.2	6.7	7.2	6.5	7.5	6.6
MIDAS	8.0	7.4	8.5	7.0	6.5	8.1	7.6	8.2	6.6
MFVAR	11.5	10.7	6.2	15.6	13.6	10.8	5.5	16.6	15.8
RMSE(UECM)	1560.1	5650.9	1952.9	382.7	1883.3	1037.7	1127.5	1114.1	261.4
RMSE(MIDAS)	2596.6	1009.1	664.4	2495.4	2142.8	608.2	1118.8	261.3	233.6
RMSE(MFVAR)	8612.9	4829.5	4957.7	13262.3	10993.8	5672.4	3089.7	16843.7	17939.1

No error for current quarter since actual values is not released yet

	2018Q2	2018Q3	2018Q4	2019Q1	2019Q2	2019Q3	2019Q4	2020Q1	2020Q2
ACTUAL	7.9	8.9	8.4	7.7	7.8	7.0	8.1	6.7	NA
UECM	4.7	7.8	8.2	6.7	7.2	6.5	7.5	6.6	2.2
MIDAS	7.4	8.5	7.0	6.5	8.1	7.6	8.2	6.6	-4.2
MFVAR	10.7	6.2	15.6	13.6	10.8	5.5	16.6	15.8	11.5
RMSE(UECM)	5650.9	1952.9	382.7	1883.3	1037.7	1127.5	1114.1	261.4	NA
RMSE(MIDAS)	1009.1	664.4	2495.4	2142.8	608.2	1118.8	261.3	233.6	NA
RMSE(MFVAR)	4829.5	4957.7	13262.3	10993.8	5672.4	3089.7	16843.7	17939.1	NA
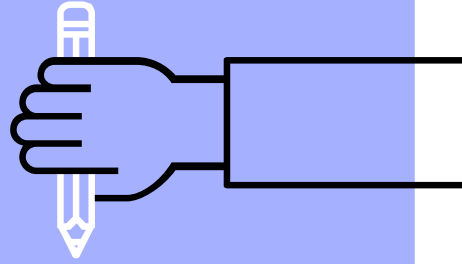
Way forward

Continue with the final set of slides
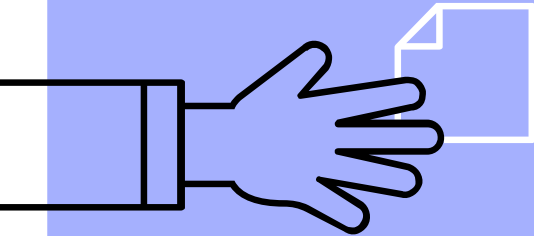
How to improve the PCI?

1) **Replacing current indicators with others** which are more accurate to predict the movement of private consumption (RMSE comparison as a benchmark)
2) **Adding more error performance criterion** (MAE, MAPE, Theil Inequality Coefficient, MSE)
3) **Increase the number of indicators used** (cost: overfitting the model)
4) Implementing **Machine Learning approach** (e.g. Decision Tree, kNN, SVM, Naïve Bayes, K-Means, Random Forest) and **Deep Learning approach** (e.g. Neural Network, Restricted Boltzmann Machine, Long Short-Term Memory)
5) **Build Private Consumption Index** (need to identify weightage + engage DOSM, however Dominance Analysis might be good option to start with)
6) **Track higher frequency data** in unstructed/ semi structured form in order to get more regular forecast update

THANKS!

Any questions?

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