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# **Model-Assisted Approach to Estimate Production of the Manufacturing Sector in the Philippines from the Monthly Integrated Survey of Selected Industries (MISSI)**

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*Model-Assisted Approach to Estimate Production of the Manufacturing Sector in the Philippines from the MISSI*

# Outline of Presentation

**1** Introduction

**2** Methodology

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**4** Summary and Recommendation

# Introduction

- The Monthly Integrated Survey of Selected Industries (MISSI) provides official statistics on the performance of growth-oriented industries in the manufacturing sector.
- MISSI generates indices and growth rates that measure the average change of the value and volume of production over time, relative to the base period (2018=100).
  - Value of Production Index (VaPI)
  - Volume of Production Index (VoPI)

# Introduction

- Reliable estimates of levels of production of the manufacturing sector cannot be generated using the current design of MISSI.

<b>Domain</b>	National
<b>Unit of Enumeration</b>	Establishment
<b>Sampling Design</b>	<b>Cut-off sampling design</b> using value of production as cut-off criterion
<b>Sampling Frame</b>	All manufacturing establishments in the CPBI or ASPBI with <b>Total Employment (TE) of 20 and over</b>
<b>Sample Size</b>	<b>920</b> establishments monthly





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## Introduction

- The objective is to determine an appropriate methodology for estimating the levels of value of production for the manufacturing sector.

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# Methodology

Two methods of estimation explored:

Survey-based	Model-Assisted (Proposed)
<ul style="list-style-type: none"><li>Design-based estimation using the current design of MISSI</li></ul>	<ul style="list-style-type: none"><li>Uses a combination of a model and survey data from the current design of MISSI</li><li>Developed to reduce the bias in the value of production from survey-based estimation</li></ul>

# Methodology

MISSI survey-based estimator:

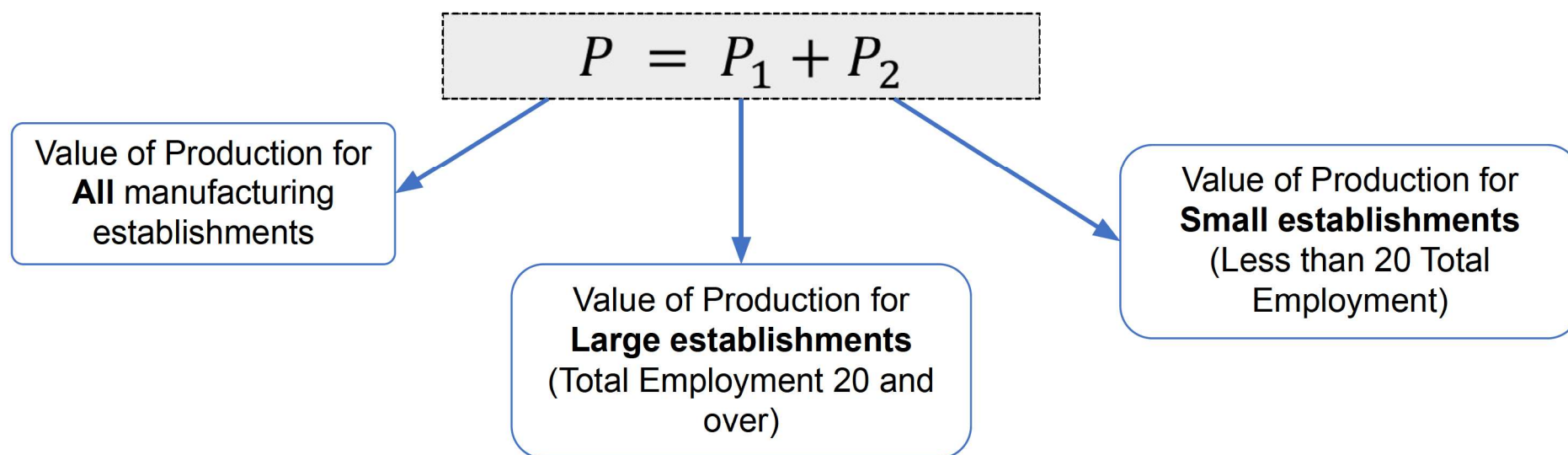
$$\hat{P}_{Sij} = X'_{ij} * \frac{N_i}{n_i}$$

where:

- survey-based estimate of value of production of the  $i$ th industry division/group for the  $j$ th month
- unweighted value of production of sampled large establishments from MISSI of the  $i$ th industry division/group for the  $j$ th month
- total number of manufacturing establishments in the sampling frame (CPBI/ASPBI) for the  $i$ th industry division/group
- number of manufacturing establishments in the  $i$ th industry division/group that are sampled in MISSI

# Methodology

General model in model-assisted estimation of production:





# Methodology

Model-assisted formula:

$$\hat{P}_{Mij} = X'_{ij} * \frac{(1 - a_{2i})}{(1 - a_{1i})}$$

where:

model-assisted estimate of value of production of the  $i$ th industry division/group for the  $j$ th month

unweighted value of production of sampled large establishments from MISSI of the  $i$ th industry division/group for the  $j$ th month

percent share of unsampled large establishments to the total value of production of large establishments in the sampling frame (CPBI/ASPBI) of the  $i$ th industry division/group

# Methodology

## Estimator of Annual Production:

### Survey-based

$$\hat{P}_S = \sum_{i=1}^m \sum_{j=1}^{12} \hat{P}_{Sij}$$

### Model-Assisted

$$\hat{P}_M = \sum_{i=1}^m \sum_{j=1}^{12} \hat{P}_{Mij}$$

where  $m$  = number of manufacturing industry division/groups

# Methodology

Estimator of Variance of Model-Assisted Methodology (two cases):

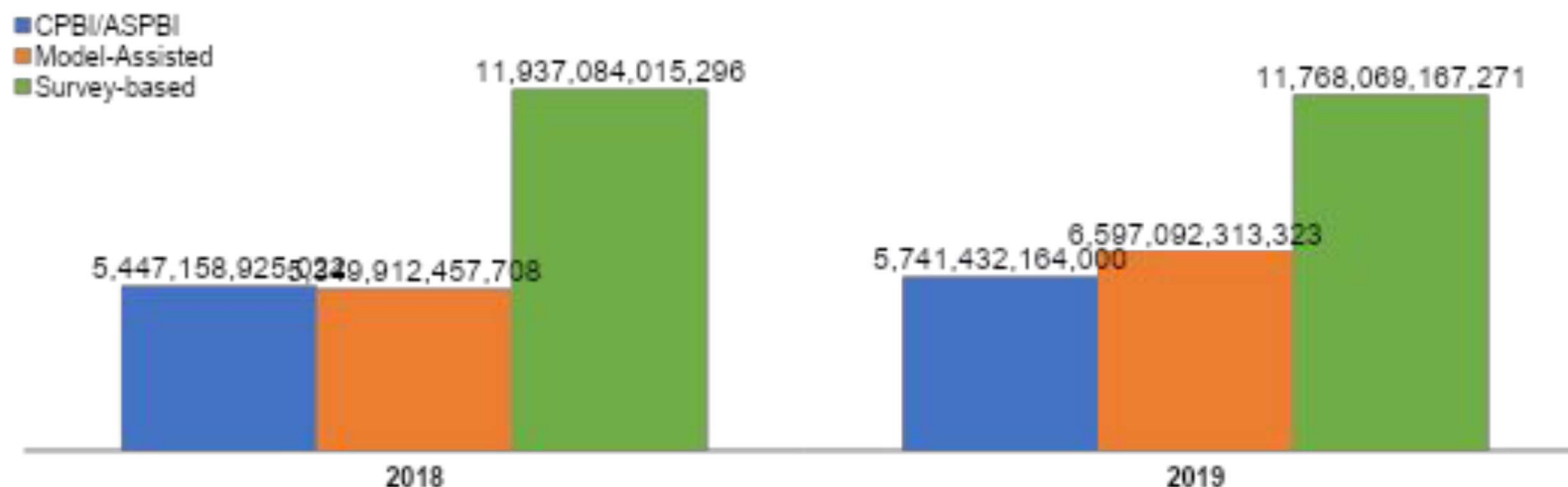
1  $Var(\hat{P}_M) = \left( \frac{(1 - a_2)}{(1 - a_1)} \right)^2 * var \left( \sum_{i=1}^{12} X'_i \right)$  Assumes  $X'_1, X'_2, X'_3, \dots$  are independent

2  $Var(\hat{P}_M) = \left( \frac{(1 - a_2)}{(1 - a_1)} \right)^2 \sum_{i=1}^{12} Var(X'_i) + 2 \sum_i \sum_j cov(X'_i, X'_j)$  Assumes  $X'_1, X'_2, X'_3, \dots$  are dependent

# Results

Survey-based method consistently overestimates the annual production. This upward bias is reduced by the model-assisted approach, generating estimates of annual production that are close to ASPBI/CPBI.

**Figure 1.** Comparison of Annual Value of Production of the Manufacturing Sector from CPBI/ASPBI, Model-assisted procedure, and Survey-based estimation in 2018 and 2019







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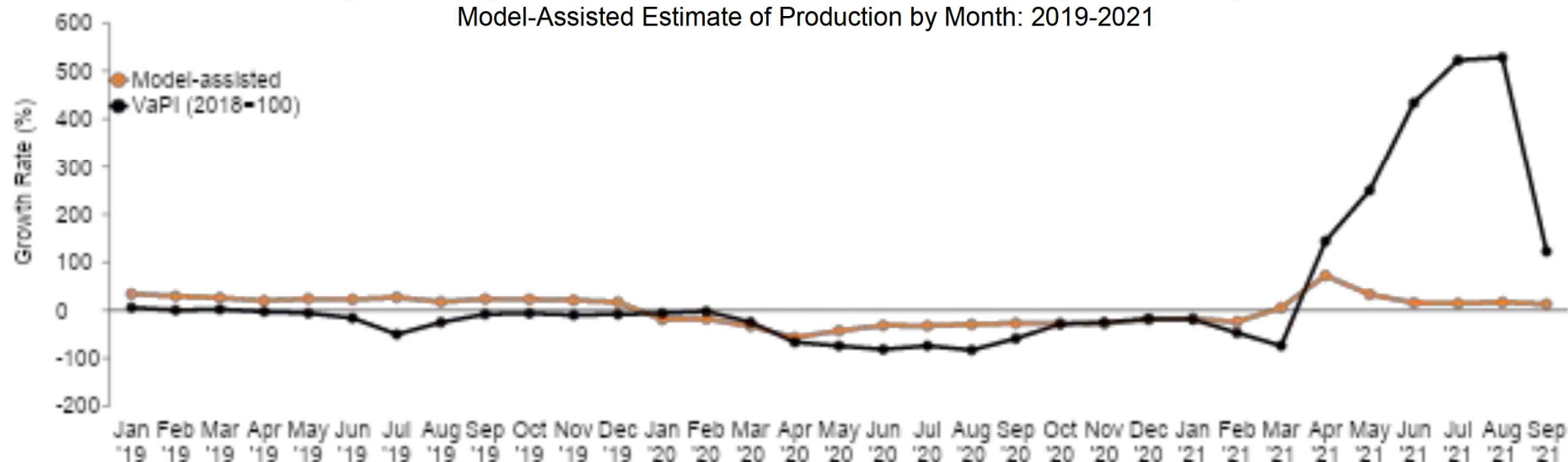
# Results

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Annual growth rates of the estimated monthly value of production and Value of Production Index (VaPI) (2018=100) nearly follow the same trend, except in the period May to July 2021 when VaPI had sharp increases due to shocks.

**Figure 2.** Comparison of Annual Growth Rates of MISSI Indices (VaPI and VoPI) and Model-Assisted Estimate of Production by Month: 2019-2021



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## Results

Estimates of annual production are precise with CVs using dependent case variance higher than the independent case.

**Table 1.** Comparison of Computed CVs of Annual Value of Production for Independent and Dependent Case: 2018-2019

Case	2018	2019
Independent	3.47	3.80
Dependent	7.79	7.82

## Summary & Recommendation

- Survey-based estimation using the current MISSI sampling design overestimates the levels of annual production for manufacturing. This upward is reduced by using a model-assisted approach.
- The model-assisted approach uses a model and the survey data of MISSI to produce estimates of levels of production that are precise and close to the estimate of ASPBI and CPBI.

## Summary & Recommendation

- Redesigning the MISSI to generate reliable levels of production is costly since the required sample size would be higher. (*Current  $n = 920$ , Redesigned MISSI  $n = 2,500$  to  $3,000$* )
- The model-assisted approach is recommended because it reduces the bias from design-based estimation (survey-based) and yields precise estimates at no additional cost.





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## Thank you!



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