Anticipating Philippine Trade Flows: Data-Driven Forecasting for Timely Policy Action

using local and global forecasting models

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FORECASTING

Forecasting tools are vital in guiding policymakers toward timely, impactful economic decisions, prompting institutions like central banks to explore innovative models to support effective policy formulation.

PHILIPPINE IMPORT AND EXPORT

PH imports and exports (values in Billion USD) are key drivers of Gross Domestic Product (GDP). Limited trade data, supply chain network effects, and a two-month lag in official statistics make accurate and timely forecasting difficult for policymakers.

In this study, we develop various forecasting models of Philippine Import and Export activity. We examine whether global forecasting models, with cross-learning, can provide better forecast performance compared to local/single tasks models.

DIVING INTO THE THEORY

Baseline model

SINGLE-TASK LEARNING (STL)

Proposed Model

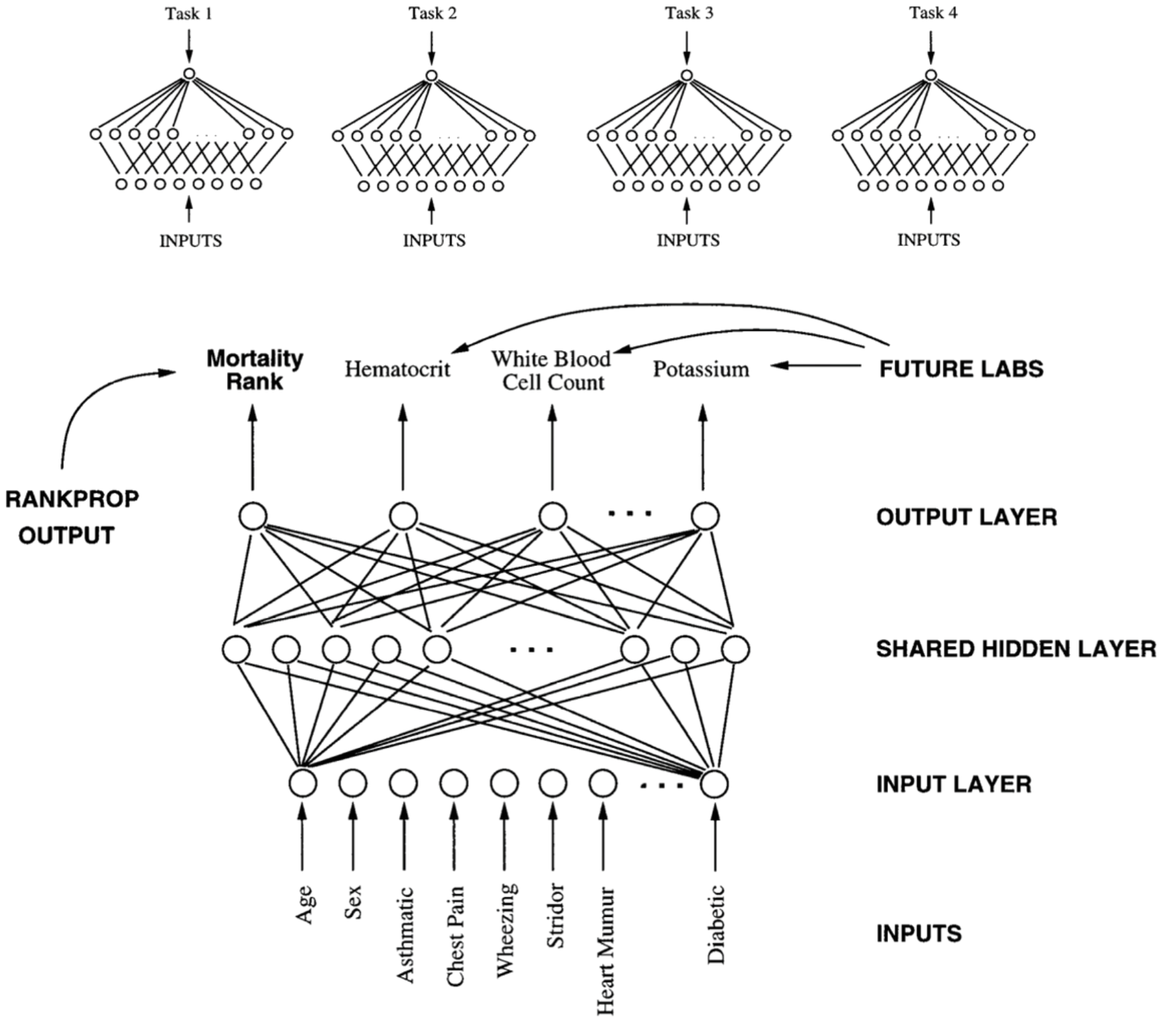
MULTI-TASK LEARNING (MTL)

MTL aims to enhance the performance of multiple tasks by training them jointly (Caruana, 1997).

This approach learns tasks in parallel through a shared representation.

The assumption is that the effectiveness relies on the relatedness of the tasks.

Previous studies have highlighted MTL's ability to leverage cross-task information, leading to improved accuracy and generalization compared to training tasks independently (Caruana, 1997; Ruder, 2017; Zhang & Yang, 2021).



Caruana (1997)

TAKING A CLOSER LOOK

1

NB1 : Exploring the Time Series

2

NB2 : Single Task Learning

3

NB3 : Multi Task Learning

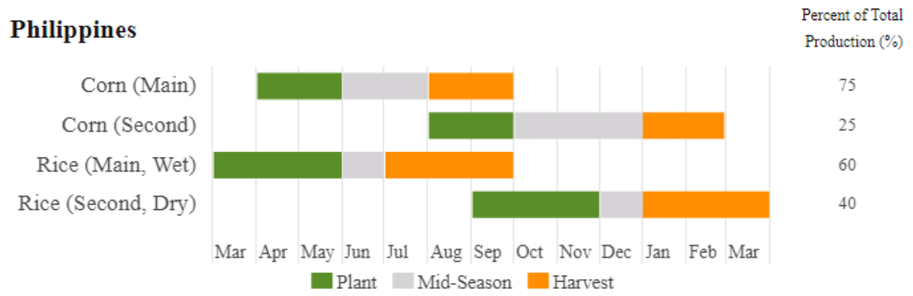
NB1 : Exploring the Time Series

Data was sourced from S&P Global (Value of Import and Exports in Billion USD) and BSP (FX rates) across several countries.

Monthly Ph import, export, and FX series covers period January 2010 to March 2025 (N_obs = 168 months).

Key observations

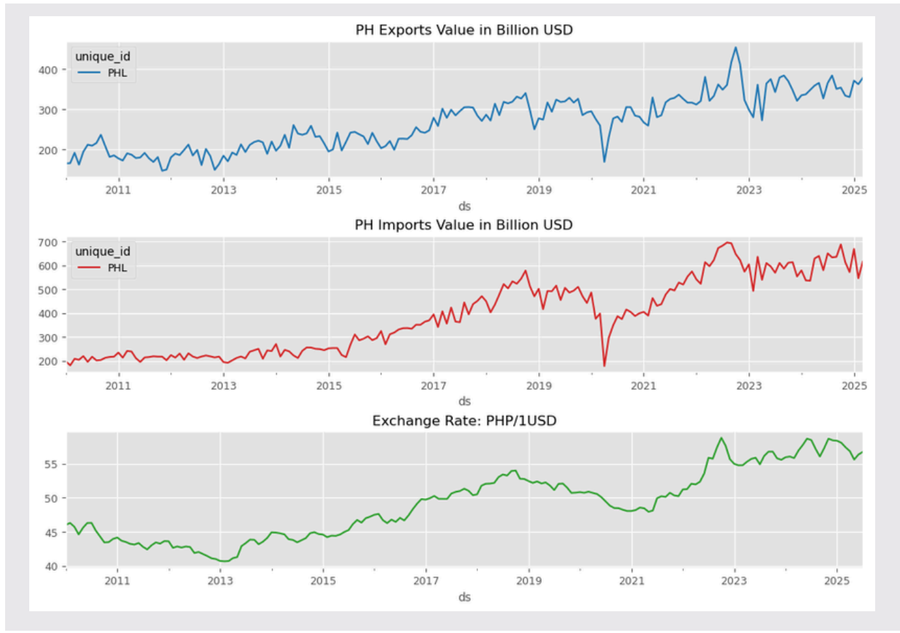
- Trend. PH series are strongly dominated by an upward trend (strength of trend close to 1.0).
- Residuals. Trough and peaks in PH import and export coincided with economic events, e.g., Global economic slowdown due to COVID-19 pandemic (in 2020) and resurgence of demand (in late 2022).
- Seasonality. Some seasonality in export activity correlates to harvest season of some exported crops (in the first quarter).
- Value of exported goods are driven by semiconductors and manufactured products which show a slowdown of production during holiday season (in November and December)



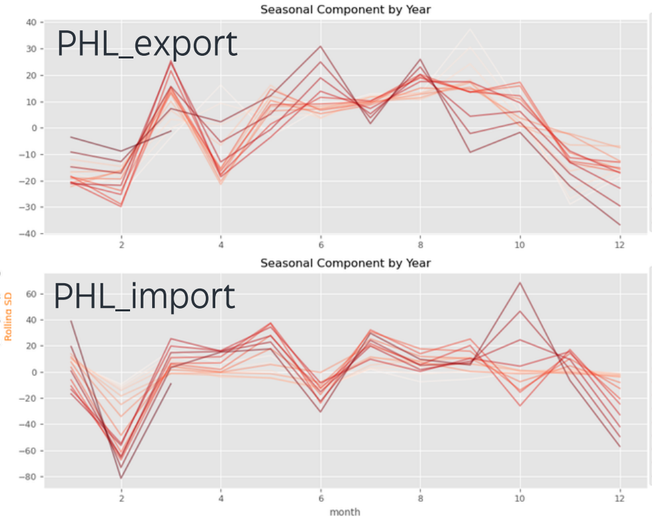
https://ipad.fas.usda.gov

Refer to Appendix for other countries' data used for cross validation

Main Analysis



Decomposition



MODEL DEVELOPMENT STRATEGY

Train/test Split [2024-01 to 2025-03]

Data: Import and Export

Exogenous Factor: Foreign Exchange

2

STL
Models: ETS (additive and multiplicative), Naive, RWD, ARIMA, Random Forest, Gradient Boosting, and Long-Short-Term Memory Neural Network.

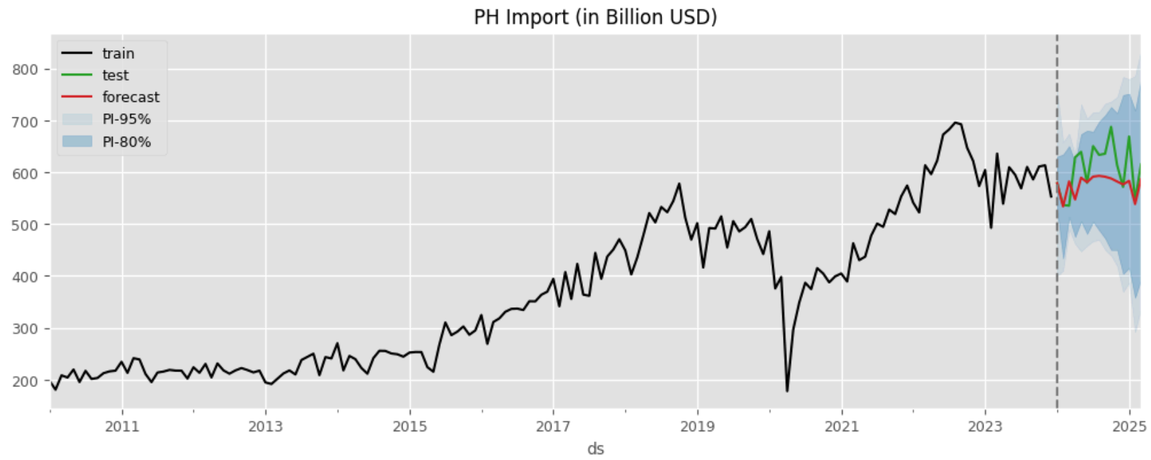
3

MTL

- Explored different sets of countries for Cross-learning
- Models: DeepAR, TFT, PatchTST
- Feature Engineering: Fourier Terms

Main Evaluation Metrics MAE, Prediction Intervals

NB2 : Single Task Learning



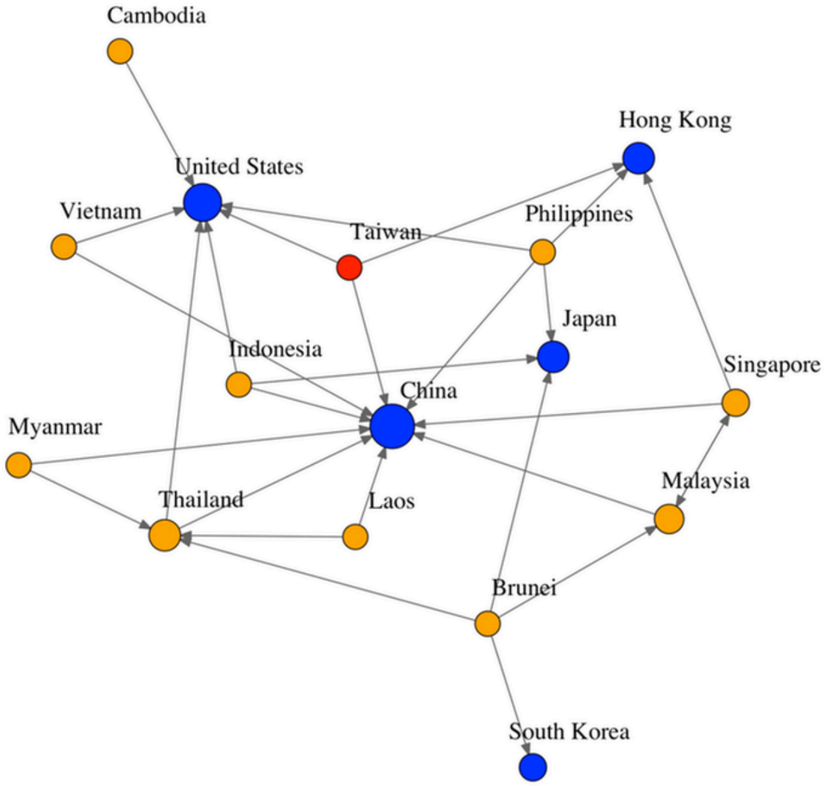
	Best model	MAE	MAPE	MASE	RMSE	RMSSE
PH_export	ETS_multiplicative	20.34	5.83	0.70	25.03	0.64
PH_import	ETS_additive	38.87	6.12	0.63	50.0	0.60

For PH exports, Exponential Trend Smoothing (ETS_multiplicative) was the best among statistical and ML models for the single-task learning.

For PH imports, ETS_additive also showed the minimal forecast error.

We can also observe that both models exhibit high forecast uncertainty (wider prediction interval).

NB3 : Multi Task Learning

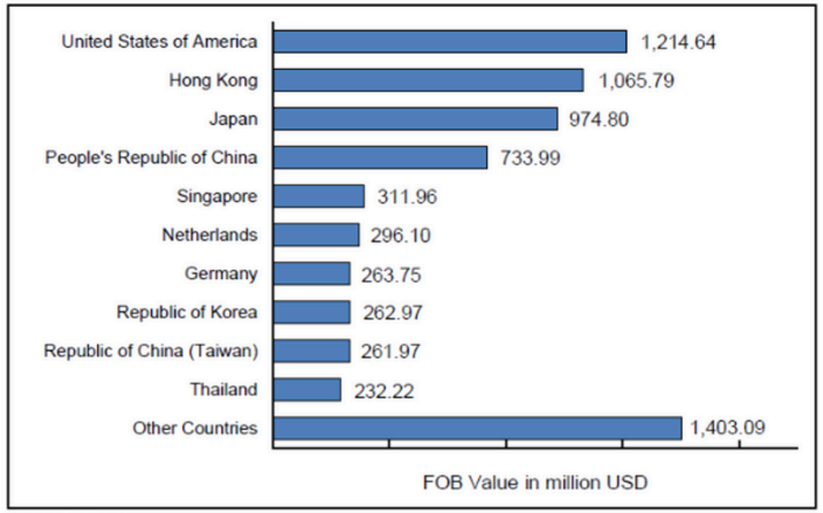


2017 Trade Network
The graphs shows linkages of Philippine trade partners suggesting that import/export activity of the Philippine may also be affected by the activity of our trade partners.

Recent PSA reports show the share to the value of imported and exported goods across different trading partners.

TOP TRADE PARTNERS

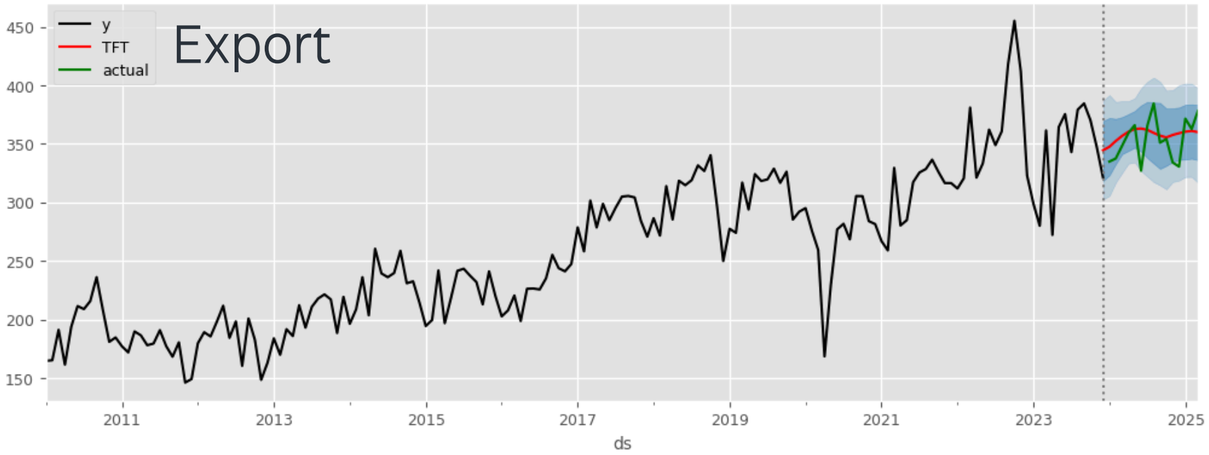
Figure 5. Value of Philippine Exports by Major Partner Country
June 2025p

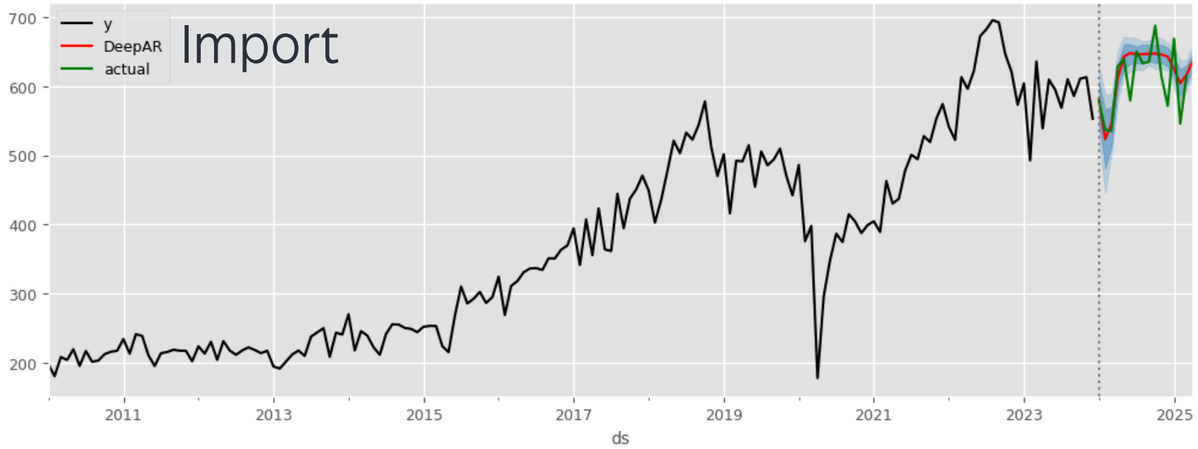


p - preliminary
Note: Details may not add up to total when computed manually due to rounding.
Source: Philippine Statistics Authority

T. Kristinsson (2021)
Networks of order in East Asia: Beyond hegemonic theories of the Liberal International Order

NB3 : Multi Task Learning





	Best model	MAE	MAPE	MASE	RMSE	RMSSE
Top 4 Exports Only with Forex	TFT	13.03	3.76	0.45	16.87	0.43
Top 4 Imports Only with Fourier Terms	DeepAR	26.11	4.37	0.43	35.29	0.42

For PH exports, Time Fusion Transformers (TFT) performed the best with inputs/tasks of predicting the export activity of top trade partners (Hongkong, Japan, China, Singapore).

For PH imports, DeepAR was the best model with inputs/tasks combined with trade partners.

LIMITATIONS

1. Additional information on Import/ Export from other countries may be unavailable. Further, this analysis cannot openly be done as the data required is subscription-based

2. There could be omitted variables in the model as suggested by the bias in the forecast residuals.

3. Models may benefit hyperparameter tuning but requires higher computational cost

NEXT STEPS

Examine further the features and include informative indicators such as uncertainty indices to improve prediction intervals.
Include interpretability and feature importance

CONCLUSION

MTL shows superior performance for forecasting Philippines exports and imports activity with up to 36 percent improvement in MAE against STL models.

Data from other countries help regularize the model by supplementing the model with more information enabling a production of a single global model for trade for dfferent countries

Central Banks and statistical agencies may consider Multi-task/Global forecasting models as part of their forecasting tool.

	Best model	MAE	Delta
MTL: PH_export	TFT Task: Top 4 Trade partners, with Forex	13.03	-36%
MTL: PH_import	DeepAR Task: Top 4 Trade partners	26.11	-33%
STL: PH_export	ETS_multiplicative	20.34	N.A
STL: PH_export	ETS_additive	38.87	N.A

THANK YOU

Appendix: Full MTL Analysis

	best_model	mae	mape	mase	rmse	rmsse
Top 4 Exports Only With Forex	TFT	13.032	3.759	0.448	16.870	0.433
All Timeseries on PHL Exports	DeepAR	16.224	4.704	0.558	19.666	0.505
Top 4 Exports Only	TFT	20.305	5.932	0.698	25.646	0.659
Exports Only	PatchTST	21.508	5.954	0.740	28.836	0.740
Top 4 Imports Only With Fourier Terms	DeepAR	26.106	4.369	0.426	35.294	0.421
Top 4 Exports Only With Fourier Terms	TFT	26.576	7.521	0.914	29.341	0.753
All Timeseries With Fourier Terms on PHL Exports	DeepAR	29.838	8.666	1.026	36.621	0.940
Top 4 Exports Only With Fourier Terms and Forex	TFT	33.851	9.526	1.164	40.663	1.044
All Timeseries With Fourier Terms and Forex on PHL Exports	TFT	35.635	9.929	1.225	40.821	1.048
All Timeseries With Fourier Terms on PHL Imports	DeepAR	37.483	6.224	0.612	44.435	0.530
All Timeseries on PHL Imports	DeepAR	46.480	7.483	0.759	53.578	0.639
Imports Only	DeepAR	49.767	7.959	0.812	58.512	0.698
Exports Only With Forex	TFT	69.431	19.371	2.387	74.938	1.924
All Timeseries With Fourier Terms and Forex on PHL Imports	TFT	75.423	11.931	1.231	89.520	1.068
Top 4 Imports Only	DeepAR	77.289	12.258	1.261	88.347	1.054
Imports Only With Forex	TFT	108.591	17.342	1.772	125.328	1.496
Top 4 Imports Only With Fourier Terms and Forex	TFT	147.110	23.856	2.401	158.752	1.895
Top 4 Imports Only With Forex	TFT	147.776	23.714	2.412	159.793	1.907

Note: In this Table, top 4 export/import partners are Hongkong, Japan, China, Singapore.