# Forecasting Inflation and Unemployment Jointly Improves Out-of-Sample Accuracy of Inflation Forecasts

*A Multi-Task Deep Learning Model for Inflation Forecasting: Dynamic Phillips Curve Neural Network (DPCNN)*

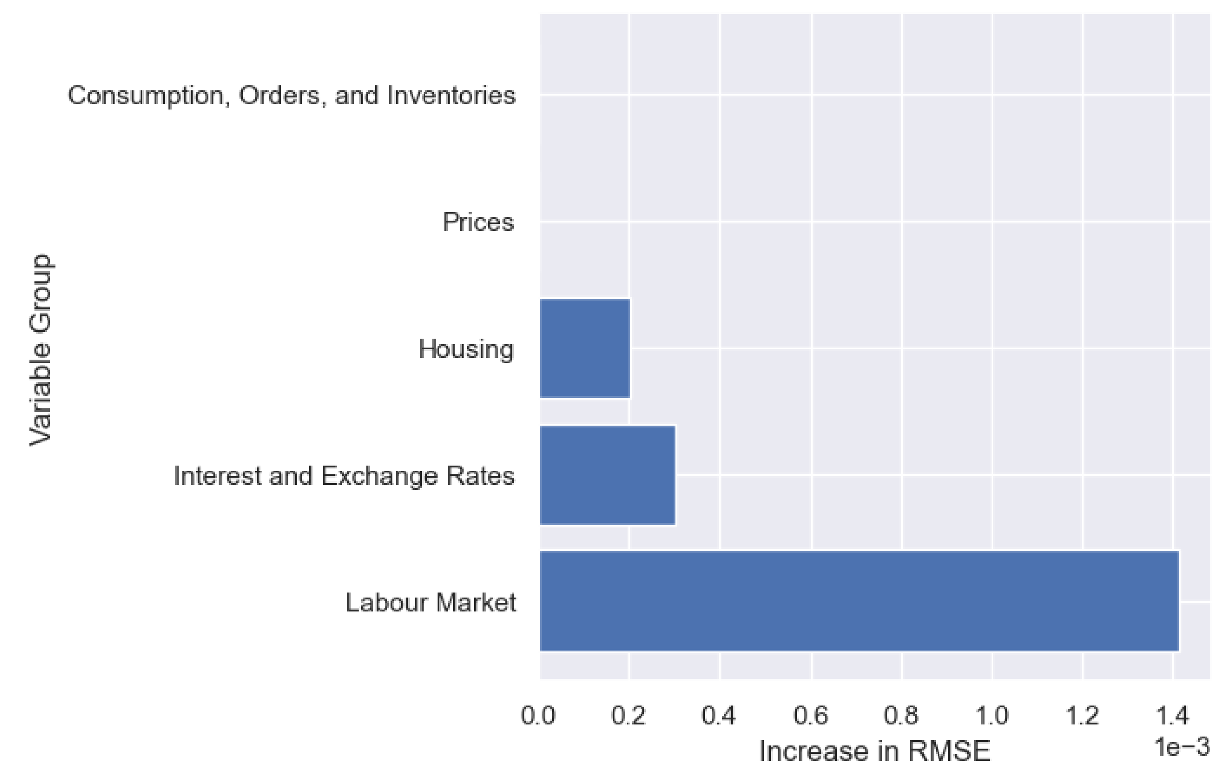
**Background:** Forecasting inflation has been difficult for central banks in the past due to the abundance of shocks and the complexities of business cycle transitions. However, advancements in machine learning theory and computational resources have driven encouraging results in macroeconomic time series forecasting.

**Result 1:** DPCNN outperforms both traditional time series and state-of-the-art ML models, especially at long horizons.

Table 1: RMSE relative to the random walk. Best model is in bold.

| | Forecast Horizon | | | |
|---|---|---|---|---|
| Model | 1m | 3m | 6m | 12m |
| RW | 1.000 | 1.000 | 1.000 | 1.000 |
| LinReg | 1.484 | 1.087 | 1.869 | 3.276 |
| Ridge | 0.901 | 0.838 | 0.922 | 1.105 |
| LASSO | 0.786 | 0.826 | 0.942 | 1.186 |
| EN | 0.786 | 0.831 | 0.931 | 1.135 |
| RF | 0.743 | 0.760 | 0.795 | 0.905 |
| XT | 0.733 | 0.744 | 0.788 | 0.912 |
| GBT | 0.778 | 0.751 | 0.780 | 0.875 |
| LSTM | 0.746 | 0.748 | 0.763 | 0.771 |
| DPCNN | **0.728** | **0.733** | **0.757** | **0.746** |

**Result 2:** Labour, rates, and housing are the most predictive variable groups of inflation at the twelve-month horizon, according to the DPCNN.

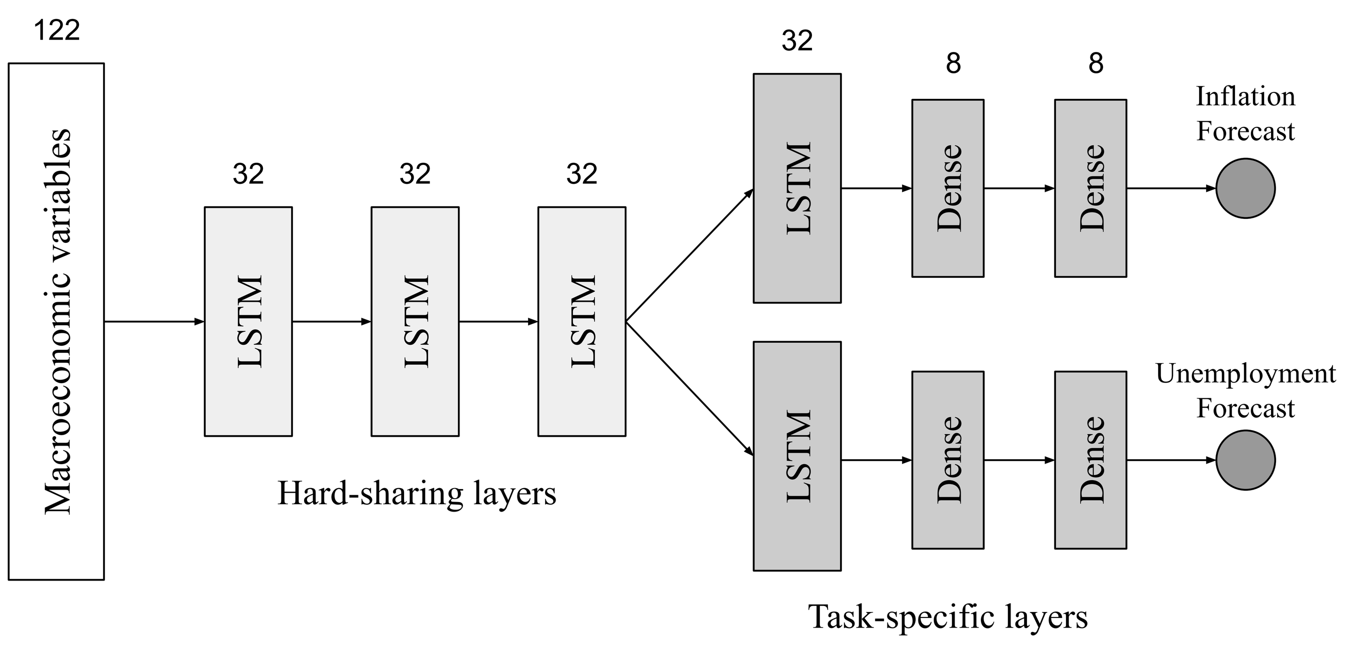



## Methods

Deep Learning

Time series

1. DPCNN imposes the economically motivated constraint of a common structure between inflation and unemployment.




2. Multi-task learning (MTL) facilitates "inductive transfer" which improves learning by using the information learned from related tasks. MTL also serves as a form of regularization since shared parameters need to be more versatile, improving out-of-sample performance.

3. Recurrent neural network (RNN) with long short-term memory (LSTM) provides dimension reduction akin to principal components analysis (PCA) while extracting macroeconomic hidden states carrying long- and short-term information.

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