

# Using National Payment System Data to Nowcast Economic Activity in Azerbaijan

*Ilkin Huseynov, Nazrin Ramazanova, Hikmat Valirzayev  
Central Bank of the Republic of Azerbaijan*

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## **Motivation:**

### ***Macroeconomic Nowcasting:***

**Delay:** Official estimates are released with a substantial lag

**Uncertainty:** Multiple revisions sometime after years

### ***Payment data, DFM&ML:***

**Timely & Precise:** available immediately, no measurement error

**High-frequency:** daily payment flows

**Nonlinearity:** flexible in capturing nonlinear relationships

**Handle Big Data:** non-traditional, high-frequency

## **Objective:**

- Estimate current period (nowcast) GDP
- Demonstrate use of big data in nowcasting/forecasting;

# Model Specification

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The empirical specification take the following form for each month of the quarter:

**Month 1:**  $\Delta GDP_{Q_t} = \alpha + \sum_{j=1}^{20} B_j \Delta S_{j,Q_{t_1}} + \Delta cashtocard_{Q_{t_1}} + \varepsilon_{Q_{t_1}}$

**Month 2:**  $\Delta GDP_{Q_t} = \alpha + \sum_{j=1}^{20} B_j \Delta S_{j,Q_{(t_1,t_2)}} + \Delta cashtocard_{Q_{(t_1,t_2)}} + \varepsilon_{Q_{(t_1,t_2)}}$

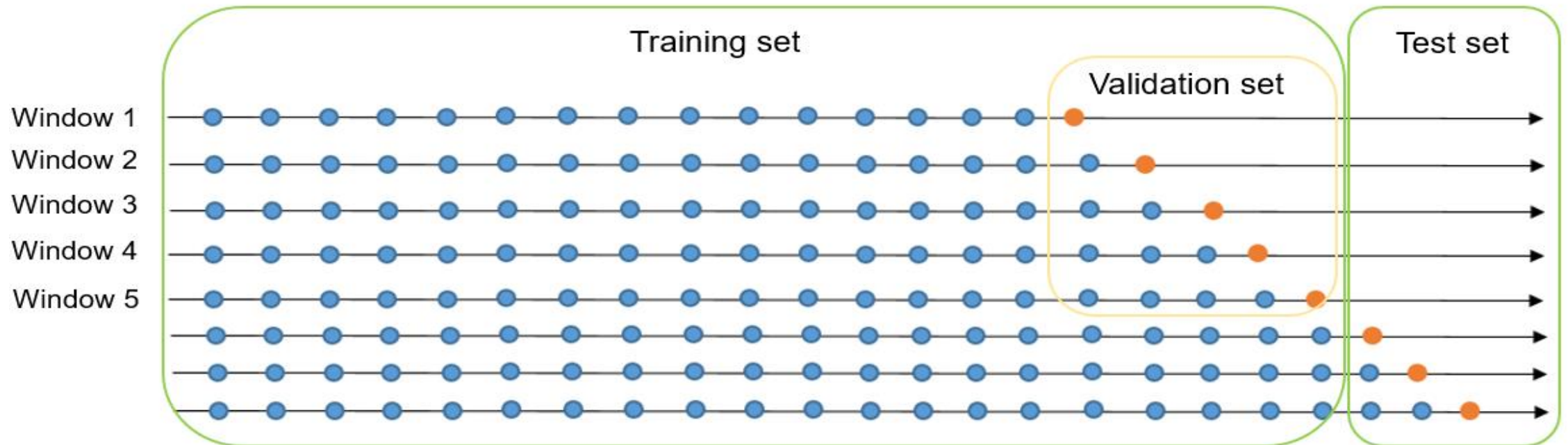
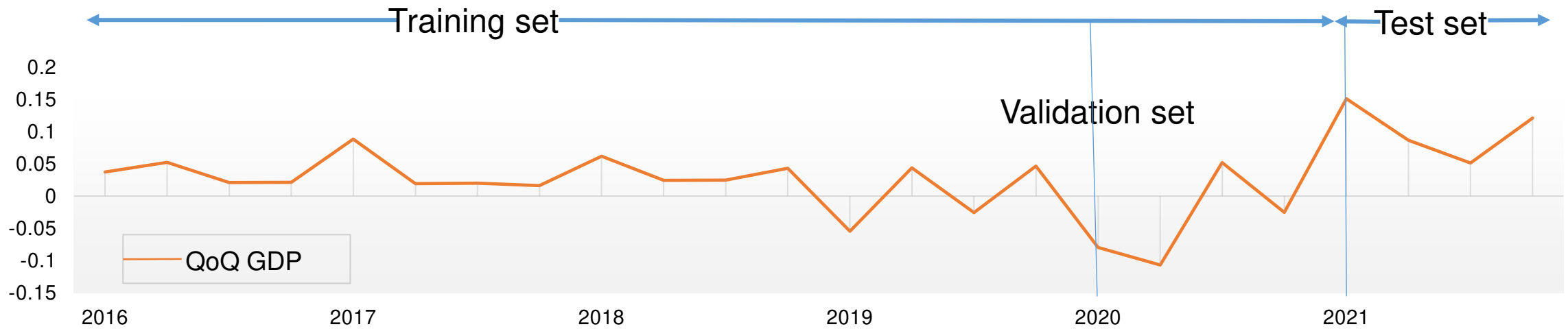
**Month 3:**  $\Delta GDP_{Q_t} = \alpha + \sum_{j=1}^{20} B_j \Delta S_{j,Q_{(t_1,t_2,t_3)}} + \Delta cashtocard_{Q_{(t_1,t_2,t_3)}} + \varepsilon_{Q_{(t_1,t_2,t_3)}}$

Where  $\Delta GDP_{Q_t}$  is the growth rate of nominal *GDP* at quarter *t*;

*t1, t2 and t3* indicates the first, second, and third month of the quarter;

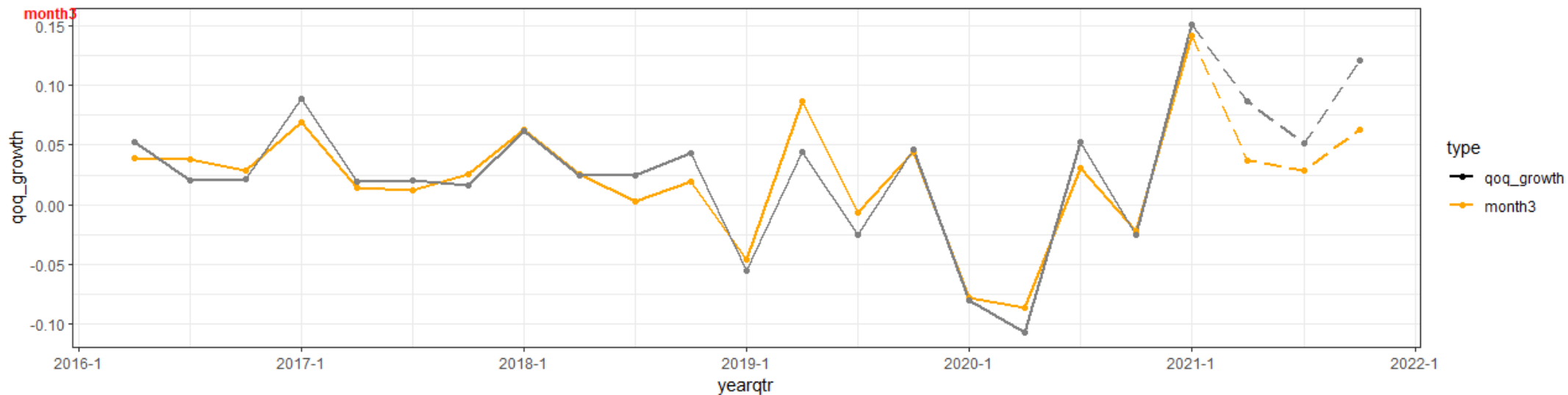
$\Delta S_{j,Q_{t_i}}$  is the growth rate of average payment inflows in sector *j* at month *t*

# Time series cross validation with expanding window

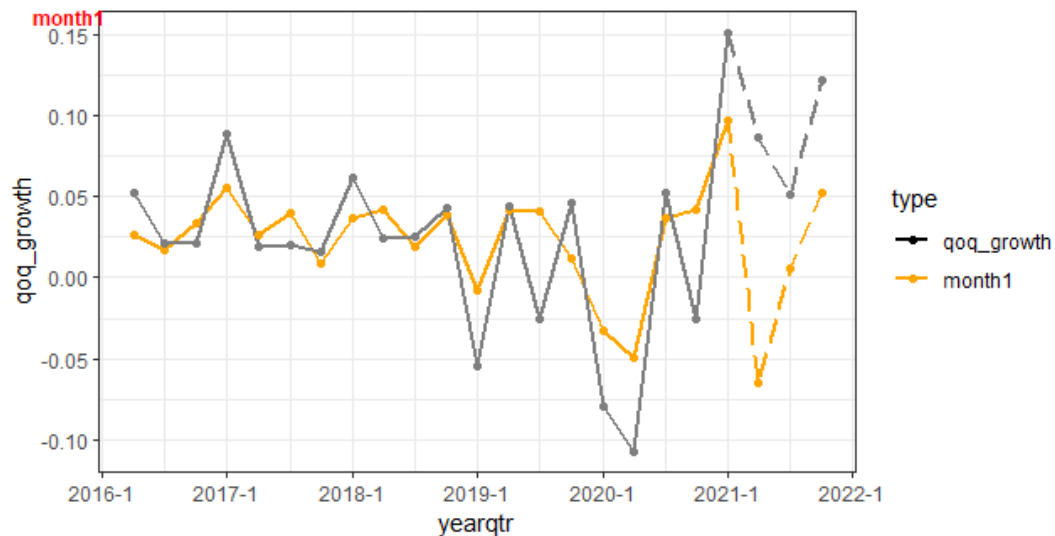


# Results: ML models (Lasso)

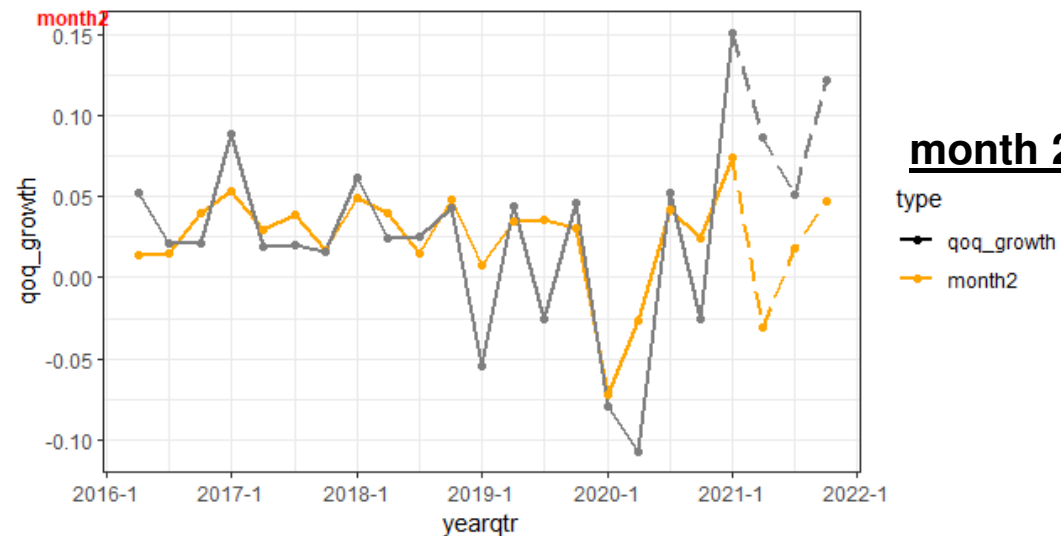
month 3



month 1

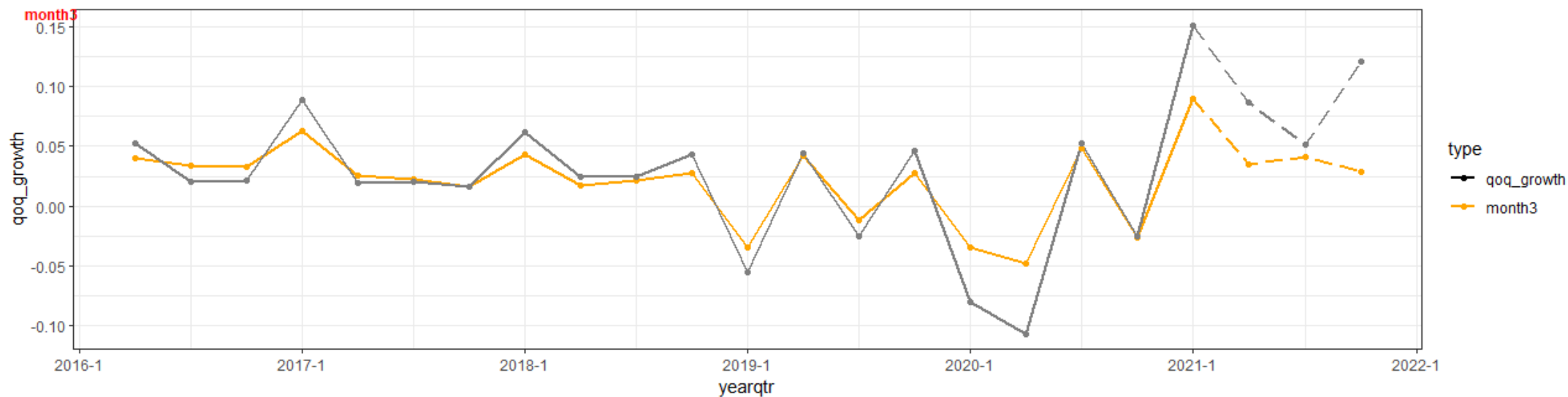


month 2

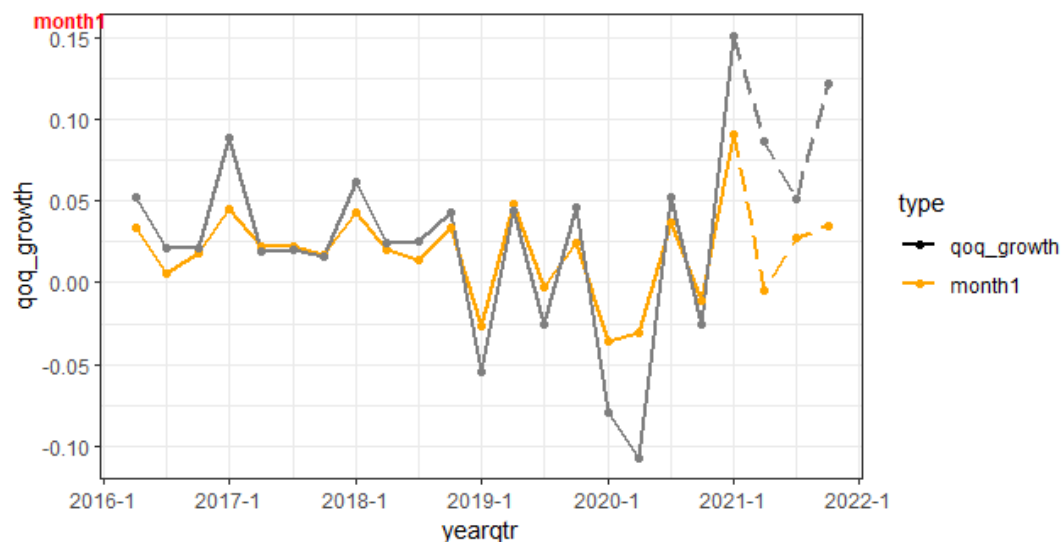


# Results: ML models (Random Forest)

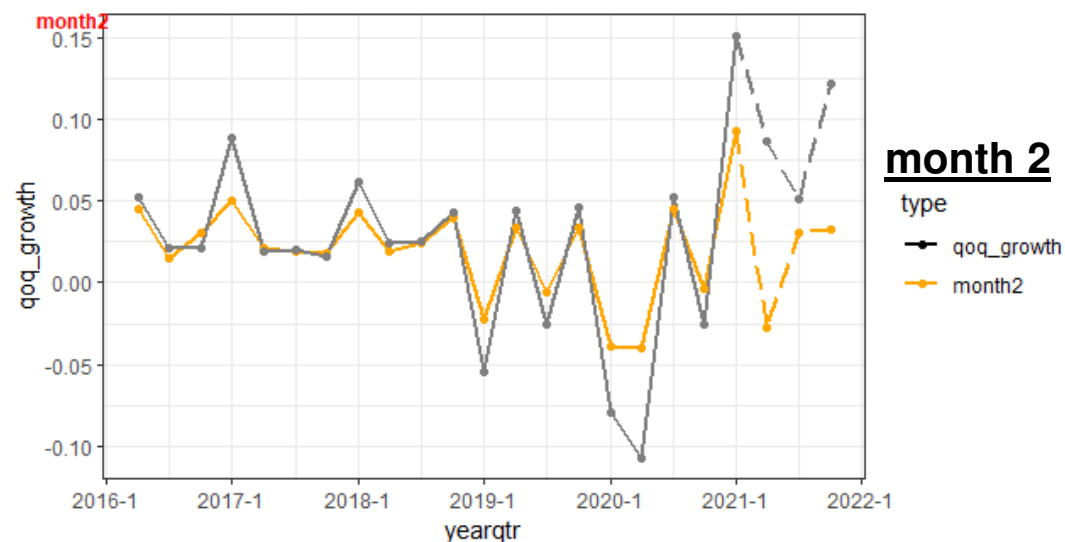
month 3



month 1

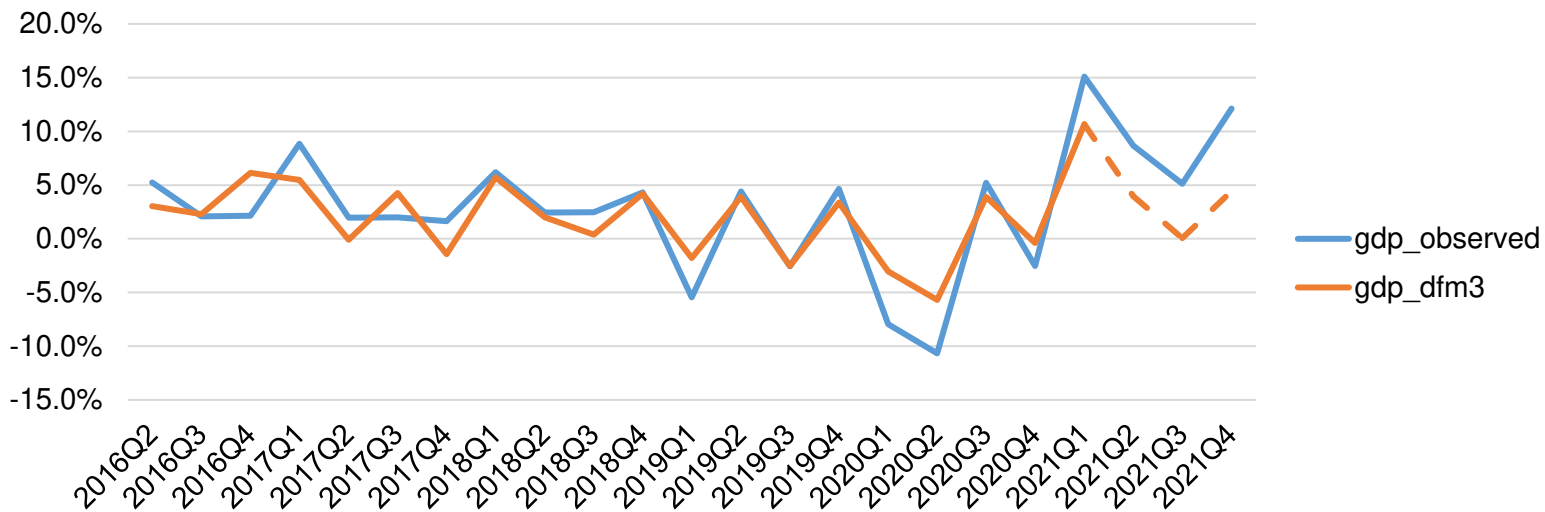


month 2

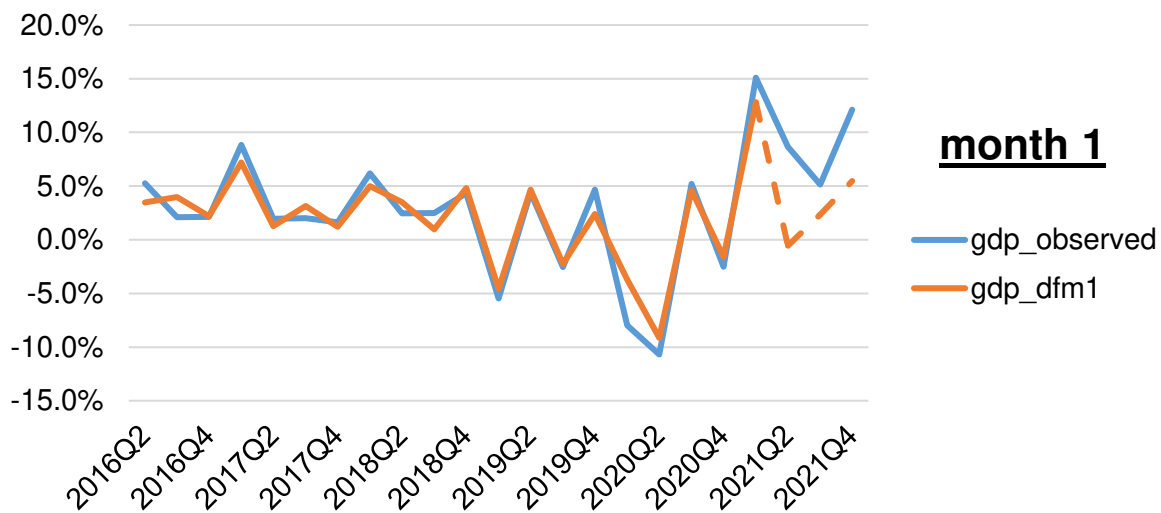


# Results: Dynamic Factor Model

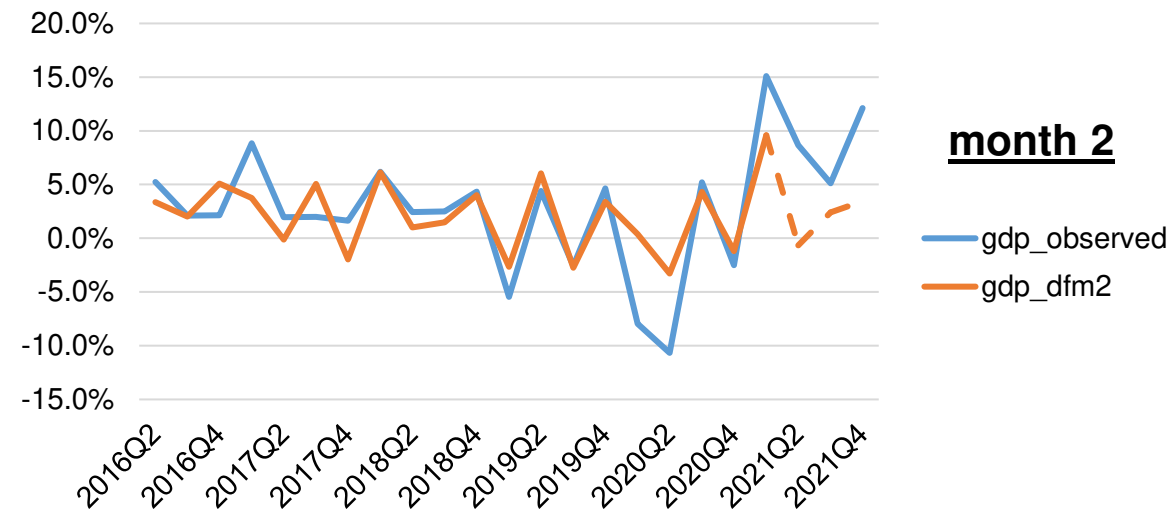
**month 3**



**month 1**



**month 2**



# Comparison of out-of-sample RMSE

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**Target:** Nominal QoQ GDP growth

	t	t+1	t+2
DFM	0.90	0.99	0.78
ML:			
Lasso	1.31	1.08	<b>0.59</b>
Random Forest	0.98	1.04	0.80

**Training:** January 2016 to March 2021 and **testing:** April 2021 to December 2021

**Benchmark:** AR(1)

**Note:** A ratio of less than 1 indicates that the model has a higher predictability than a simple AR model

# Conclusions

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- Payments data provide economic information in real-time and help reducing dependence on low frequency indicators;
- Payments system data can lower nowcast errors significantly over benchmark models;
- Machine learning can help capture nonlinear relationships in the data, such as the sudden and substantial effects of economic crises;
- DFM is a powerful approach to capture the common dynamics of a set of predictors in a relatively small number of latent factors;