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| صورة تحتوي على نص, دائرة, الخط, رسم بياني  تم إنشاء الوصف تلقائياً | **Cairo University**  **Faculty of Graduate Studies for Statistical Research** | صورة تحتوي على نص, رمز, قصاصة فنية, الخط  تم إنشاء الوصف تلقائياً |

**Study On** **Panel Data Methodologies**

**With**

**Application for** **Macroeconometrics**

**(****Inflation Forecasting)**

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# Abstract:

This study examines the effectiveness of panel data methodologies in Macroeconometrics, with an application to inflation forecasting. Using a harmonized dataset covering 70 countries from 2000 to 2024, we investigate how different panel estimators—Pooled OLS, Fixed Effects (FE), Random Effects (RE), and dynamic approaches such as the Arellano–Bond GMM—perform in predicting average consumer price changes (PCPIPCH). Explanatory variables include government fiscal indicators, trade volumes, investment ratios, labor market conditions, and PPP measures, primarily sourced from the IMF World Economic Outlook and the World Bank.

Empirical analysis involves model selection via Hausman and Wald tests, alongside diagnostics for serial correlation, stationarity, and heteroskedasticity. Forecast accuracy is evaluated using out-of-sample Root Mean Square Error (RMSE). Results reveal that dynamic panel models consistently yield lower RMSE values, effectively addressing endogeneity and country-specific shocks. The Arellano–Bond GMM estimator emerges as the most robust tool when lagged inflation and macroeconomic fundamentals are included.

Our findings highlight the importance of methodological rigor in panel estimation for macroeconomic forecasting. These insights offer evidence-based guidance for policymakers seeking reliable inflation projections across diverse economic environments.

By identifying the most suitable panel model for inflation prediction, this research contributes to Macroeconometrics literature and provides practical tools for policymakers. The study aims to demonstrate that dynamic panel estimators deliver superior forecasting accuracy, offering robust insights into inflation dynamics under varying economic conditions.

**Keywords:** Panel Data, Macroeconometrics, Python, Statistical Models, Inflation Forecasting.

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# Introduction:

Accurate inflation forecasting is fundamental for sound monetary policy, fiscal planning, and investment strategy in an interconnected global economy. Conventional time-series models often struggle to capture cross-country heterogeneity and exploit both temporal and spatial dimensions of macroeconomic data. Panel data methodologies overcome these limitations by combining cross-sectional and time-series information, thereby enhancing estimator efficiency and controlling for unobserved effects.

overview of the historical development of models:

The present study, titled "Study on Panel Data Methodologies with Application for Macroeconometrics (Inflation Forecasting)," applies multiple panel estimation techniques to a comprehensive macroeconomic dataset of 70 countries spanning 2000–2024. Our target variable is PCPIPCH (Inflation, average consumer prices), with regressors encompassing GDP growth, government revenue and debt ratios, trade flows, unemployment rates, investment shares, and PPP adjustments.

**Dataset Description Table:**

|  |  |  |
| --- | --- | --- |
| Variable Code | Description | Units |
| Country\_Code | ID number for each country | ID |
| Country | Name of 70 countries | String |
| Advanced\_Country | Is the country developed (1) or developing (0)? | Boolean |
| Years | date from 2000 to 2024 | Date |
| NGDP\_RPCH | Gross domestic product, constant prices | Percent change |
| PPPPC | Gross domestic product per capita, current prices | Purchasing power parity; international dollars |
| PPPSH | Gross domestic product based on purchasing-power-parity (PPP) share of world total | Percent |
| NGSD\_NGDP | Gross national savings | Percent of GDP |
| NID\_NGDP | Total investment | Percent of GDP |
| PPPEX | Implied PPP conversion rate | National currency per current international dollar |
| TX\_RPCH | Volume of exports of goods and services | Percent change |
| TM\_RPCH | Volume of imports of goods and services | Percent change |
| LUR | Unemployment rate | Percent of total labor force |
| GGR\_NGDP | General government revenue | Percent of GDP |
| GGX\_NGDP | General government total expenditure | Percent of GDP |
| GGSB\_NPGDP | General government structural balance | Percent of potential GDP |
| GGXWDG\_NGDP | General government gross debt | Percent of GDP |
| BCA\_NGDPD | Current account balance | Percent of GDP |
| TRWMA | Tariff rate, applied, weighted mean, all products | Percent |
| PCPIPCH | Inflation, average consumer prices (Target) | Percent change |

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