Toulouse School of Economics

The Impact of the real Interest Rate on aggregate Consumption: a worldwide study.

Léopold DOVILLE, Romain MEUNIER, and Corentin OLLIVIER

Group 6

Applied Econometrics Paper

March 2025

Abstract

The impact of real interest rates on aggregate consumption remains a debated issue in macroeconomics, some economists argue that the impact is negative while others argue that is more ambiguous. Thanks to the panel data used gathering 105 countries over the period 1980–2023, we can observe a heterogeneous private consumption among countries {4}, in contrast to the homogeneity of the real interest rate in the world {5}. Hence, this study aims to understand how a real interest rate that seems stable over countries impacts different levels of consumption. To study such a relationship it has been developed different econometrics models: Fixed Effects, Two-Stage Least Squares (2SLS), Fixed Two-Stage Least Squares (F2SLS), and Generalized Method of Moments (GMM). In the end, the F2SLS is chosen, which indicates a negative effect between real interest rate and consumption. Indeed, a one percentage point increase in the real interest rate reduces consumption by 0.7%.

Table of Contents

1 Introduction

Although private consumption and real interest rates are relatively different between countries, where the literature fails to find out a pattern between developed, developing, and lest developed. Understanding the impact of the real interest rate on consumption is crucial from an economic perspective by shedding light on the real impact of the real interest rate, hence, enhancing the monetary policy effectiveness and guaranteeing financial stability.

One of the potential explanations for the aggregate consumption gap is monetary policy. Indeed, a monetary policy is a set of tools controlling the overall money supply and promoting economic growth. Monetary policies are used by a nation's central bank or any other institution in charge of it. One of the most famous tools of monetary policy is the nominal interest rate (Challe, 2023) that impacts economic activity and especially aggregate consumption. Since 1907 when I.Fisher developed the concept of real interest rate (Irving Fisher, 1907) and then developed further this concept with the Fisher equation: $r_t = i_t - \pi_{t+1}{}^e$ (Irving Fisher, 1930). It has been widely used around the world by the Central Bank to Government with more than 10,581 quotes of his book "The Theory of Interest" according to Google Scholar. Nevertheless, it is not because this concept has become popular that there is a common agreement on how the real interest rate impacts society. Mark. P Taylor has highlighted it with: *"While standard discussions of the transmission mechanism of monetary policy tend to assume a strong and negative link between real interest rates and real macroeconomic activity [...] the empirical evidence suggests that the link between real interest rates and macroeconomic aggregates such as consumption and investment is, in fact, somewhat tenuous."* (Taylor, 1999)

As MP Taylor highlighted already in 1999, the need for further research on real interest rates and its empirical impact on aggregate macroeconomic measures is still necessary. Most of the literature is based on the study of one country or region either at the aggregate scale or individual one, this paper aims to advance comprehension of the impact of the real interest rate on aggregate consumption, by analyzing panel data from 105 countries over 43 years. The subsequent will delve into the presentation of the data.

2 Data

2.1 Sample selection

The final data set is panel data depending on countries and time: from 1980 to 2023. We create the final data set using 6 data sets that come from World Bank Open Data. Each one represents one variable in the final data set: private consumption, inflation, unemployment, GDP per capita, real interest rate, and tax revenue. For each data set, there were not the same countries available so we took the intersection of the countries of all the data sets and ended up with a sample of 110 countries. Then, we delete from our data set all the countries that have less than 5 values for at least one of the variables and end up with 105 countries in the final data set. The full list is in the Appendix.

The data set has a lot of missing values, especially for the first years. This is complicated to fill these as it depends on time. To solve this issue, we use a Kalman filter with a structural time series model. This enables us to take into account trend, seasonality, and stochastic variance when computing the predictions for the missing values.

2.2 Analysis variables

The dependent variable is the private consumption and the variable of interest is the real interest rate as we want to study its impact on the private consumption. The other independent variables are unemployment, tax revenue, the GDP per capita, and the lag of GDP per capita one period before. In order to treat the endogeneity problem that we encounter, we also add two instrumental variables which are the inflation and lag of GDP per capita two periods before.

Variables of private consumption and GDP per capita are transformed in log. As they were variables with large values and large disparities between countries, the log-linearization enables us to reduce the scale effect and keep the proportionality between countries. This gives us a better estimate of the regressions. Also, the tax revenue is expressed in percentage of GDP. As the countries have very different scales, taking this variable in percentage of GDP allows us to compare more easily and

with a better scale the different countries.

3 Model

When we have data on multiple countries and over several years, differences between these countries, such as cultural, institutional, or structural differences, may affect our explanatory variables. Therefore, if we do not control for these differences, there is a risk of drawing incorrect conclusions. This is the reason why we introduce Fixed and Random Effects models :

3.1 Fixed vs. Random Effects Models

The Fixed Effects model specifies that each country has unique characteristics, that is culture, political institutions, economic history, geography, and so on, that remain constant over time. In classical regression models, we don't necessarily account for these effects, but we are aware that they exist and hardly change over time. For instance, France has a different culture compared to the USA. This difference in culture is potentially affecting consumption patterns independently from the economic variables we observe in our model. Thus, we decide to derive the following:

$$\log(C_{i,t}) = \beta_0 + \beta_1 r_{i,t} + \beta_2 \log(Y_{i,t}) + \beta_3 \log(Y_{i,t-1}) + \beta_4 T_{i,t} + \beta_5 u_{i,t} + \eta_i + \epsilon_{i,t}$$

Hence, if country-specific characteristics continuously impact consumption, their effect is automatically accounted for and we have no longer dynamic panel biases in our results.

On the other hand, the Random Effects model also considers that each country has differences. But unlike Fixed Effects, these country-specific differences are random and not correlated directly with the explanatory variables. It implies viewing countries as randomly selected from a larger population. This assumption is often unrealistic as differences are rarely completely independent of the economic variables.

Indeed, to choose between these two models we derive a Hausman test. The latter compares the results obtained in both models and indicates if the differences between the models' estimations are statistically significant. The test indicates a low p-value (0.01831<0.05) (4) which suggests that we should use the Fixed Effects model. This conclusion conforms with the literature *"The fixed effects model [...] is a common choice for macroeconomists. It is generally more appropriate than a random*

effects model" Judson and Owen (1999). However, the presence of endogeneity is suspected for one explanatory variable: GDP per capita. To tackle this, it has been developed a 2SLS. Let's delve into it in the next section.

3.2 Instrumental Variables Models : 2SLS, F2SLS and GMM

3.2.1 2SLS and F2SLS

As its name suggests, the Two-Stages Least Squares (2SLS) divides the regression into two different stages.

First Stage of the 2SLS: The problematic variable, GDP per capita, is regressed using variables called instruments. Instrumental variables are variables correlated to the problematic variable but not directly with the dependent variable, consumption (i.e : correlated with past variables for instance).

Second Stage of the 2SLS: Then we use the predicted values of GDP per capita computed in the first stage as explanatory variables for consumption. Therefore, endogeneity and reverse causality effects are removed.

That is why, given that we found earlier that the fixed effect model was the best, we apply the 2SLS to this model, which will be called the Fixed Effects 2SLS (F2SLS). This model enables tackling the endogeneity and reverse causality problem as well as controlling for constant differences between countries at the same time.

First Stage F2SLS: Inflation, Private consumption last period, GDP per capita two years from now are used as instruments

$$\log(Y_{i,t}) = \alpha_0 + \alpha_1 r_{i,t} + \alpha_2 \log(Y_{i,t-1}) + \alpha_3 T_{i,t} + \alpha_4 u_{i,t} + \alpha_5 C_{i,t-1} + \alpha_6 \log(Y_{i,t-2}) + \alpha_7 \pi_{i,t} + \upsilon_{i,t}$$

Second Stage F2SLS:

$$\log(C_{i,t}) = \beta_0 + \beta_1 r_{i,t} + \beta_2 \widehat{\log(Y_{i,t})} + \beta_3 \log(Y_{i,t-1}) + \beta_4 T_{i,t} + \beta_5 u_{i,t} + \eta_i + \epsilon_{i,t}$$

Nevertheless, we need to make sure the instruments we are using are relevant and valid so that we can draw good conclusions. To test these two conditions, we first computed a Sargan test in which

its' p-value is extremely low, meaning that our instruments are not valid. However, the relevance condition is respected since we obtain a F-statistic above the threshold of 10 (F>10).

3.2.2 Generalized Method of Moments

The Generalized Method of Moments (GMM) is a generalization of 2SLS. Even though F2SLS handles endogeneity, reverse causality, and differences between countries it may not handle well complex correlation patterns of errors, such as economic shocks, over time. This is what GMM is used for: it still solves issues like in F2SLS but also explicitly deals with autocorrelation and heteroskedasticity simultaneously.

Autocorrelation is when the error terms in the data are related over time. For instance, if a country experiences an economic crisis, or a negative shock, its consumption may remain lower in the following years: the shock effects persist over time.

Heteroskedasticity is when we have variability in the errors. For example, some countries might have stable consumption patterns, with small fluctuations in errors, while other countries may have unstable consumption patterns which will imply larger fluctuations in errors.

Thus, GMM provides estimates that are more accurate and reliable, especially for complicated data like ours with multiple countries and for long periods of time.

But how does it work? While 2SLS relies on the concept of Least Squares, which focuses on minimizing the squared differences between observed and predicted values, GMM relies on moments. Moments are statistical conditions about the expected relationship in the data, which the model tries to satisfy.

Therefore, it uses the same equation and instruments as F2SLS but with the lag of GDP per capita from two year from now to first period and with different conditions. Also, GMM provides valid and relevant instruments: the p-value of the Sargan test is above 0.05 and the F-statistic is above 10. Both autocorrelation tests, AR(1) and AR(2), suggest that their is no autocorrelation in our model. Hence, GMM provides robust and valid results.

4 Results

Overall, the study of these different models highlights a significant impact of the real interest rate on private consumption at 1% level. Let us delve into it:

4.1 Fixed Effect Model

The results are presented in Table 3. First of all, the real interest rate is significant at 1% level and for each percentage point increase of the real interest rate, the private consumption is attended to decrease by 0,1%. Moreover, its standard error is quite small with a value of 0.003. It is important to notice that these results align with the literature. The real interest rate has a more tenuous impact as stated by Taylor (1999) with this weak negative magnitude. As we supposed that GDP can be a good measure of income, we check that the permanent income hypothesis of J. M Keynes is satisfied. His hypothesis stated that current income has a positive impact on private consumption (Keynes, 1936). In the data set used, when the GDP per capita increases by one percentage point the private consumption increases by 0.979%, checking the Keynes' hypothesis. Moreover, the positive coefficient in front of the lag GDP per capita is smaller but still positive, aligning with the idea that individuals also account for past income in their consumption decisions, which is consistent with Friedman's Permanent Income Hypothesis (Friedman, 1957). While the result concerning the unemployment rates is quite counterintuitive, indeed, when the unemployment rate increased by one percentage point, private consumption increased by 1,8%. In addition to this surprising result, it is significant at 1% level, the most likely explanation is more unemployment leads to higher government spending which has a positive impact on consumption as it has been stated by Blanchard and Perotti (2002). A concrete example of this mechanism is the French government's "quoi qu'il en coûte" policy during the COVID-19 crisis. Under President Emmanuel Macron, the French state implemented massive fiscal measures—including furlough schemes, direct aid to businesses, and social spending—to sustain household income despite rising unemployment. As a result, even though unemployment increased, consumption remained relatively stable due to government support, illustrating how fiscal intervention can mitigate the usual negative relationship between unemployment and private consumption. Regarding the tax revenue in percentage of GDP, when it increases by one percentage point the private consumption increases by 0,7%. This positive coefficient could be explained by the trend of bigger countries to have a larger consumption as well as

their tax revenue which is more important due to their richer economy.

Finally, this model has an adjusted R squared of 0.831, which means that the model explains 83.1% of the total sum of squares which is a strong result on the reliability of the model. Given the adjusted R squared and the overall specification of the model with the control variables that are all significant at the 1% level, the model captures the macroeconomic dynamics of private consumption and its determinants.

However, our result might be driven by an endogenous problem, especially with the GDP that could be probably correlated with the error term due to a supply/demand shock that is not captured in our model for example. To tackle this issue we, first, developed a 2SLS in the fixed effect model.

4.2 2SLS: Fixed Effect Model

The magnitudes of the coefficients change slightly, but the signs of the coefficients remain exactly the same. When the real interest rate increases by 1 percentage point, private consumption decreases by 0.7%. This result emphasizes the negative link of real interest on consumption by 0.6 percentage points compared to the classical fixed effect model. The hypothesis of Keynes as well as the one from Friedman are still respected in this model with positive coefficients in front of the GDP per capita and the lag 1 of GDP per capita. All the control variables and the real interest rate are significant at 1% level. However, knowing that the instruments used are not good enough due to the lack of the validity condition, even though the relevance condition is respected. We derive the GMM estimation, as presented earlier 3.2.2 the GMM provides a robust in our case. Let us take a closer look at its results.

4.3 GMM

Not only, has the real interest rate changed significantly, but overall the magnitudes are strengthened. Nevertheless, all the coefficients are significant at 0.1% level. Now, when the real interest rate increases by one percentage point, private consumption increases by 1,7%.

The effect of a permanent income on consumption is re-enforced in this model, because when the GDP per capita increases by one percentage point the private consumption increases by 1.92% with a small standard error (0,001). The GDP per capita of the previous year experiences also its magnitude

re-enforce, when the GDP per capita of t-1 increases by one percentage point leading to an increase of consumption by 0,65%, aligning with Friedman's hypothesis of permanent income. The positive effect of tax revenue is still positive and significant at 1% level, experiencing also a deepening effect. When the tax revenue of a country increases by 1 point percentage, its private consumption increases by 7%. Unfortunately, unemployment has still a positive impact on private consumption but is even greater with an increase of a percentage point in the unemployment rate leading to an increase of 15%.

Although the 2SLS model does not fully satisfy the instrument validity condition, its estimates align better with economic theory and expected relationships. In contrast, the GMM model, while theoretically more robust, yields counterfactual results, suggesting possible misspecification or overfitting. Given these considerations, we cautiously prefer the 2SLS estimates for their economic plausibility, while acknowledging their limitations.

5 Conclusion

Our analysis highlights a significant relationship between the real interest rate and aggregate consumption, although the direction and magnitude of the effect vary across models. The fixed effects model suggests a weak negative relationship (-0.1%), while the 2SLS model strengthens this negative impact (-0.7%). However, the GMM model yields an unexpected positive effect (+1.7%), suggesting potential misspecification issues or instrument weaknesses.

These findings are partially consistent with the literature. While classical economic theory (Challe, 2023) predicts a negative relationship between real interest rates and consumption, empirical studies have often found mixed results (Taylor, 1999). The variation in our results across models reflects this ongoing debate and highlights the importance of correctly addressing endogeneity and model specification issues.

5.1 Policy Implications

5.1.1 Monetary policy and Forward guidance

Since the impact of the real interest rate is ambiguous, central banks could manage inflation expectations to shape the way households and businesses anticipate future real interest rates. To be credible

and for forward guidance to be efficient, central banks need to be transparent about their targets and goals so that people believe in future policies.

However, we observe a relatively weak effect of the real interest rate on private consumption in some of our models. Hence, central banks could combine forward guidance with fiscal measures to reinforce the expected effects of monetary policies.

5.1.2 Fiscal, Tax policy and Social benefits

The positive relationship between unemployment and consumption suggests that automatic stabilizers, such as unemployment benefits and social transfers, play a crucial role in sustaining demand during downturns. The positive impact of tax revenue on consumption suggests a well-designed tax structure because it enhances economic stability. Therefore it would be interesting to investigate the impact of progressive taxation on private consumption and show how it can mitigate the impact of monetary policy shocks on lower-income households.

5.2 Limits and Future Work

5.2.1 Data and sample constraints

Our dataset covers 105 countries, but missing values required interpolation techniques, which may introduce biases. Future studies could expand the dataset by integrating additional data sources.

Also, we did not differentiate between developed and developing countries. While our fixed effects model accounts for country-specific characteristics, it assumes a single coefficient for the real interest rate effect on consumption. Future research could explicitly investigate heterogeneous effects by estimating separate models for developed and developing countries or introducing interaction terms to capture potential differences

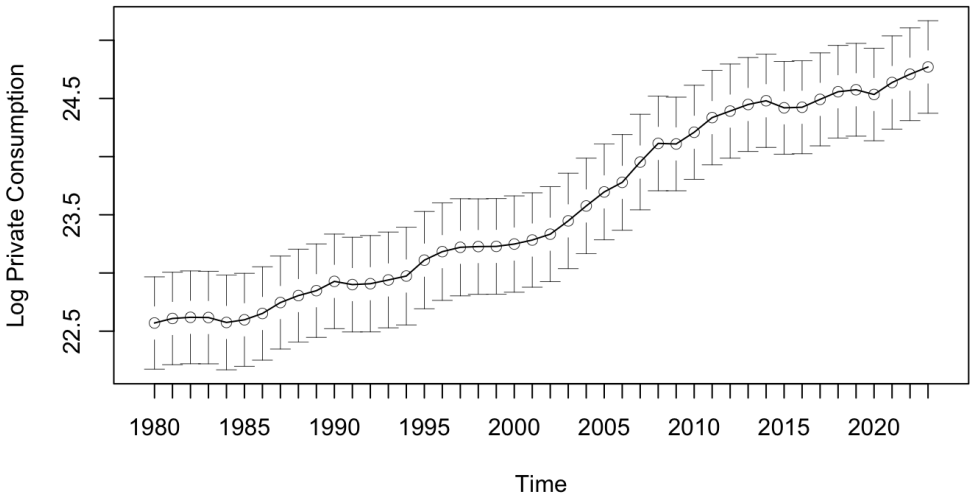
5.2.2 Model and instruments

While we used 2SLS and GMM to correct for endogeneity, our instrument validity tests indicate potential weaknesses, particularly in the 2SLS model. Future work should explore alternative instruments, such as financial market indicators or consumption expectations.

6 Appendix

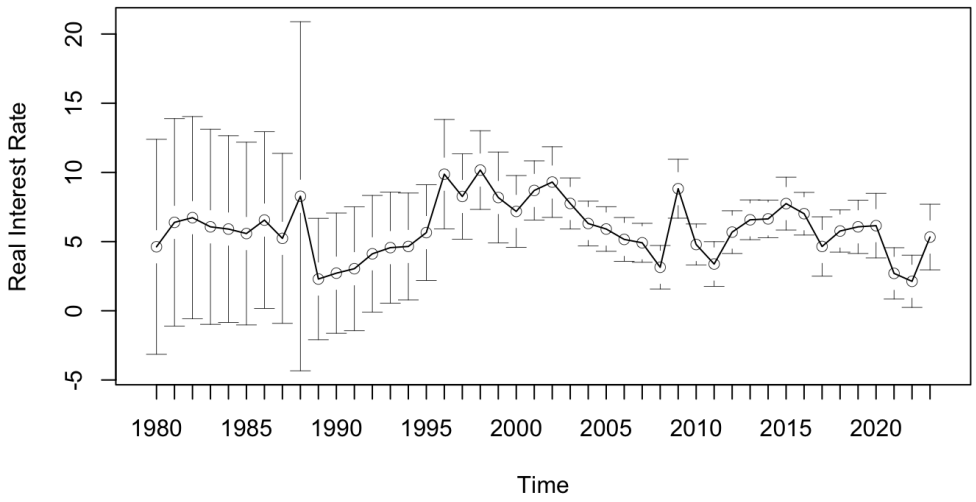
6.1 Graphics

Figure 1: Private Consumption Across time



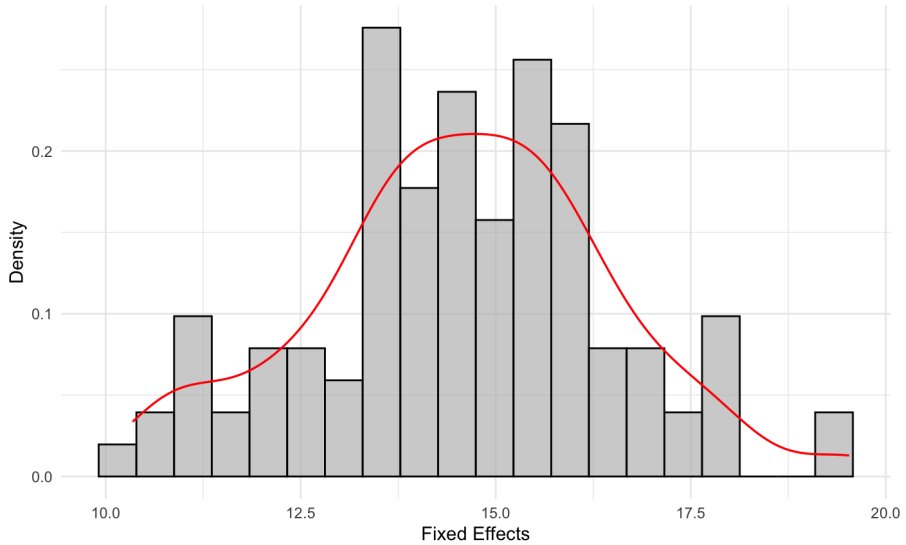
The figure 1 provides the overall trend of private consumption across time. Each point represents the mean of the private consumption of each country at that time. The moustaches around each point of each year, represents the confidence interval at 95%.

Figure 2: Real Interest Rate Across time



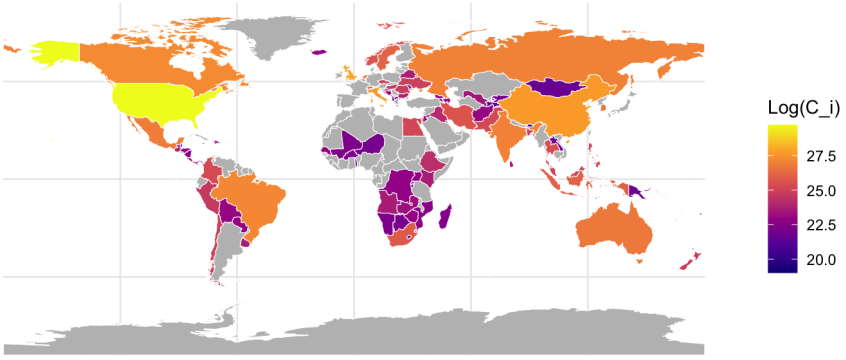
The figure 2 provides the overall trend of the real interest rate across time. Each point represents the mean of the real interest rate of each country at that time. The moustaches around each point of each year, represents the confidence interval at 95%. This figure captures very well the different main crises, such as the subprimes and covid crises.

Figure 3: Fixed effects distribution with Kernel Density



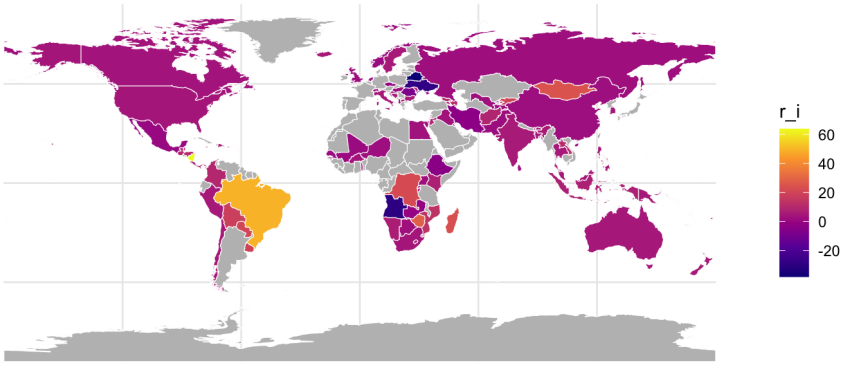
The figure 3 show the fixed effect distribution. The fixed effect distribution seems symmetric even if we have more values on the left tail. The distribution is widely spread.

Figure 4: The average private consumption around the world.



The figure 4 is a choropleth map showing the average private consumption across countries in the world. We can see that the private consumption is very different across countries, especially when comparing developed and developing countries.

Figure 5: The average real interest rate around the world.



The figure 5 is a choropleth map showing the average real interest rate across countries in the world. We can see that the real interest rate seems very similar across countries.

6.2 Data

The list of the countries in the data set is the following : Afghanistan, Albania, Angola, Armenia, Australia, Azerbaijan, Bahamas, Bahrain, Bangladesh, Belarus, Belize, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, Burkina Faso, Burundi, Cabo Verde, Canada, Chile, China, Colombia, Congo, Costa Rica, Cote d'Ivoire, Croatia, Czechia, Dominican Republic, Egypt, Ethiopia, Fiji, Georgia, Guatemala, Honduras, Hungary, Iceland, India, Indonesia, Iran, Iraq, Israel, Italy, Jamaica, Jordan, Kenya, Korea, Kuwait, Kyrgyz Republic, Lao PDR, Lebanon, Lesotho, Macao SAR China, Madagascar, Malaysia, Maldives, Mali, Malta, Mauritius, Mexico, Moldova, Mongolia, Mozambique, Namibia, Netherlands, New Zealand, Nicaragua, Niger, North Macedonia, Norway, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Romania, Russian Federation, Rwanda, Samoa, Senegal, Serbia, Singapore, Solomon Islands, South Africa, Sri Lanka, Sweden, Switzerland, Tajikistan, Tanzania, Thailand, Timor-Leste, Togo, Tonga, Uganda, Ukraine, United Kingdom, United States, Uruguay, Uzbekistan, Vanuatu, West Bank and Gaza, Zambia and Zimbabwe.

Table 1: Variables

Abbreviation	Variable	Explications	transform
$C_{i,t}$	Private consumption	sum of household final consumption expenditure (private consumption) and general government final consumption expenditure (general government consumption). Data are in current U.S. dollars.	log
$\pi_{i,t}$	inflation	annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used.	
$r_{i,t}$	Real Interest Rate	lending interest rate adjusted for inflation as measured by the GDP deflator	
$u_{i,t}$	Unemployment	Unemployment refers to the share of the labor force that is without work but available for and seeking employment.	
$Y_{i,t}$	GDP Per Capita	gross domestic product divided by midyear population. Data are in current U.S. dollars.	log
$T_{i,t}$	Tax Revenue	compulsory transfers to the central government for public purposes. Data are in percentage of GDP.	

6.3 Results

Table 2: Descriptive statistics

Statistic	Mean	St. Dev.	Min	Max	Median	N
inflation	120.560	1,129.805	−18.479	23,773.130	5.939	4,620
real_interest_rate	5.885	21.608	−97.693	628.320	5.229	4,620
unemployment	7.089	5.675	−4.718	38.800	5.407	4,620
tax_revenue	16.219	10.741	0.086	147.640	14.622	4,620
private_consumption_log	23.569	2.206	17.477	30.747	23.331	4,584
gdp_per_capita_log	7.824	1.530	3.133	11.597	7.680	4,620

The table 2 gives the descriptive statistics of all the variables in our dataset.

Table 3: Econometrics Resutls

	Dependent variable: private_consumption_log		
	Pooled	Random Effects	Fixed Effects
	(1)	(2)	(3)
real_interest_rate	−0.003*** (0.001)	−0.001** (0.0003)	−0.001** (0.0003)
gdp_per_capita_log	0.931*** (0.151)	0.978*** (0.029)	0.979*** (0.029)
unemployment	−0.0003 (0.005)	0.017*** (0.002)	0.018*** (0.002)
tax_revenue	−0.034*** (0.002)	0.007*** (0.001)	0.007*** (0.001)
lag(gdp_per_capita_log, 1)	−0.089 (0.152)	0.121*** (0.029)	0.122*** (0.029)
Constant	17.546*** (0.145)	14.739*** (0.183)	
Observations	4,482	4,482	4,482
R^2	0.352	0.831	0.835
Adjusted R^2	0.352	0.831	0.831
F Statistic	486.802*** (df = 5; 4476)	22,051.050***	4,418.611*** (df = 5; 4372)
Note:			*p<0.1; **p<0.05; ***p<0.01

Table 4: Hausman Test Results

Test	Statistic	p_value
Hausman test	171.220	$2.2e-16$

The table 4 provides the results of the Hausman test performed to choose between random and fixed model. Due to a p-value below 0.05, the null hypothesis is rejected and suggest that estimators are similar. Hence, it is better to pursue the analysis by using a fixed effects model.

Table 5: PFTest Results

Test	Statistic	p_value
PFTest	1136.5	$2.2e-16$

The table 5 provides the results of the PFTest performed to choose between pooled and fixed model. Due to a p-value below 0.05, the null hypothesis is rejected and suggest that estimators are similar. Hence, it is better to pursue the analysis by using a fixed effects model.

Table 6: Breusch-Godfrey Test Results

Test	Statistic	p_value
Breusch-Godfrey	3371.3	$2.2e-16$

The table 6 provides the results of the Breusch-Godfrey test performed to observe if there is serial correlation and heteroskedasticity. Due to a p-value below 0.05, the null hypothesis is rejected and suggest that there is serial correlation and heteroskedasticity.

Table 7: Breusch-Pagan Test Results

Test	Statistic	p_value
Breusch-Pagan	161.27	$2.2e-16$

The table 7 provides the results of the Breusch-Pagan test performed to observe if there is heteroskedasticity. Due to a p-value below 0.05, the null hypothesis is rejected and suggest that there is heteroskedasticity.

Table 8: Robust Estimators Results

	Dependent variable: private_consumption_log
real_interest_rate	−0.001 (0.001)
gdp_per_capita_log	0.979*** (0.043)
unemployment	0.018** (0.009)
tax_revenue	0.007*** (0.002)
lag(gdp_per_capita_log, 1)	0.122*** (0.044)
Note:	*p<0.1; **p<0.05; ***p<0.01

To control for heteroskedasticity, we compute the robust estimators.

Table 9: GMM Estimators Results

	Dependent variable: private_consumption_log
real_interest_rate	0.017*** (0.002)
gdp_per_capita_log	1.927*** (0.258)
unemployment	0.156*** (0.025)
tax_revenue	0.072*** (0.017)
lag(gdp_per_capita_log, 1)	0.651*** (0.242)
Observations	105
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 10: 2SLS Model Results

	Dependent variable: private_consumption_log
real_interest_rate	−0.056*** (0.006)
gdp_per_capita_log	0.808*** (0.021)
unemployment	−0.002 (0.006)
tax_revenue	−0.035*** (0.003)
lag(gdp_per_capita_log, 1)	
Constant	18.136*** (0.183)
Observations	4,584
R^2	0.087
Adjusted R^2	0.086
Residual Std. Error	2.109 (df = 4579)
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 11: 2SLS with Fixed Effects Model Results

	Dependent variable: private_consumption_log
real_interest_rate	−0.007*** (0.001)
gdp_per_capita_log	0.345*** (0.041)
unemployment	0.019*** (0.002)
tax_revenue	0.008*** (0.001)
lag(gdp_per_capita_log, 1)	0.780*** (0.042)
Observations	4,377
R^2	0.810
Adjusted R^2	0.805
F Statistic	19,190.500***
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 12: 2SLS Fixed Effects and GMM Results

	Dependent variable: private_consumption_log	
	2SLS Fixed Effects	GMM
	(1)	(2)
real_interest_rate	−0.007*** (0.001)	0.017*** (0.002)
gdp_per_capita_log	0.345*** (0.041)	1.927*** (0.258)
unemployment	0.019*** (0.002)	0.156*** (0.025)
tax_revenue	0.008*** (0.001)	0.072*** (0.017)
lag(gdp_per_capita_log, 1)	0.780*** (0.042)	0.651*** (0.242)
Observations	4,377	105
R^2	0.810	
Adjusted R^2	0.805	
F Statistic	19,190.500***	
Note:	*p<0.1; **p<0.05; ***p<0.01	

References

Blanchard, Olivier and Roberto Perotti (2002). "An Empirical Characterization of the Dynamic Effects of Changes in Government Spending and Taxes on Output". In: *The Quarterly Journal of Economics* 117.4, pp. 1329–1368.

Challe, Édouard (2023). *Macroeconomic Fluctuations and Policies*. MIT Press.

Fisher, Irving (1907). *The Rate of Interest*. Macmillan.

Fisher, Irving (1930). *The Theory of Interest*. Macmillan.

Friedman, Milton (1957). *Theory of the Consumption Function*. Princeton University Press.

Judson, Ruth A and Ann L Owen (1999). "Estimating dynamic panel data models: a guide for macroeconomists". In: *Econ. Lett.* 65.1, pp. 9–15.

Keynes, John Maynard (1936). *The General Theory of Employment, Interest and Money*. Macmillan.

Taylor, Mark P. (1999). "Real interest rates and macroeconomic activity". In: *Oxford Review of Economic Policy* 15.2, pp. 95–113.