

Wealth and consumption

Haichuan Zhang
Peilin Wang
Zhenyang Cui

Introduction

- We wonder about do household consume more when their wealth increases?
- We expect to identify a positive relationship between consumption and wealth by using 20 EU zone countries and Japan datasets to regress.

Definition

Wealth:

- **Fixed asset value:** the worth of long-term physical assets owned by the household, such as a house, car, or land.
- **Stock market financial assets:** instruments like stocks, bonds, mutual funds, and ETFs that individuals or institutions invest in through financial markets.
- **Employee compensation or income:** total earnings an individual receives from employment,
- Consumption is consumption of household(s).

Github

- Link to Our project github:

<https://github.com/Graspp-25-Spring/graspp-25S-Wealth-Consumption>

EU Datasets

- Source: ECB(European Central Bank)
- Description: Quarterly private consumption data
- Countries: 20 EU zone countries
- Time Series: ranges from April 1995 to December 2024

Descriptive Statistics EU

Indicator

Descriptive Statistics:

	consumption	housing_wealth	financial_assets	income
count	6.400000e+01	6.400000e+01	6.400000e+01	6.400000e+01
mean	1.550830e+06	3.087334e+07	3.950816e+06	1.786037e+06
std	2.020929e+05	4.915196e+06	1.150425e+06	2.543454e+05
min	1.314874e+06	2.613831e+07	2.433442e+06	1.470215e+06
25%	1.392866e+06	2.687493e+07	2.816647e+06	1.592234e+06
50%	1.497452e+06	2.840087e+07	3.928425e+06	1.703921e+06
75%	1.624710e+06	3.401353e+07	4.843694e+06	1.901443e+06
max	2.026259e+06	4.086596e+07	6.028015e+06	2.438200e+06

Descriptive Statistics EU

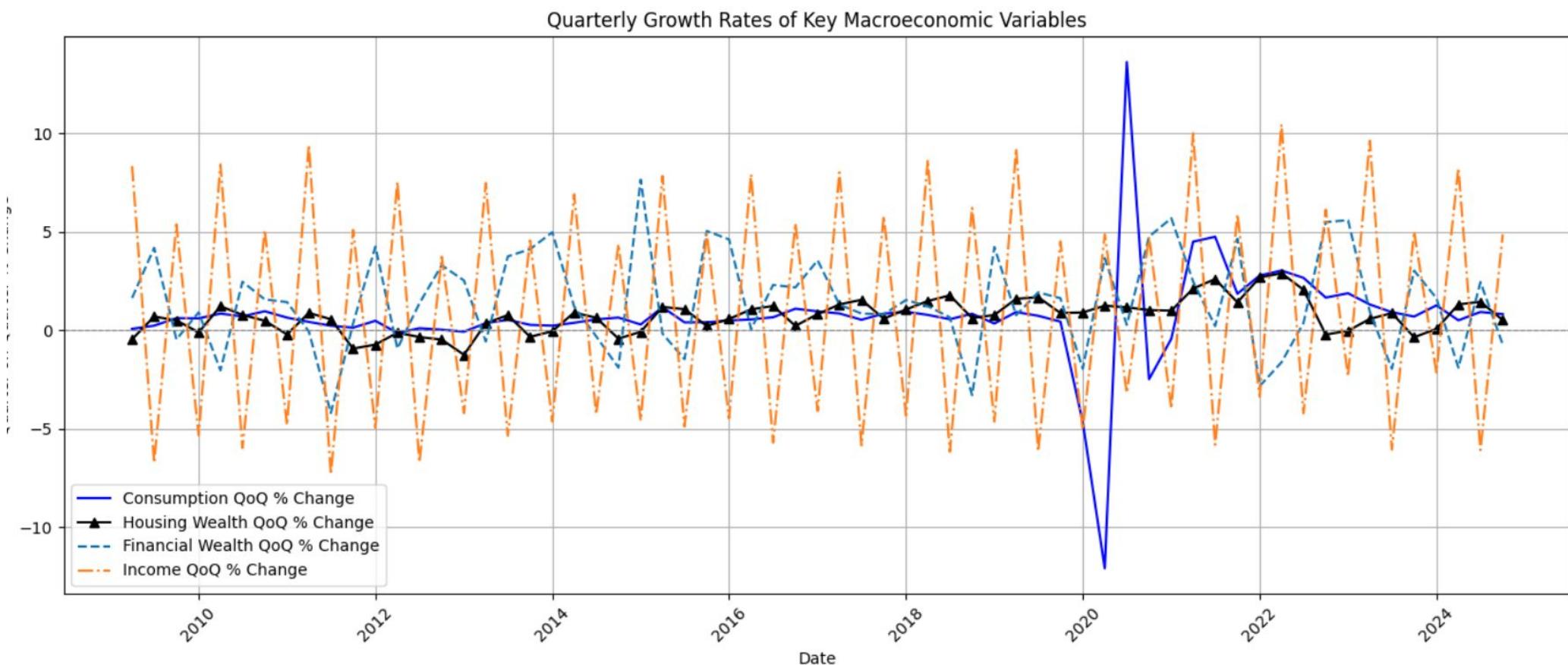
Growth Rate

Growth Rates (% QoQ) without NaNs:

	date	consumption_growth	housing_growth	finance_growth	income_growth
1	2009-04-01	0.060537	-0.466948	1.631440	8.329978
2	2009-07-01	0.223128	0.684648	4.174886	-6.732396
3	2009-10-01	0.606806	0.491849	-0.475556	5.360243
4	2010-01-01	0.594463	-0.118865	0.898373	-5.347608
5	2010-04-01	0.835155	1.211768	-2.047182	8.411097

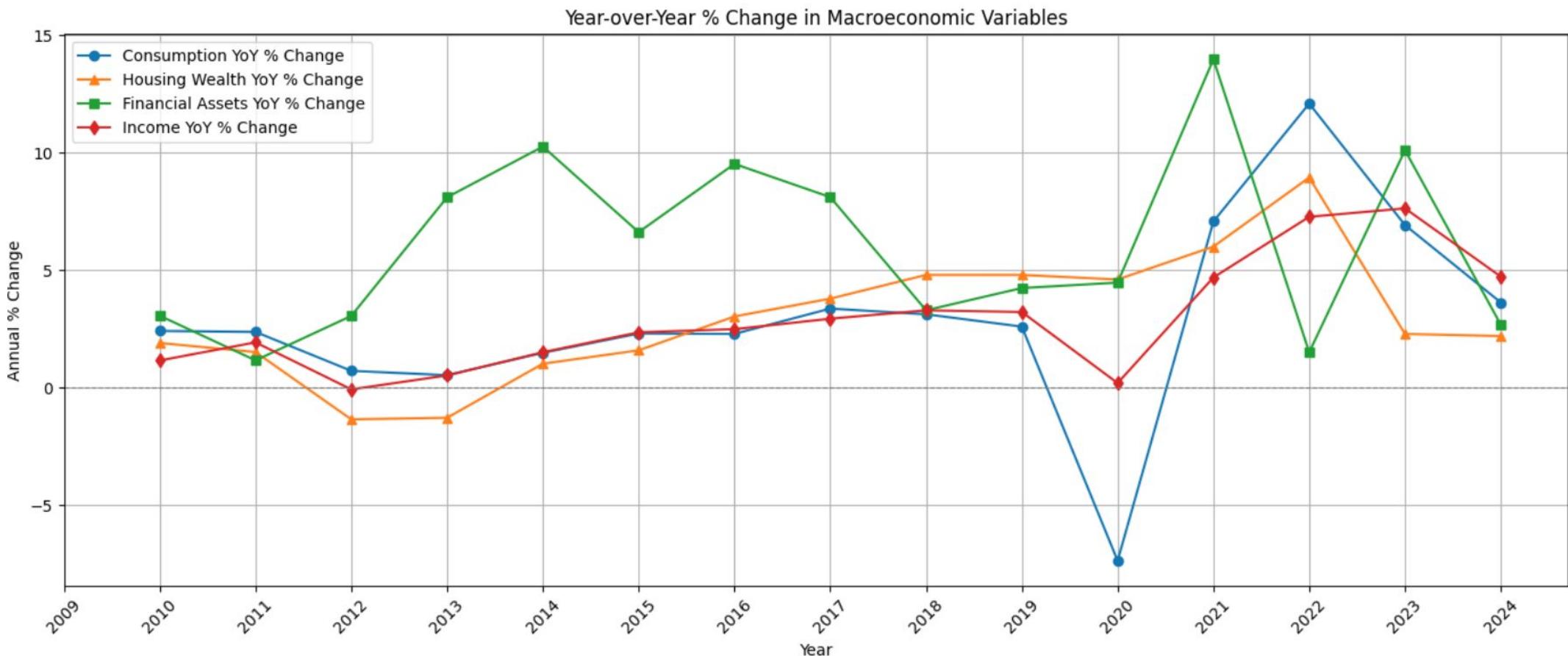
Visualization EU

Time Series Plot



Visualization EU

Time Series Plot



Visualization EU

What can we get from these line charts

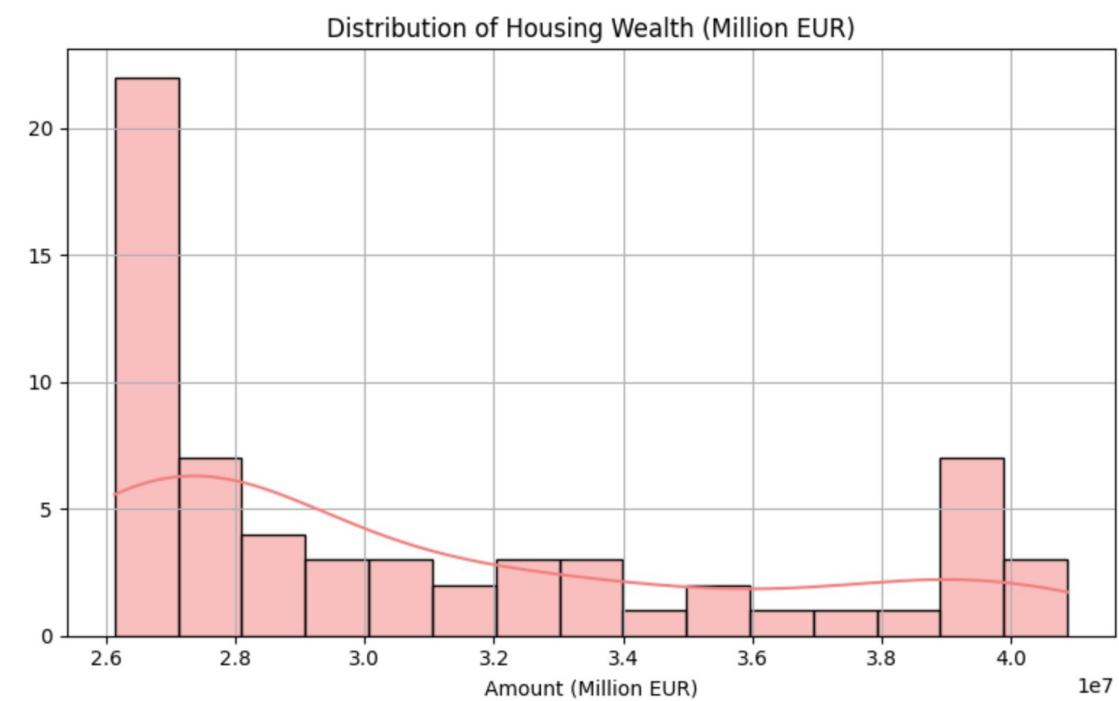
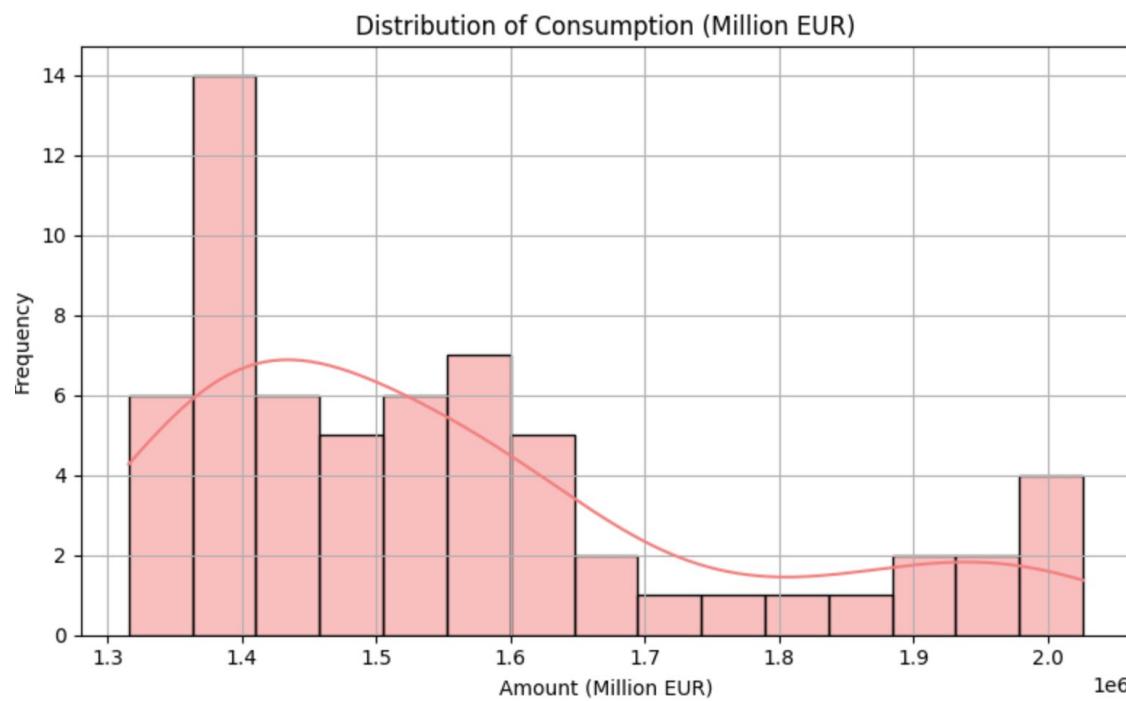
- Quarter-on-Quarter Dynamics (Top Chart)
- Year-over-Year Trends (Bottom Chart)

Implications:

1. The relationship between housing wealth and consumption growth, while present, appears more modest and lagged than that of financial assets.
2. These trends may reflect changes in wealth effects, savings behavior, or macroprudential responses across the EU.

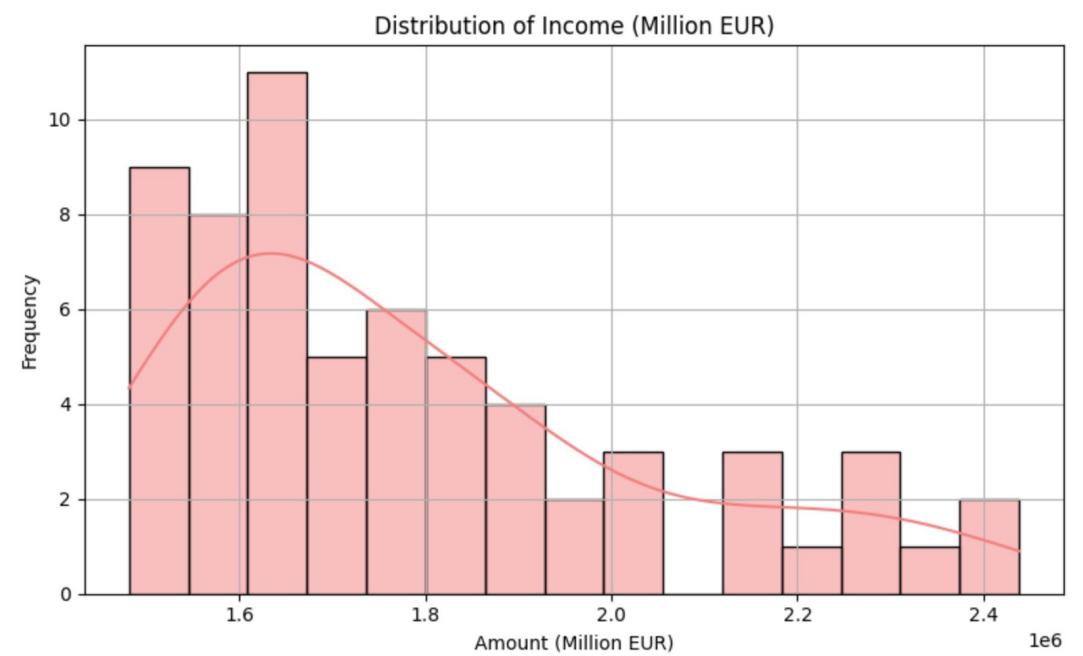
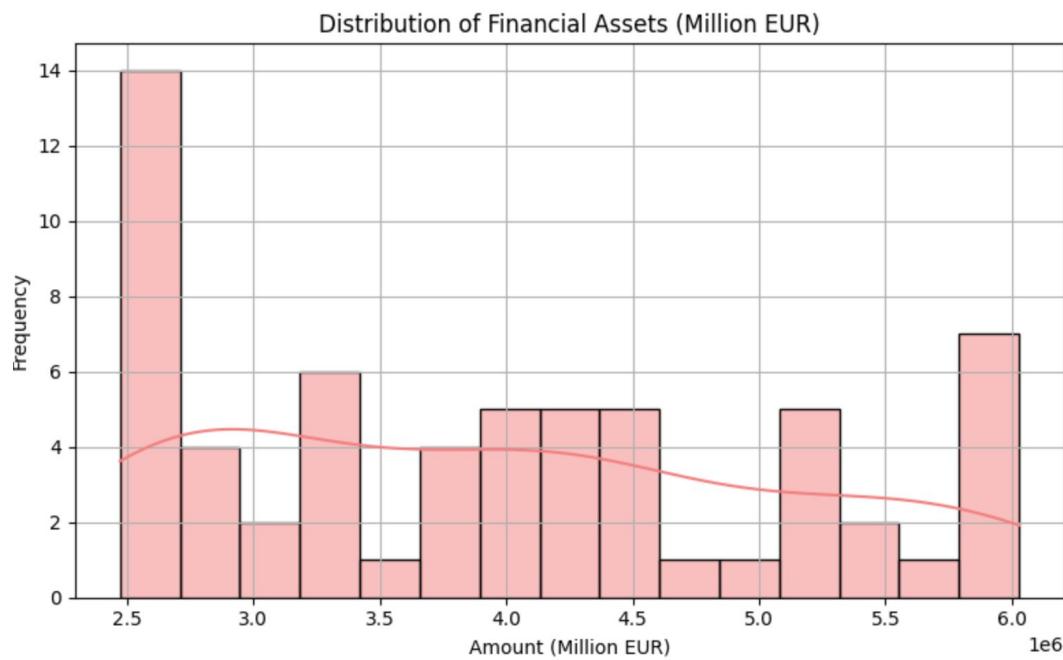
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Normality



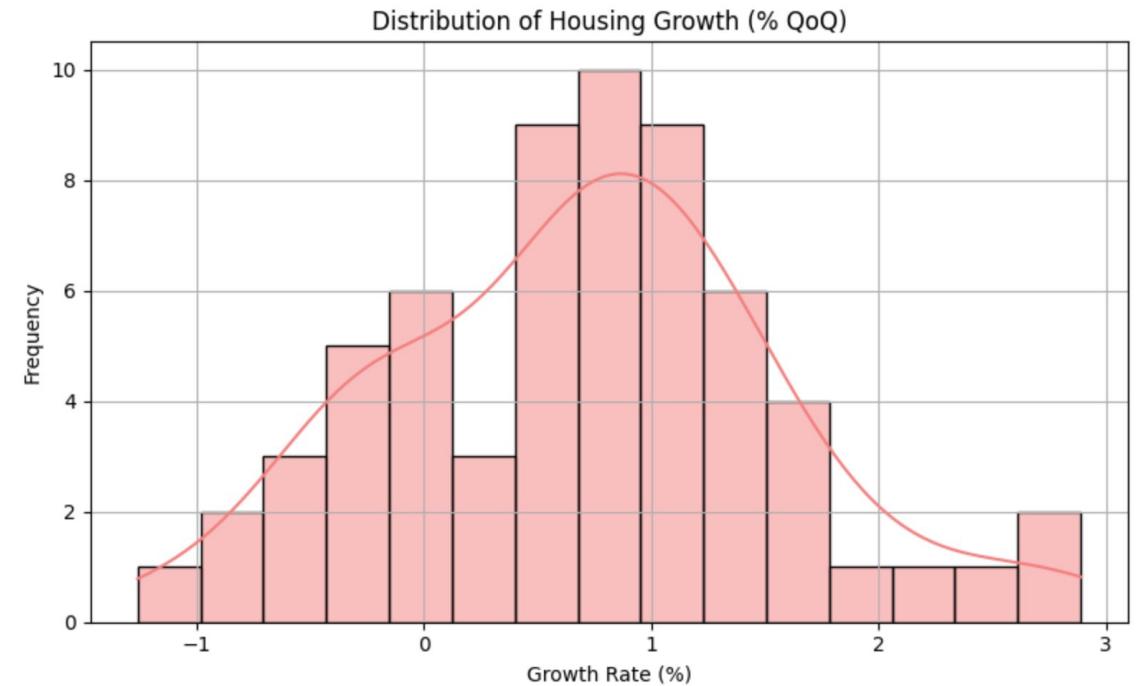
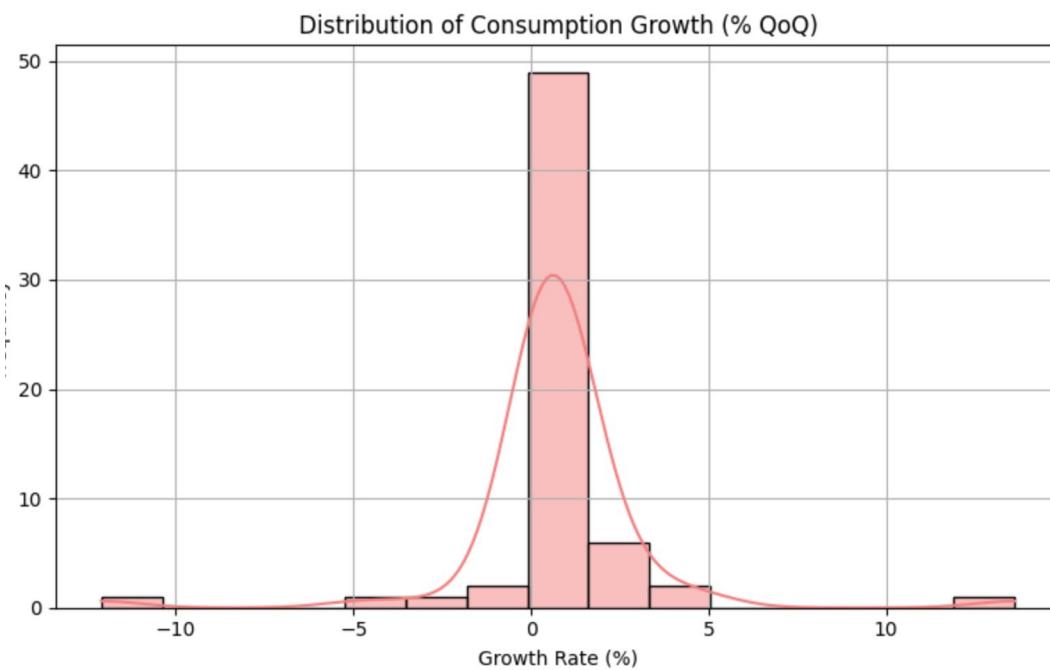
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Normality



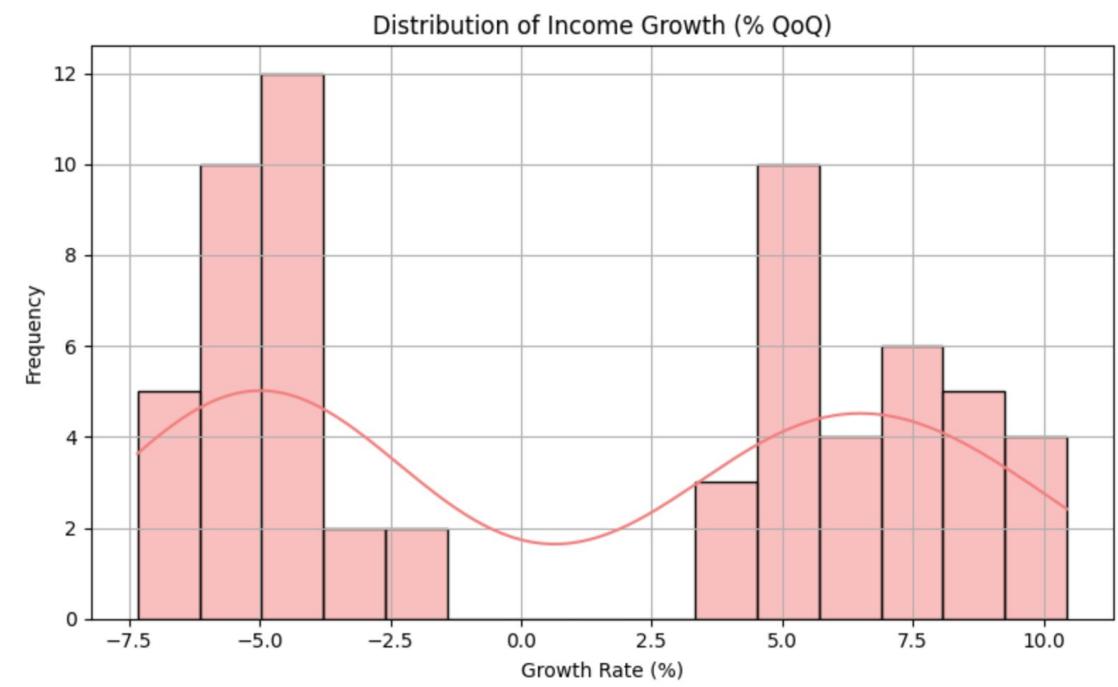
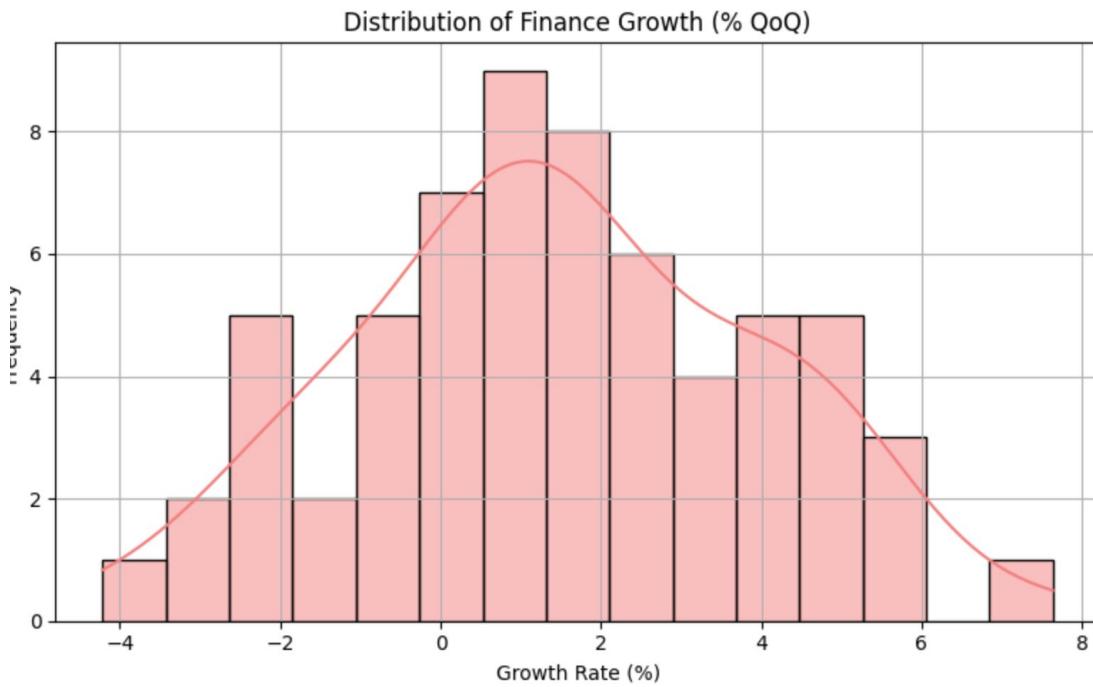
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Normality of growth rate



Visualization EU

Normality of growth rate



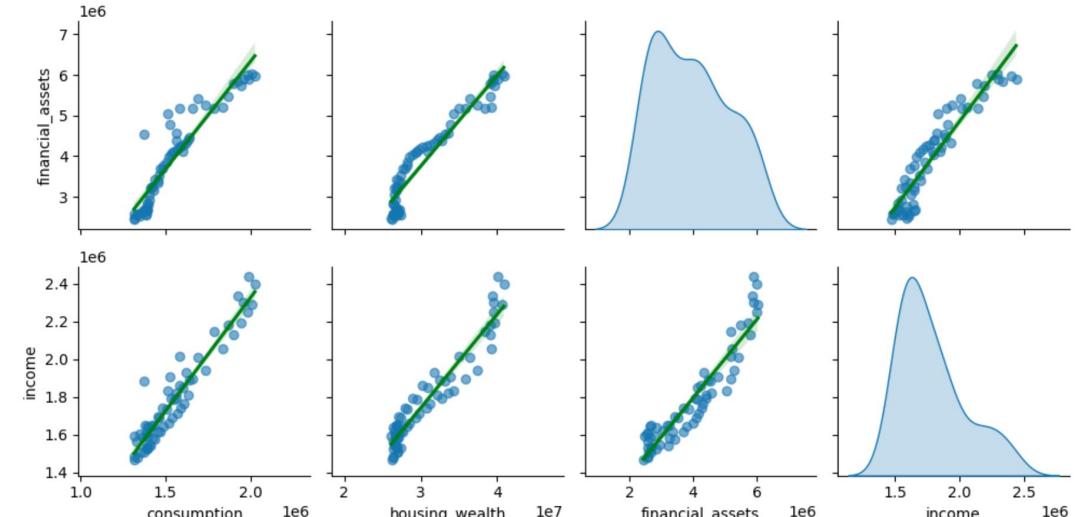
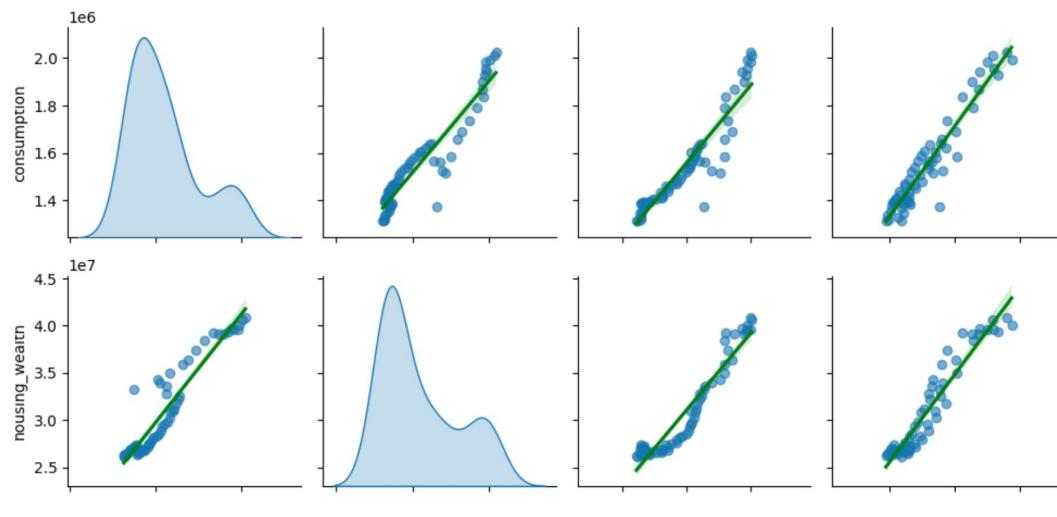
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Scatter Plot

Correlation Matrix:

	consumption	housing_wealth	financial_assets	income
consumption	1.000000	0.943324	0.931933	0.954612
housing_wealth	0.943324	1.000000	0.955045	0.957165
financial_assets	0.931933	0.955045	1.000000	0.939513
income	0.954612	0.957165	0.939513	1.000000

Scatter Plots with Regression Lines



Japan Datasets

- Source: Cabinet Office Japan (内閣府) and Family Income and Expenditure Survey (e-Stat)
- Description: Quarterly macroeconomic data for Japan
- Time Series: 1994–2023

Japan Dataset

- Consumption: Household consumption expenditure (from Family Income and Expenditure Survey - 家計調査)
- Housing Wealth: Fixed assets (housing component) from National Accounts (SNA)
- Stock Market Wealth: Household financial assets (specifically "stocks") from National Accounts (SNA)
- Income: Compensation of employees from National Accounts (SNA)

Descriptive Statistics Japan

Indicator

Descriptive Statistics (Converted to Billion Yen):

	year	household_consumption	fixed_asset	stock_asset	employment_income
count	30.000000	30.000000	30.000000	30.000000	30.000000
mean	2008.500000	286.519100	410.729967	143.437700	268.422100
std	8.803408	9.773603	13.696322	48.360759	13.729709
min	1994.000000	266.251000	385.535000	80.111000	251.155000
25%	2001.250000	280.426750	401.289750	102.274250	257.151000
50%	2008.500000	283.809500	409.338000	134.562500	266.433500
75%	2015.750000	291.108250	418.097250	178.615500	273.625000
max	2023.000000	314.756000	443.824000	250.212000	302.364000

Descriptive Statistics Japan

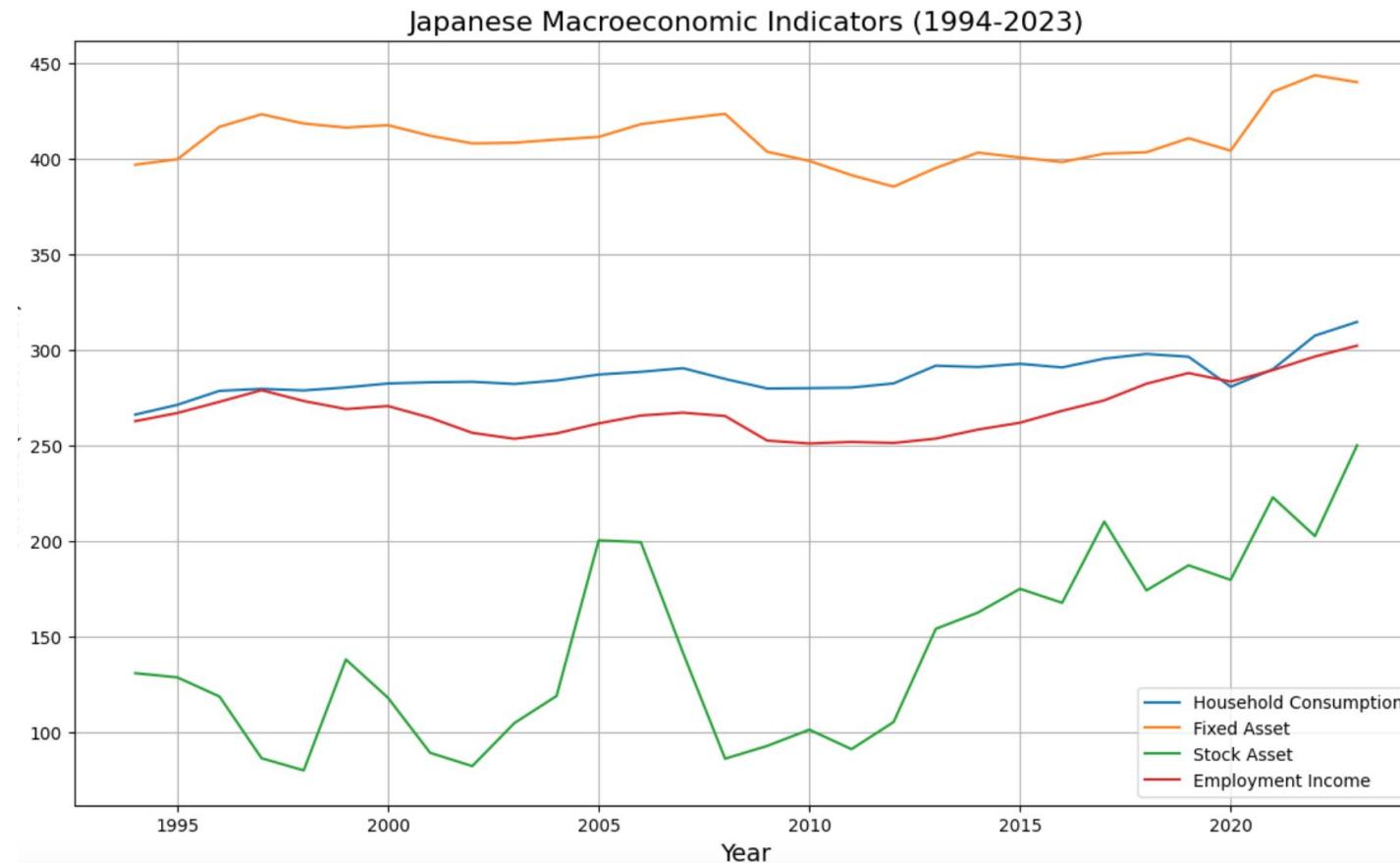
Growth Rate

Descriptive Statistics of Growth Rates (%):

	household_consumption_growth	fixed_asset_growth	stock_asset_growth	employment_income_growth
count	29.00	29.00	29.00	29.00
mean	0.60	0.38	5.18	0.50
std	1.96	2.20	26.14	1.95
min	-5.29	-4.69	-39.15	-4.84
25%	-0.24	-0.97	-9.10	-0.66
50%	0.56	0.31	-0.45	1.11
75%	1.07	1.57	15.59	2.03
max	6.08	7.61	72.45	3.18

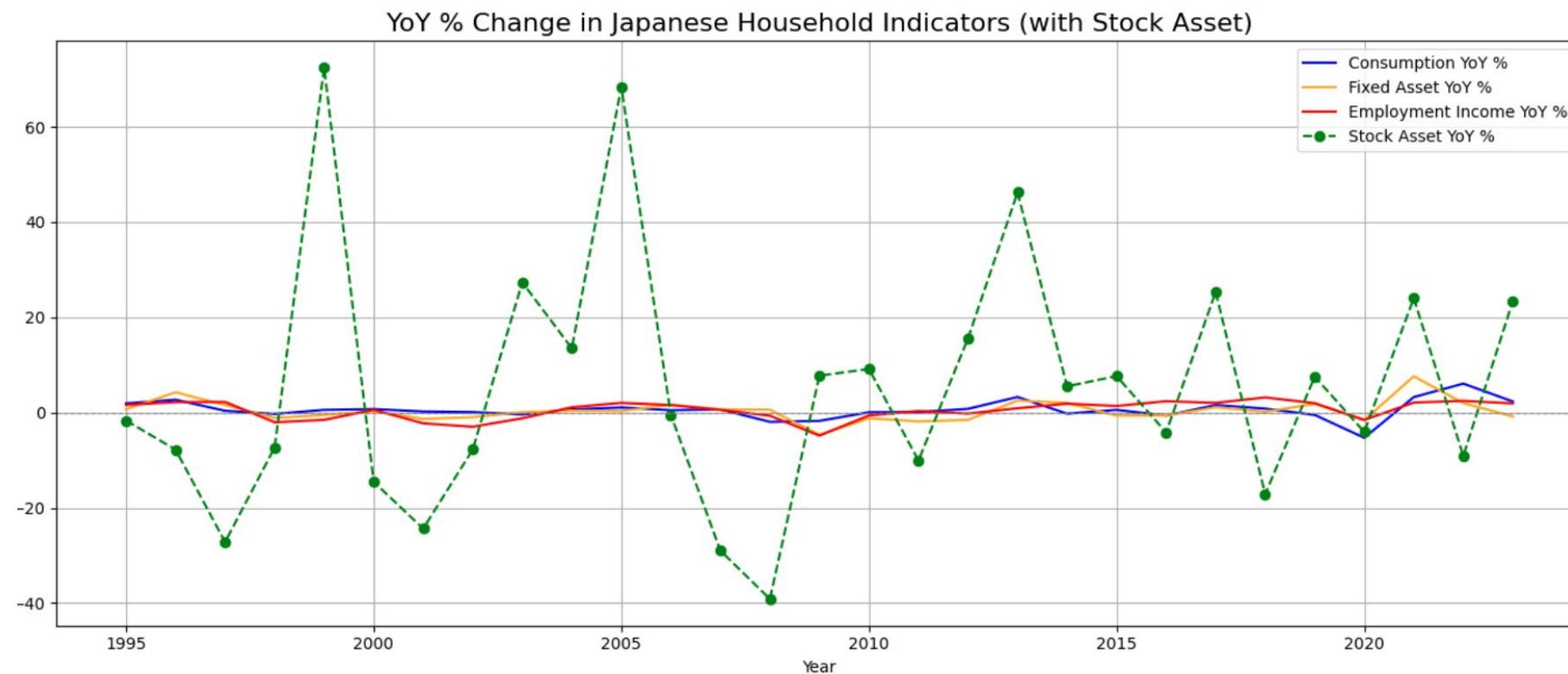
Visualization Japan

- Time Series Plot



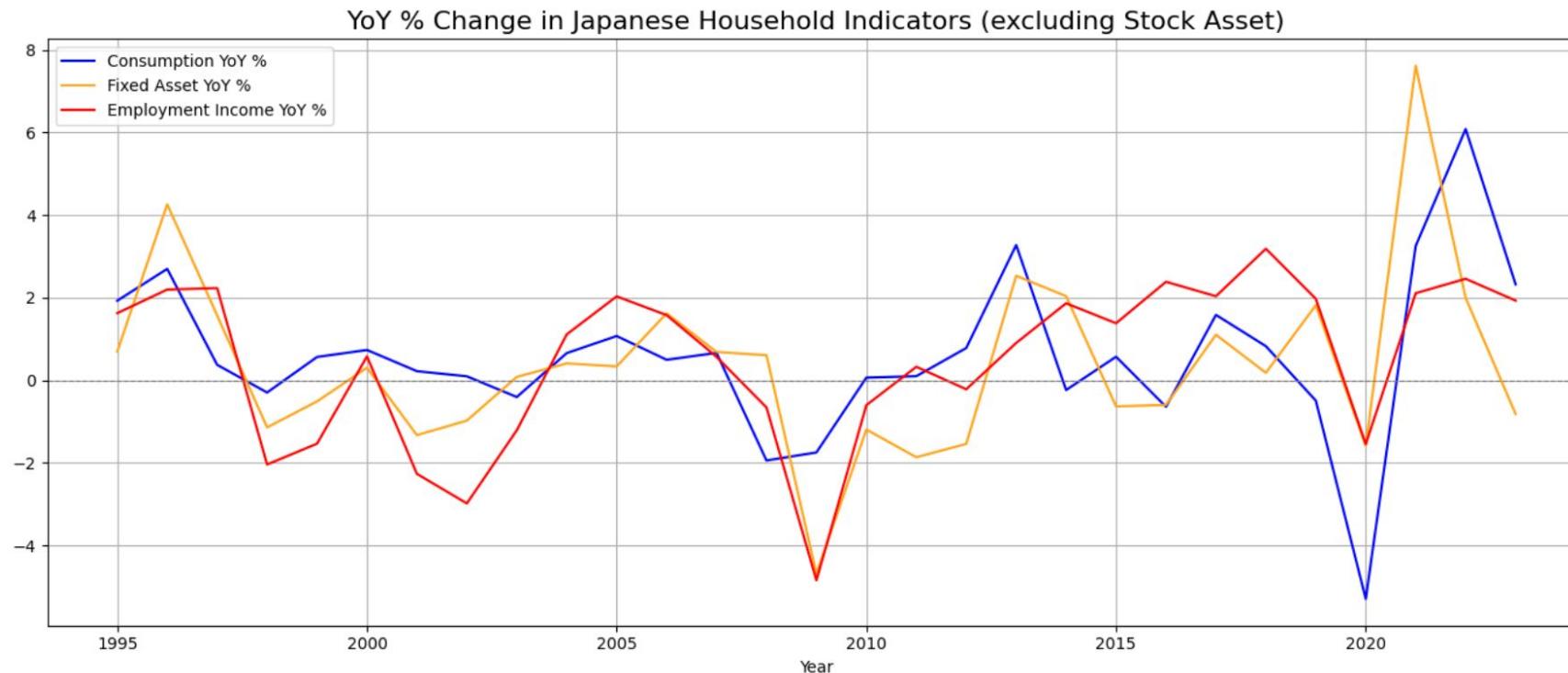
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Quarter-on-Quarter % Change



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Quarter-on-Quarter % Change



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Explain for the economic shock

- Post-Bubble Stagnation (Late 1990s)
- 2008 Global Financial Crisis
- COVID-19 Pandemic (2020)

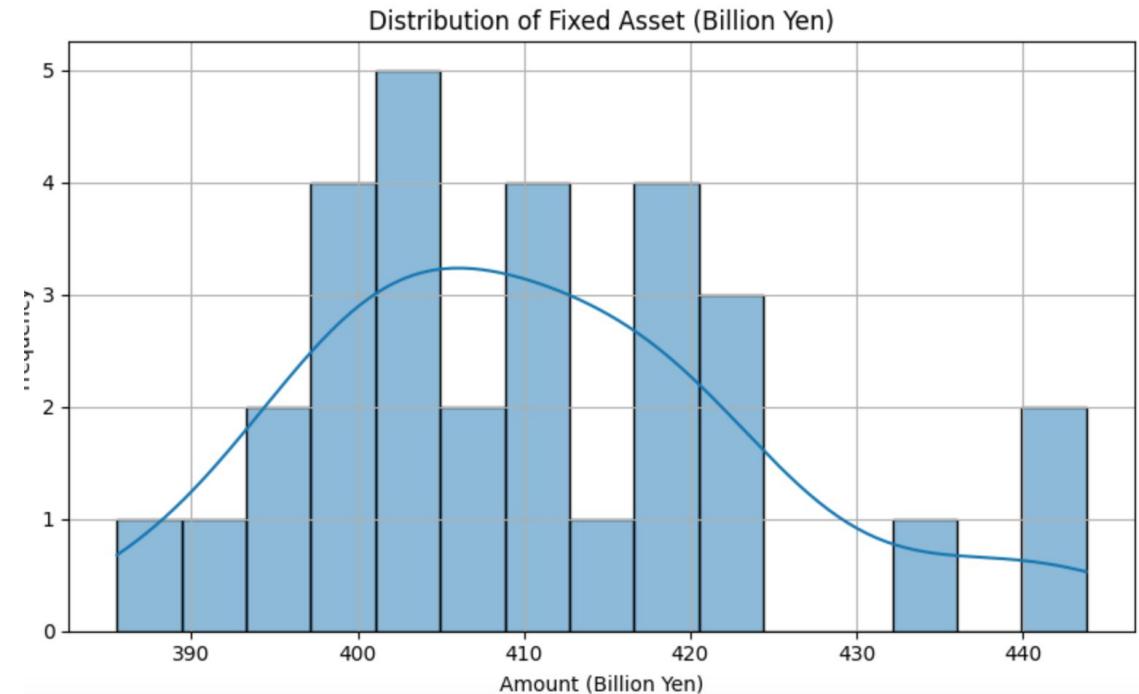
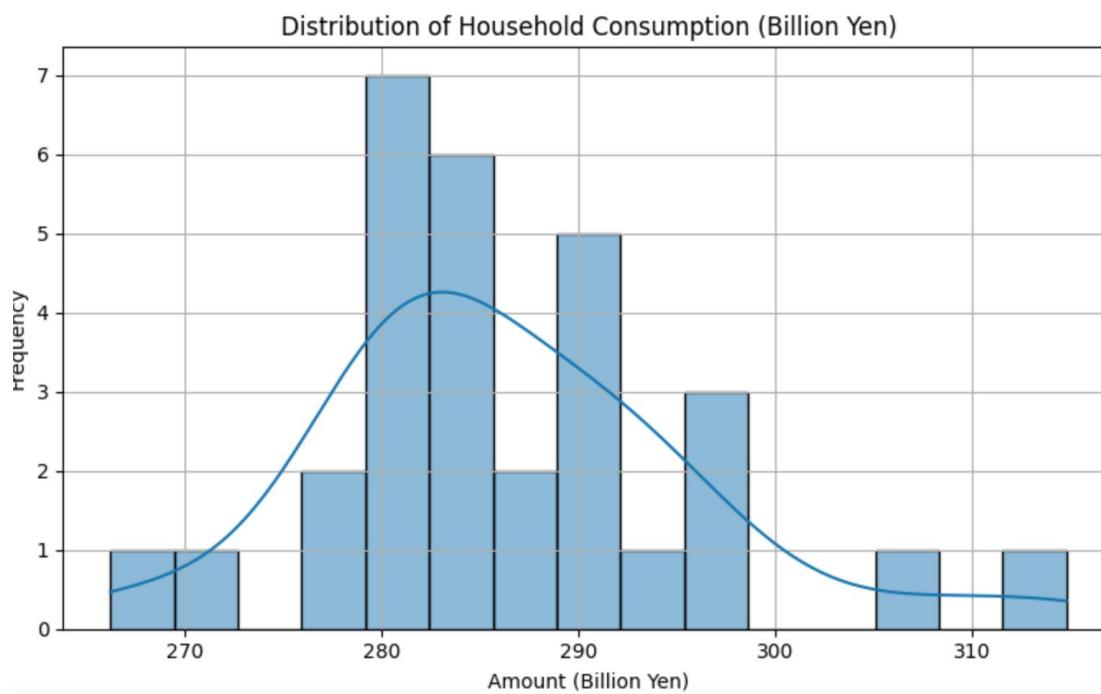
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Implications:

- Japanese consumer behavior is still strongly income-driven. Wealth effects (from asset appreciation) appear limited.
- real estate as a safer household asset class.
- financial markets are highly sensitive to global and domestic shocks
- short-term policy success, but the sustainability of this recovery remains uncertain.

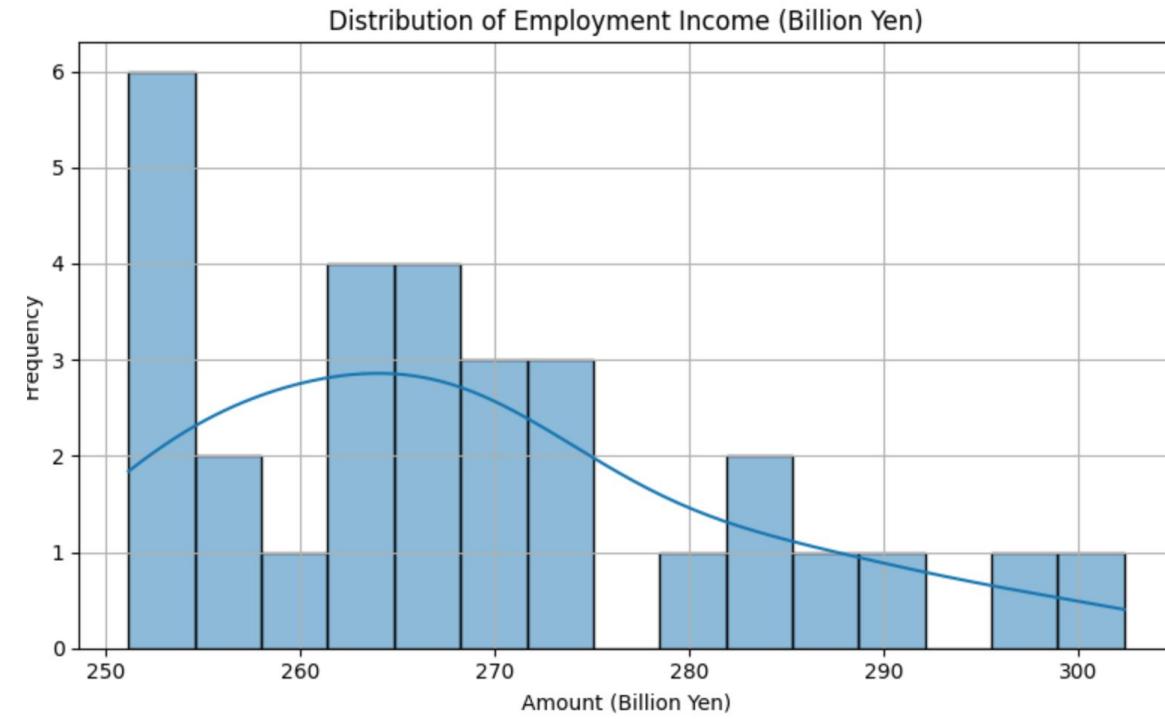
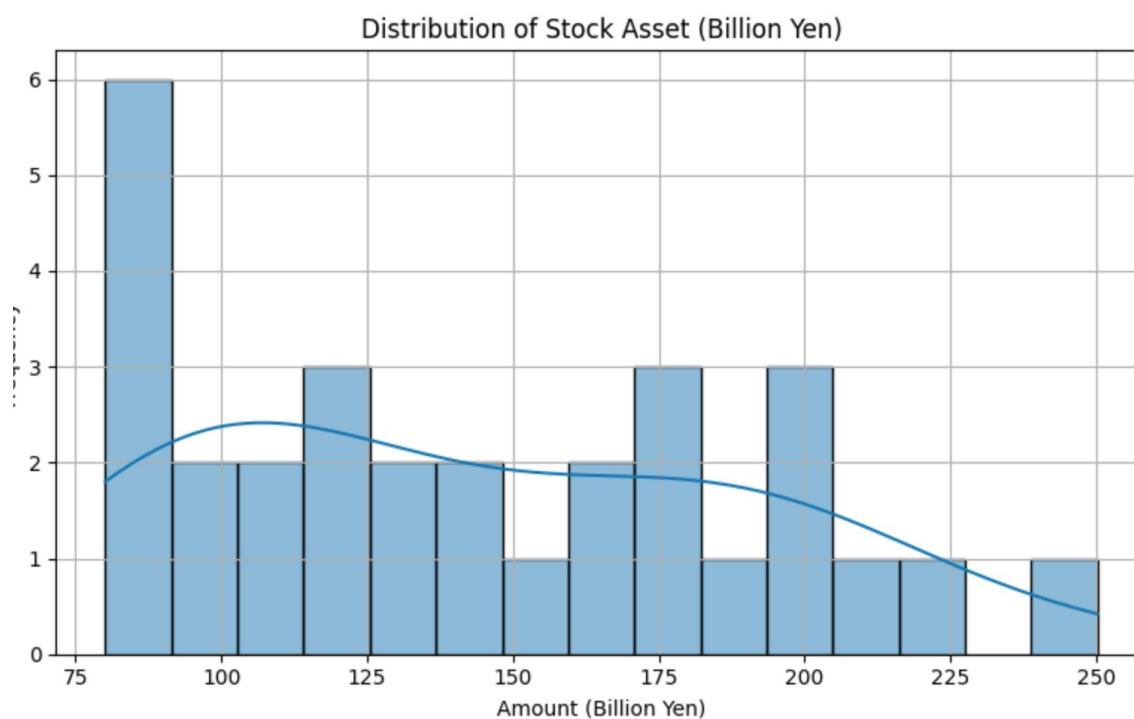
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Normality



Visualization Japan

Normality



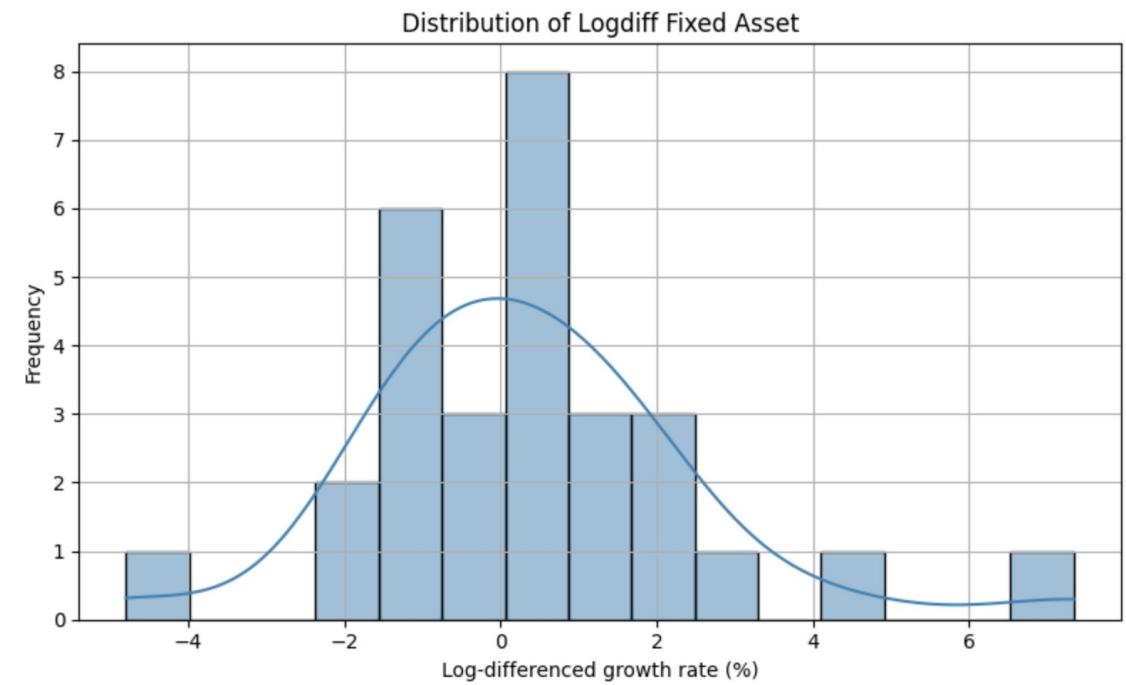
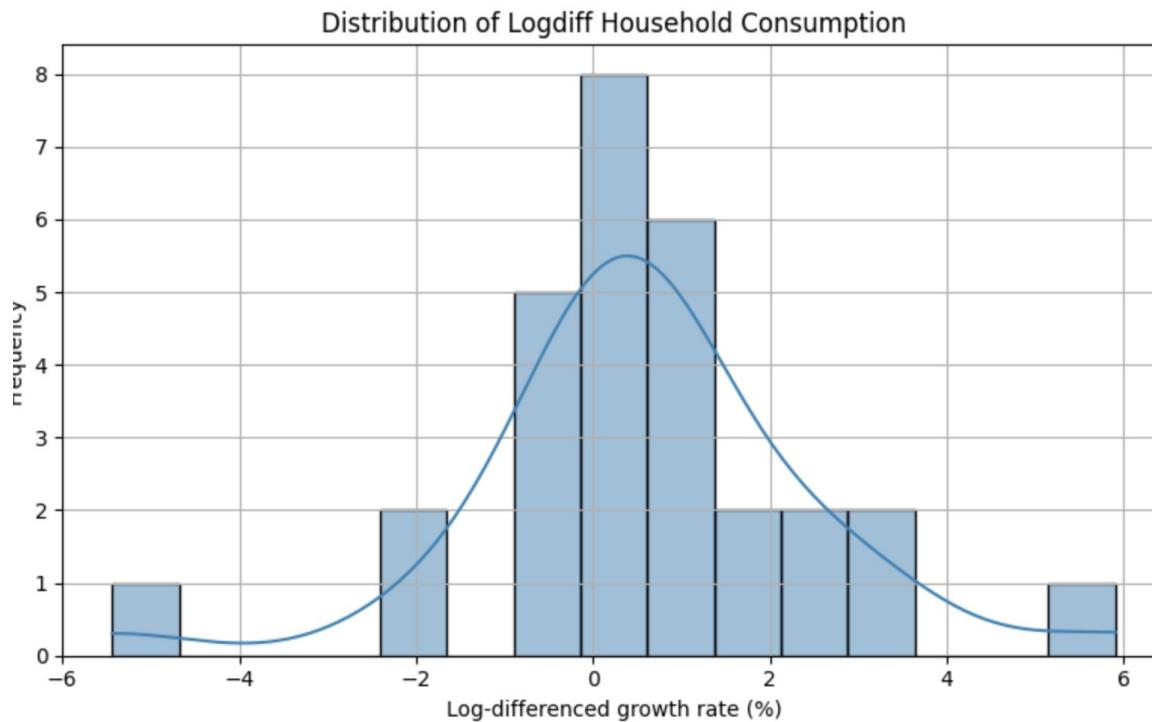
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Normality:

- Household Consumption:a generally stable level of household consumption with a few years of stronger spending.
- Fixed Asset: fixed assets (mainly housing wealth) remained relatively steady over time, with moderate variation.
- Stock Asset:occasional spikes in financial asset holdings, but most years show modest stock wealth.
- Employment Income:labor income is relatively consistent across years, with a few outlier years of higher income likely due to economic upturns or wage policy changes.

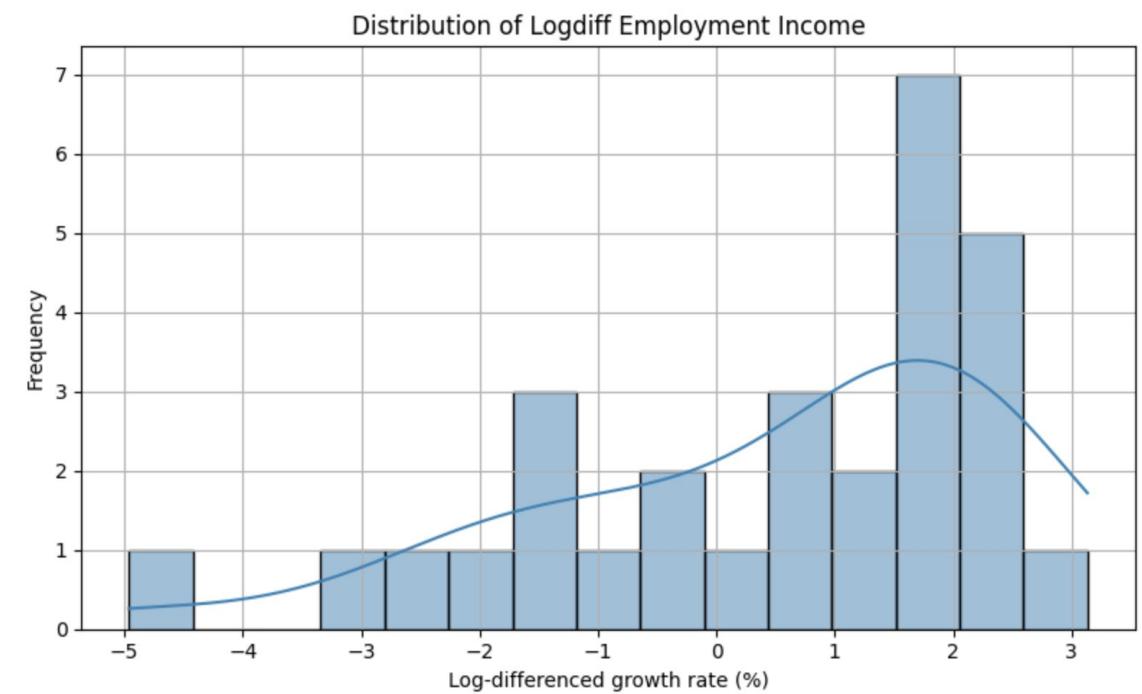
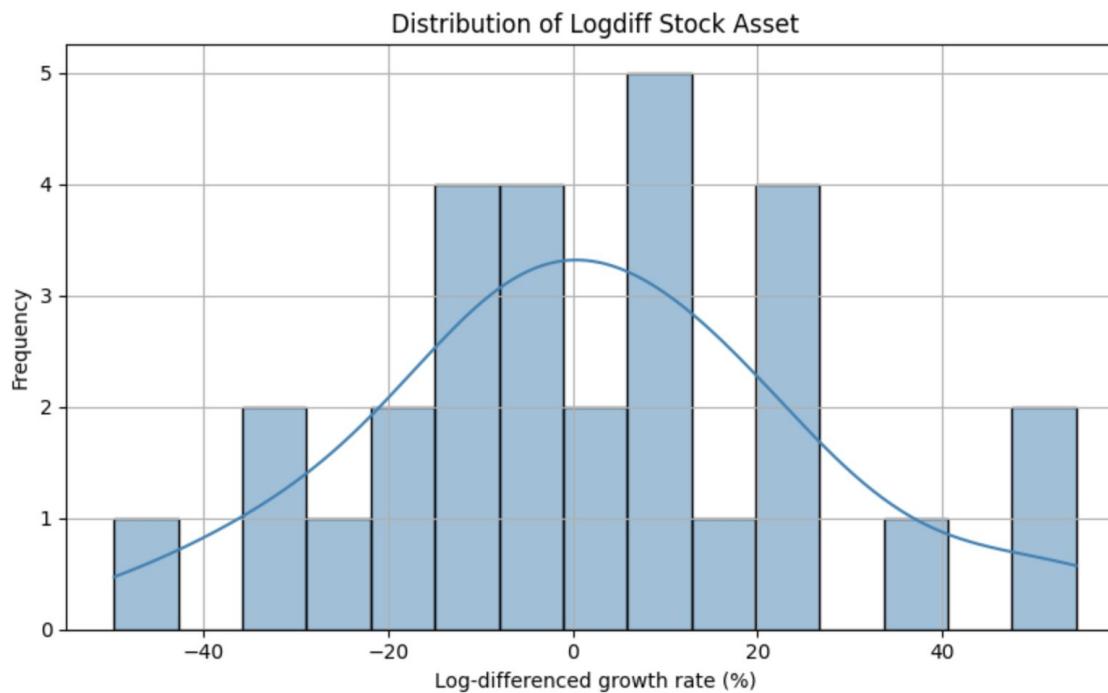
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Growth Rate of Log-Differenced



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Growth Rate of Log-Differenced



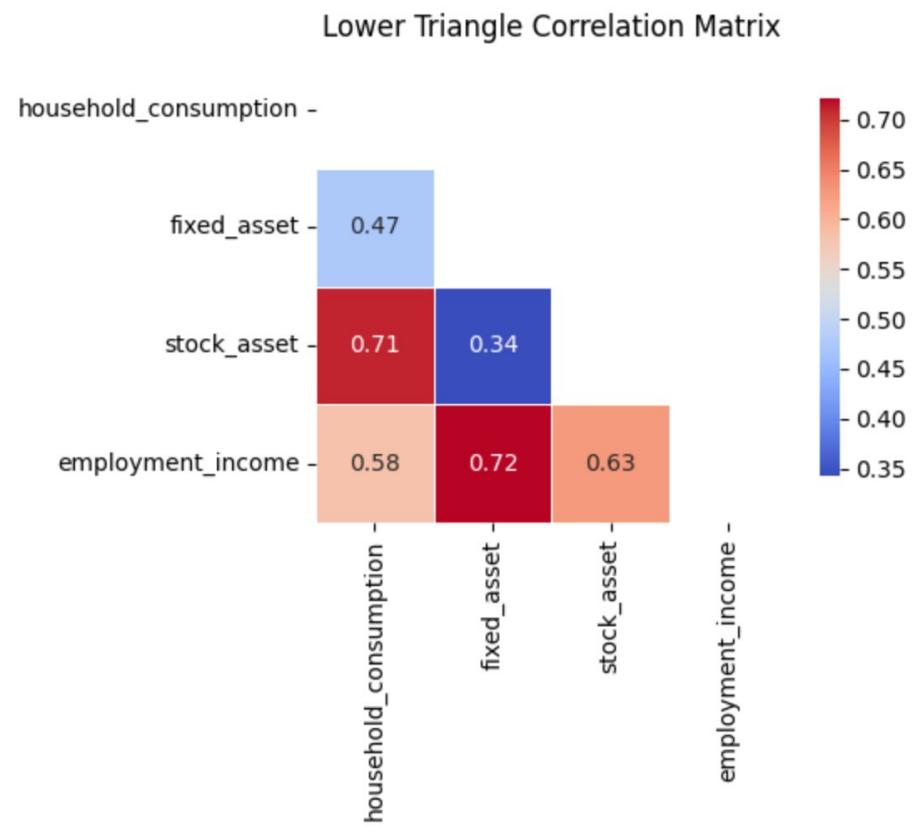
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Growth Rate of Log-Differenced

- Household Consumption:occasional years of stronger positive growth, but overall variability is low.
- Fixed Asset:housing-related wealth changes are gradual and stable over time.
- Stock Asset:the high volatility of financial assets.
- Employment Income:stable, incremental increases in labor income, consistent with macroeconomic trends in wages.

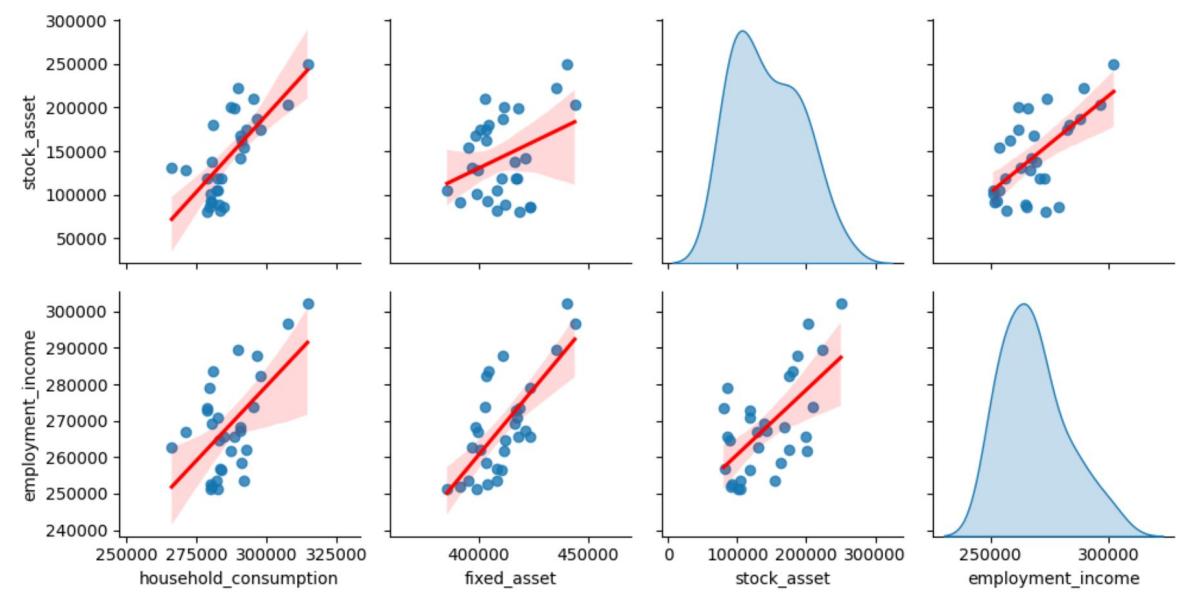
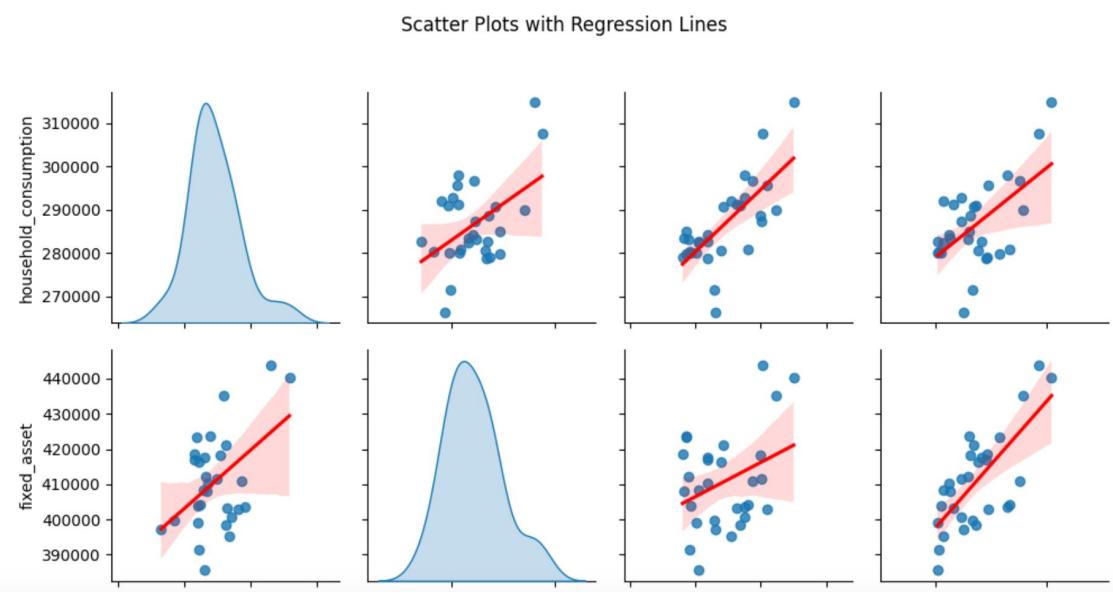
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Scatter Plot



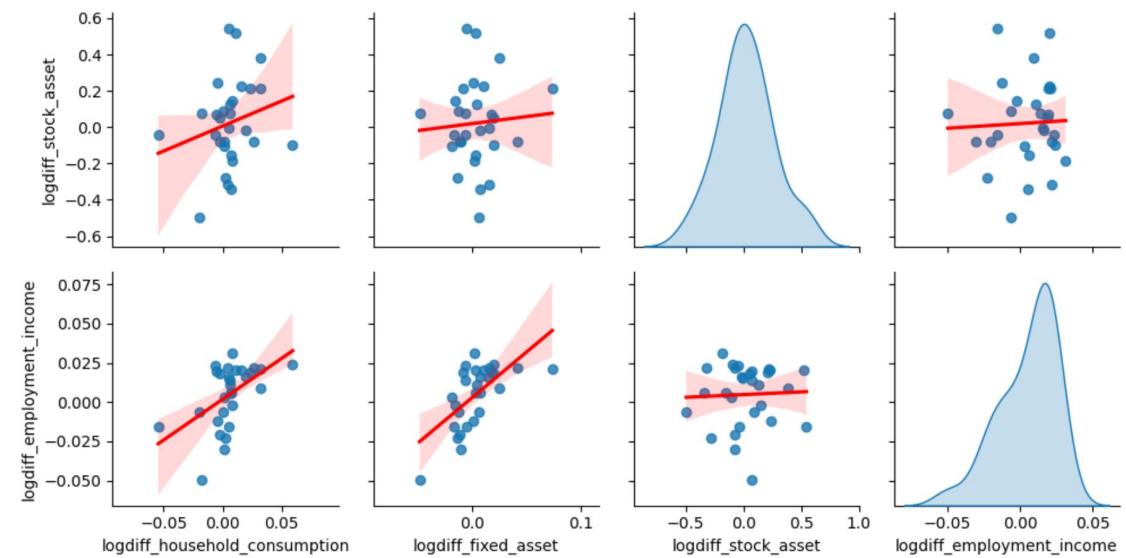
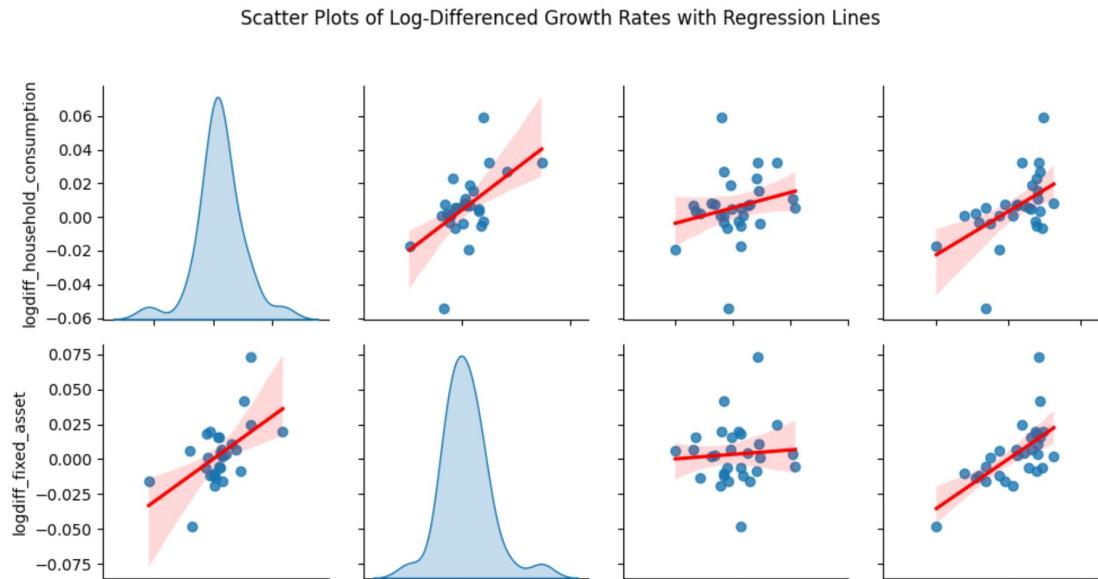
Visualization Japan

- Scatter Plot

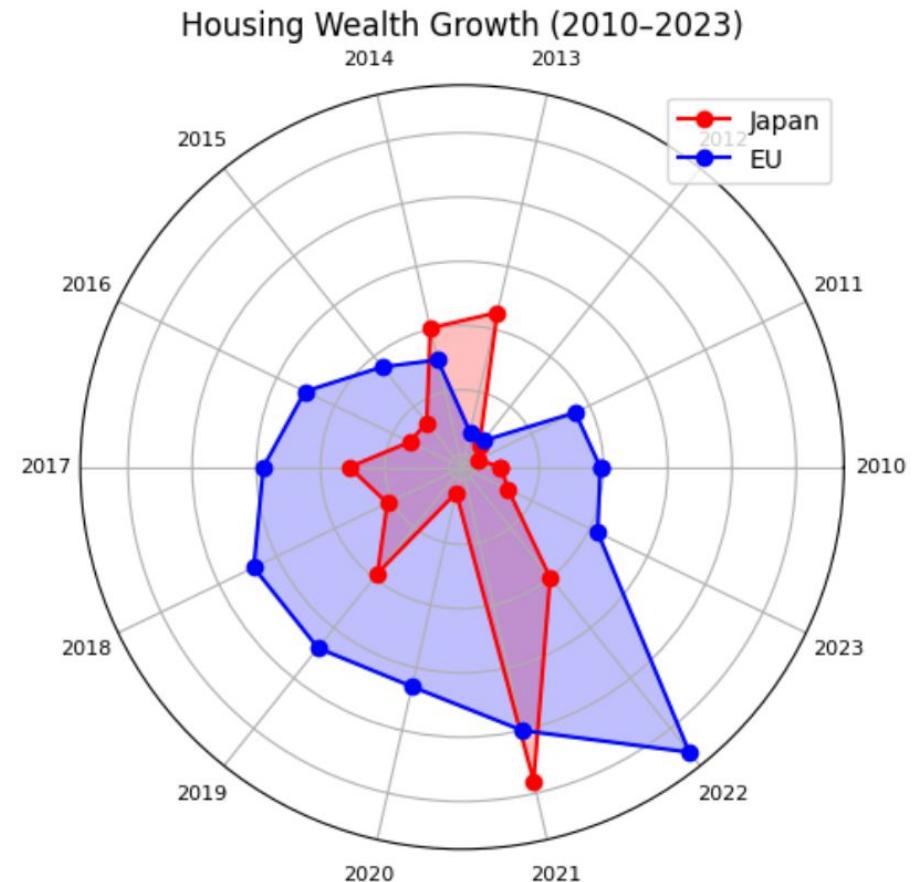
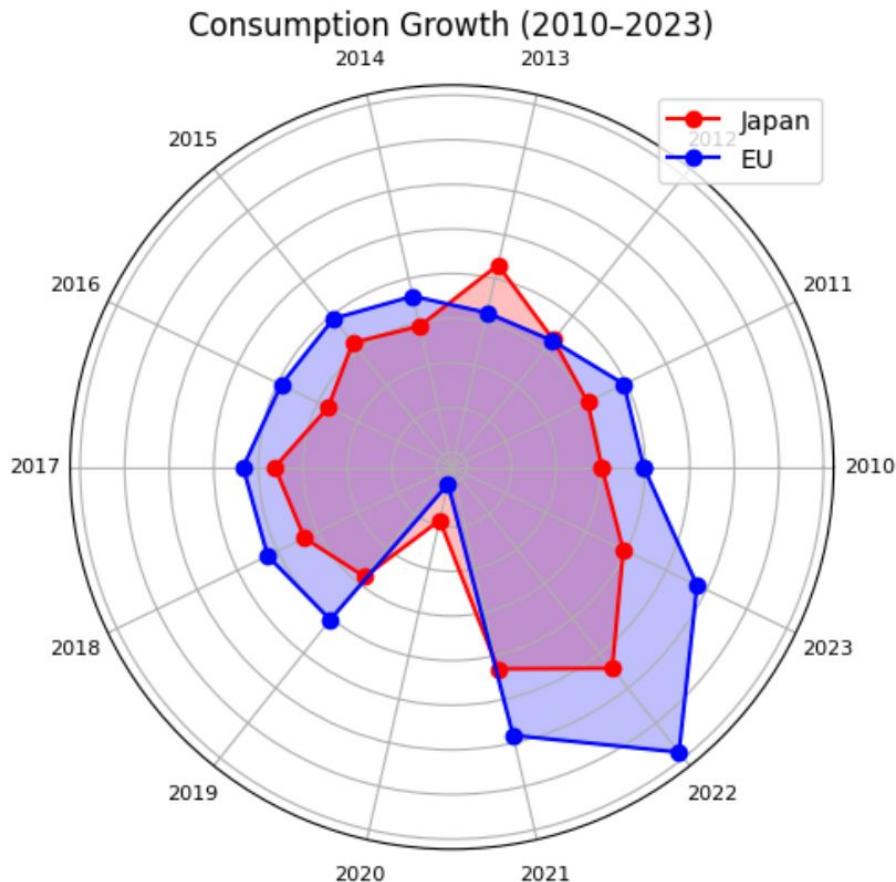


Visualization Japan

- Log

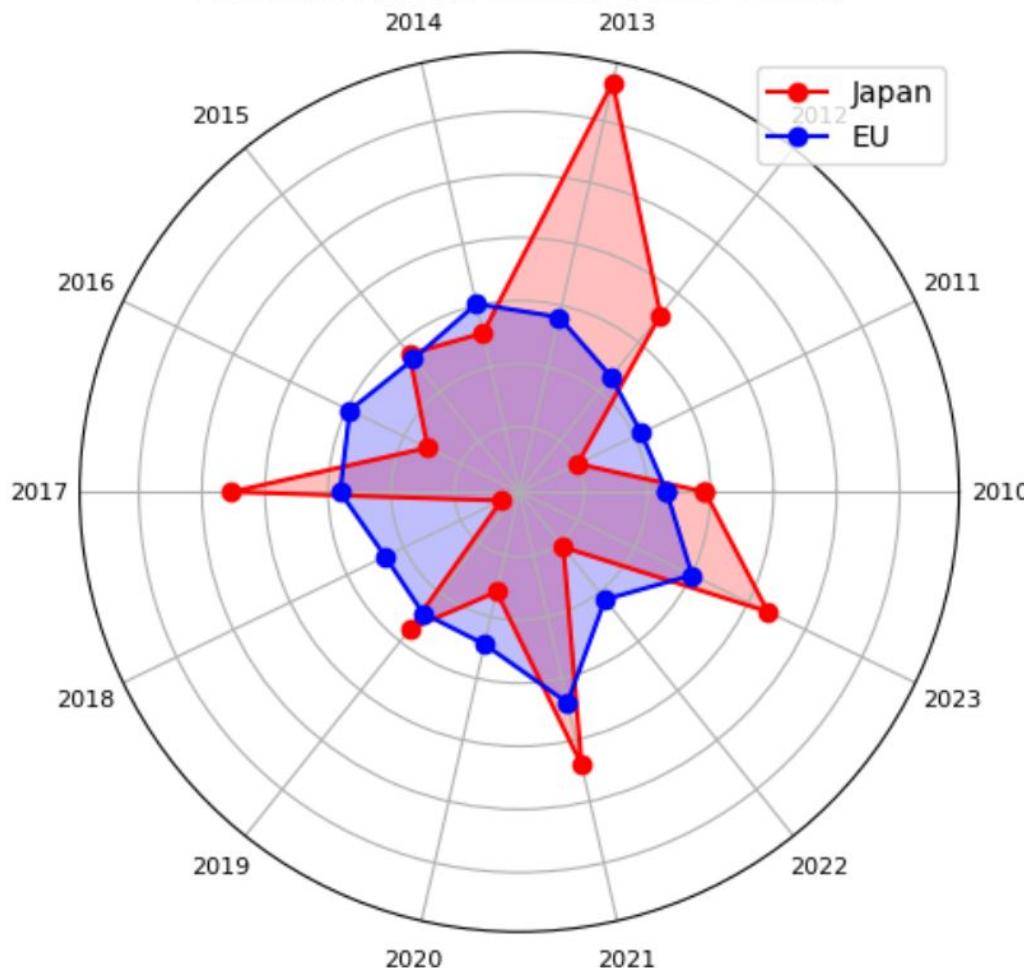


Comparison between Japan and EU

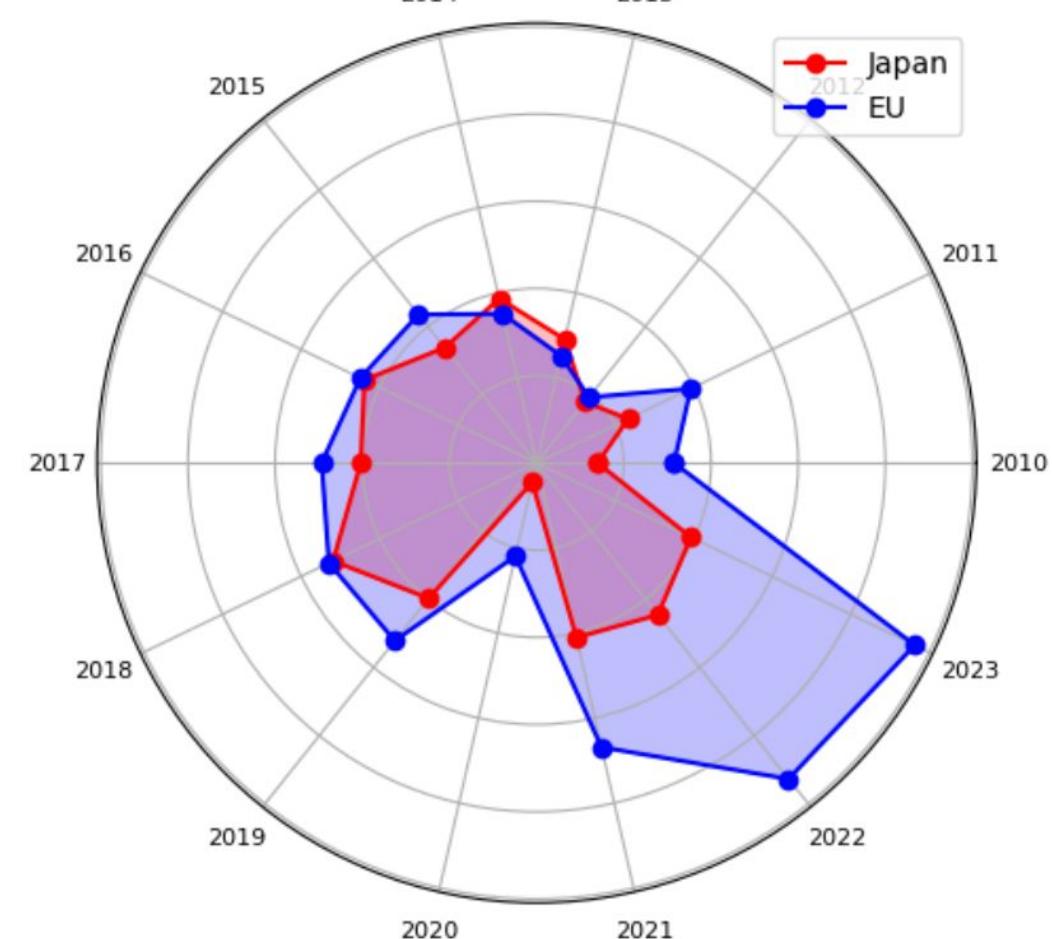


Comparison between Japan and EU

Financial Assets Growth (2010-2023)



Employment Income Growth (2010-2023)



Comparison between Japan and EU

Summary Comparison of Macroeconomic Growth (Japan vs. EU, 2010–2023)

Indicator	Japan	European Union
Consumption Growth	Strongly affected by COVID-19, slow recovery	Strong post-pandemic rebound
Housing Wealth Growth	Highly volatile	Steady and continuous
Financial Assets Growth	Highly sensitive to market fluctuations	More stable trend
Employment Income Growth	Slow growth	Strong growth in recent years

Regression

Empirical Strategy

Basic Idea:

In general, changes in assets and income in the current period do not necessarily have an immediate impact on consumption in the same period. Spillover to consumption as asset effect → Usually effect in the following period or later.

- Conduct a regression based on the following model (lag 1):

$$\log C_t = \beta_0 + \beta_1 \log H_{t-1} + \beta_2 \log F_{t-1} + \beta_3 \log Y_{t-1} + \varepsilon_t$$

- Where:

C_t	: Household consumption
H_{t-1}	: Lagged housing wealth
F_{t-1}	: Lagged financial wealth (e.g., stocks, bonds)
Y_{t-1}	: Lagged employment income
ε_t	: Error term

Main Focus

- Estimate and interpret the elasticities:

β_1	: Elasticity of consumption with respect to housing wealth (lagged)
β_2	: Elasticity of consumption with respect to financial wealth (lagged)
β_3	: Elasticity of consumption with respect to employment income (lagged)

Regression

Further Steps

- How to calculate MPC (Marginal Propensity to Consume):

$$MPC = \frac{\text{Elasticity}}{W/C}$$

- Where:

Elasticity : Estimated coefficient from the log-level model (e.g., β_1, β_2)

W : Average value of the relevant wealth component (e.g., housing or financial)

C : Average household consumption during the sample period

W/C : Wealth-to-consumption ratio

- Interpretation:

This transformation allows us to express the percentage-based elasticities as **absolute marginal effects**, i.e., the increase in consumption (in currency units) due to a one-unit increase in wealth.

Regression Eu

Modeling of Long-run (log)

lag	AIC	BIC	R2	income_pval	housing_pval	finance_pval
0	1 -238.888	-230.316	0.922	0.000	0.061	0.033
1	2 -229.450	-220.942	0.914	0.012	0.010	0.015
2	3 -225.716	-217.273	0.913	0.045	0.005	0.007
3	4 -219.860	-211.483	0.909	0.577	0.000	0.001
4	5 -216.489	-208.179	0.908	0.459	0.000	0.001
5	6 -211.049	-202.807	0.905	0.686	0.000	0.000
6	7 -202.838	-194.665	0.896	0.804	0.000	0.001
7	8 -198.356	-190.255	0.894	0.251	0.000	0.000
8	9 -190.700	-182.671	0.886	0.819	0.000	0.001
9	10 -184.530	-176.575	0.880	0.452	0.000	0.001
10	11 -177.709	-169.828	0.872	0.941	0.000	0.008
11	12 -173.797	-165.992	0.870	0.548	0.000	0.007
12	13 -169.635	-161.908	0.867	0.638	0.000	0.038

Conclusion: lag = 1 should be selected

- Evaluation:
 - AIC/BIC: Lowest (best model)
 - R² (explanatory power): Highest (0.922)
 - Coefficient p-values (significance): All significant below 5%.

Regression Eu

Modeling of Long-run (log)

Robust OLS (HC3)

OLS Regression Results

Dep. Variable:	log_consumption	R-squared:	0.922
Model:	OLS	Adj. R-squared:	0.918
Method:	Least Squares	F-statistic:	383.9
Date:	Mon, 16 Jun 2025	Prob (F-statistic):	1.18e-38
Time:	16:07:51	Log-Likelihood:	123.44
No. Observations:	63	AIC:	-238.9
Df Residuals:	59	BIC:	-230.3
Df Model:	3		
Covariance Type:	HC3		

	coef	std err	z	P> z	[0.025	0.975]
const	2.3936	0.646	3.704	0.000	1.127	3.660
log_income	0.4694	0.127	3.690	0.000	0.220	0.719
log_housing	0.2114	0.092	2.306	0.021	0.032	0.391
log_finance	0.0966	0.035	2.767	0.006	0.028	0.165

Omnibus:	43.583	Durbin-Watson:	1.024
Prob(Omnibus):	0.000	Jarque-Bera (JB):	139.594
Skew:	-2.086	Prob(JB):	4.87e-31
Kurtosis:	8.981	Cond. No.	5.38e+03

Notes:

- [1] Standard Errors are heteroscedasticity robust (HC3)
- [2] The condition number is large, 5.38e+03. This might indicate that there are strong multicollinearity or other numerical problems.

Regression Eu

Variable	Coefficient	Interpretation (Elasticity)	p-value
log(income)	0.469	A 1% increase in income leads to a 0.47% increase in consumption	0.000***
log(housing wealth)	0.211	A 1% increase in housing wealth leads to a 0.21% increase	0.021***
log(financial wealth)	0.097	A 1% increase in financial wealth leads to a 0.10% increase	0.006***
Constant	2.393	Baseline consumption level	0.000***

Key Findings (Robust OLS – HC3):

- All variables are statistically significant ($p < 0.01$ to 0.009) and the lag = 1 model is strong.
- In particular, income has the highest elasticity (0.47) and has the greatest impact on consumption.
- Housing and financial assets also significantly boost consumption, with a clear asset effect.
- There are signs of some problems with the residuals (non-normality, autocorrelation), but the model itself performs very well ($R^2 = 0.922$).

Regression Eu

- Modeling of Short-run (log-diff)

Model:

$$\Delta \log C_t = \beta_0 + \beta_1 \Delta \log H_{t-n} + \beta_2 \Delta \log F_{t-n} + \beta_3 \Delta \log Y_{t-n} + \varepsilon_t$$

- Where:

$\Delta \log C_t$: Growth rate of household consumption
$\Delta \log H_{t-n}$: Growth rate of housing wealth before lag n period
$\Delta \log F_{t-n}$: Growth rate of financial wealth (e.g., stocks, bonds) before lag n period
$\Delta \log Y_{t-n}$: Growth rate of employment income before lag n period
ε_t	: Error term

Regression Eu

	lag	AIC	BIC	R2	income_pval	housing_pval	finance_pval
0	1	-278.503	-269.994	0.157	0.124	0.032	0.010
1	2	-263.963	-255.519	0.023	0.452	0.561	0.584
2	3	-258.667	-250.289	0.026	0.299	0.668	0.499
3	4	-254.938	-246.628	0.054	0.239	0.234	0.536
4	5	-249.958	-241.717	0.061	0.190	0.189	0.588
5	6	-247.454	-239.282	0.108	0.538	0.360	0.024
6	7	-237.238	-229.137	0.029	0.397	0.582	0.479
7	8	-233.106	-225.077	0.051	0.189	0.344	0.825
8	9	-227.780	-219.824	0.052	0.182	0.415	0.398
9	10	-220.714	-212.833	0.020	0.366	0.677	0.975
10	11	-215.423	-207.618	0.019	0.393	0.716	0.879
11	12	-212.224	-204.496	0.058	0.180	0.331	0.625
12	13	-206.706	-199.058	0.053	0.287	0.340	0.752

Regression Eu

Robust OLS (HC3)

OLS Regression Results

Dep. Variable:	logdiff_consumption	R-squared:	0.157
Model:	OLS	Adj. R-squared:	0.113
Method:	Least Squares	F-statistic:	2.804
Date:	Mon, 16 Jun 2025	Prob (F-statistic):	0.0477
Time:	15:59:05	Log-Likelihood:	143.25
No. Observations:	62	AIC:	-278.5
Df Residuals:	58	BIC:	-270.0
Df Model:	3		
Covariance Type:	HC3		

	coef	std err	z	P> z	[0.025	0.975]
const	-0.0050	0.006	-0.851	0.395	-0.016	0.006
logdiff_housing	0.8499	0.299	2.839	0.005	0.263	1.437
logdiff_finance	0.3650	0.193	1.894	0.058	-0.013	0.743
logdiff_income	0.0828	0.057	1.456	0.145	-0.029	0.194

Omnibus:	35.883	Durbin-Watson:	2.394
Prob(Omnibus):	0.000	Jarque-Bera (JB):	498.177
Skew:	-0.894	Prob(JB):	6.64e-109
Kurtosis:	16.771	Cond. No.	123.

Notes:

[1] Standard Errors are heteroscedasticity robust (HC3)

Regression Eu

Generalized Least Squares (GLS)

GLS Regression Results

Dep. Variable:	logdiff_consumption	R-squared:	0.157
Model:	GLS	Adj. R-squared:	0.113
Method:	Least Squares	F-statistic:	3.593
Date:	Mon, 16 Jun 2025	Prob (F-statistic):	0.0188
Time:	15:59:05	Log-Likelihood:	143.25
No. Observations:	62	AIC:	-278.5
Df Residuals:	58	BIC:	-270.0
Df Model:	3		
Covariance Type:	nonrobust		

	coef	std err	t	P> t	[0.025	0.975]
const	-0.0050	0.005	-0.992	0.325	-0.015	0.005
logdiff_housing	0.8499	0.386	2.200	0.032	0.077	1.623
logdiff_finance	0.3650	0.136	2.678	0.010	0.092	0.638
logdiff_income	0.0828	0.053	1.561	0.124	-0.023	0.189

Omnibus:	35.883	Durbin-Watson:	2.394
Prob(Omnibus):	0.000	Jarque-Bera (JB):	498.177
Skew:	-0.894	Prob(JB):	6.64e-109
Kurtosis:	16.771	Cond. No.	123.

Notes:

[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

Regression Eu

Variable	Coefficient	Interpretation (Elasticity)	p-value
logdiff(housing wealth)	0.850	A 1% increase in housing wealth (lagged) leads to a 0.85% increase in consumption growth	0.005***
logdiff(financial wealth)	0.365	A 1% increase in financial wealth (lagged) leads to a 0.37% increase in consumption growth	0.058*
logdiff(income)	0.083	A 1% increase in income (lagged) leads to a 0.08% increase in consumption growth	0.145
Constant	-0.005	Baseline change in consumption (growth rate)	0.395

Key Findings (Robust OLS – HC3):

- Housing asset growth (lag 1) has the strongest short-term impact on consumption ($p = 0.005$)
- Financial assets also moderately effective but somewhat unstable ($p = 0.058$)
- Income growth is not statistically significant in the short run ($p = 0.145$)
- Durbin-Watson = 2.39 → almost no autocorrelation
- Model has limited explanatory power (R^2) → Reasonable for a short-term model, but room for improvement

Regression Japan

Modeling of Long-run

Empirical Strategy (Long-Run Specification)

- Conduct a regression based on the following model:

$$\log C_t = \alpha + \beta \log S_{t-1} + \gamma \log H_{t-1} + \phi \log Y_{t-1} + \varepsilon_t$$

- Where:

C_t	: Household consumption
S_{t-1}	: Lagged stock market wealth
H_{t-1}	: Lagged housing wealth
Y_{t-1}	: Lagged employment income
ε_t	: Error term

Main Focus

- Estimate and interpret long-run elasticities:

γ	: Elasticity of consumption with respect to housing wealth
β	: Elasticity of consumption with respect to stock market wealth
ϕ	: Elasticity of consumption with respect to income

Make values become log-transformed variables.

Regression Japan

	log_household_consumption	log_fixed_asset	log_stock_asset	log_employment_income
0	12.492	12.892	11.783	12.479
1	12.511	12.899	11.766	12.495
2	12.538	12.941	11.685	12.517
3	12.542	12.956	11.368	12.539
4	12.539	12.945	11.291	12.519

Regression Japan

OLS Regression Results

Dep. Variable:	log_household_consumption	R-squared:	0.496			
Model:	OLS	Adj. R-squared:	0.436			
Method:	Least Squares	F-statistic:	8.202			
Date:	Mon, 16 Jun 2025	Prob (F-statistic):	0.000571			
Time:	15:59:05	Log-Likelihood:	69.727			
No. Observations:	29	AIC:	-131.5			
Df Residuals:	25	BIC:	-126.0			
Df Model:	3					
Covariance Type:	nonrobust					
	coef	std err	t	P> t	[0.025	0.975]
const	9.1088	1.870	4.872	0.000	5.258	12.960
log_fixed_asset	0.2371	0.198	1.195	0.243	-0.171	0.645
log_stock_asset	0.0632	0.016	3.873	0.001	0.030	0.097
log_employment_income	-0.0280	0.153	-0.184	0.856	-0.342	0.286
Omnibus:	0.389	Durbin-Watson:			0.936	
Prob(Omnibus):	0.823	Jarque-Bera (JB):			0.007	
Skew:	-0.000	Prob(JB):			0.996	
Kurtosis:	3.078	Cond. No.			9.23e+03	

Notes:

- [1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
- [2] The condition number is large, 9.23e+03. This might indicate that there are strong multicollinearity or other numerical problems.

OLS Regression Results

Regression Japan

OLS Regression Results						
Dep. Variable:	log_household_consumption	R-squared:	0.496			
Model:	OLS	Adj. R-squared:	0.436			
Method:	Least Squares	F-statistic:	9.777			
Date:	Mon, 16 Jun 2025	Prob (F-statistic):	0.000190			
Time:	15:59:05	Log-Likelihood:	69.727			
No. Observations:	29	AIC:	-131.5			
Df Residuals:	25	BIC:	-126.0			
Df Model:	3					
Covariance Type:	HC3					
	coef	std err	z	P> z	[0.025	0.975]
const	9.1088	3.465	2.628	0.009	2.317	15.901
log_fixed_asset	0.2371	0.298	0.795	0.426	-0.347	0.821
log_stock_asset	0.0632	0.014	4.617	0.000	0.036	0.090
log_employment_income	-0.0280	0.164	-0.171	0.864	-0.349	0.293
Omnibus:	0.389	Durbin-Watson:	0.936			
Prob(Omnibus):	0.823	Jarque-Bera (JB):	0.007			
Skew:	-0.000	Prob(JB):	0.996			
Kurtosis:	3.078	Cond. No.	9.23e+03			

Notes:

- [1] Standard Errors are heteroscedasticity robust (HC3)
- [2] The condition number is large, 9.23e+03. This might indicate that there are strong multicollinearity or other numerical problems.

Regression Japan

GLS Regression Results						
Dep. Variable:	log_household_consumption	R-squared:	0.496			
Model:	GLS	Adj. R-squared:	0.436			
Method:	Least Squares	F-statistic:	8.202			
Date:	Mon, 16 Jun 2025	Prob (F-statistic):	0.000571			
Time:	15:59:05	Log-Likelihood:	69.727			
No. Observations:	29	AIC:	-131.5			
Df Residuals:	25	BIC:	-126.0			
Df Model:	3					
Covariance Type:	nonrobust					
	coef	std err	t	P> t	[0.025	0.975]
const	9.1088	1.870	4.872	0.000	5.258	12.960
log_fixed_asset	0.2371	0.198	1.195	0.243	-0.171	0.645
log_stock_asset	0.0632	0.016	3.873	0.001	0.030	0.097
log_employment_income	-0.0280	0.153	-0.184	0.856	-0.342	0.286
Omnibus:	0.389	Durbin-Watson:	0.936			
Prob(Omnibus):	0.823	Jarque-Bera (JB):	0.007			
Skew:	-0.000	Prob(JB):	0.996			
Kurtosis:	3.078	Cond. No.	9.23e+03			

Notes:

- [1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
- [2] The condition number is large, 9.23e+03. This might indicate that there are strong multicollinearity or other numerical problems.

Regression Japan

Generalized Linear Model Regression Results						
Dep. Variable:	log_household_consumption	No. Observations:	29			
Model:	GLM	Df Residuals:	25			
Model Family:	Gaussian	Df Model:	3			
Link Function:	Identity	Scale:	0.00055408			
Method:	IRLS	Log-Likelihood:	69.727			
Date:	Mon, 16 Jun 2025	Deviance:	0.013852			
Time:	15:59:05	Pearson chi2:	0.0139			
No. Iterations:	3	Pseudo R-squ. (CS):	0.5764			
Covariance Type:	nonrobust					
	coef	std err	z	P> z	[0.025	0.975]
const	9.1088	1.870	4.872	0.000	5.444	12.773
log_fixed_asset	0.2371	0.198	1.195	0.232	-0.152	0.626
log_stock_asset	0.0632	0.016	3.873	0.000	0.031	0.095
log_employment_income	-0.0280	0.153	-0.184	0.854	-0.327	0.271

Key Findings (Robust OLS – HC3):

- The elasticity of equity assets to consumption (0.063) is small but statistically significant. This suggests that the short-term effect of stock prices may be immediate.
- The coefficient on housing assets (0.237) is larger but not significant. Perhaps the effect appears late or is collinear with other variables.
- Employment income is statistically insignificant ($p=0.864$). This indicates either a limitation as an explanatory variable or a limitation of the data sample.

Regression Japan

Modeling of Short-run

Empirical Strategy (Short-Run Specification)

- Estimate the short-run relationship using the following model:

$$\Delta \log C_t = \alpha + \beta \Delta \log S_{t-1} + \gamma \Delta \log H_{t-1} + \phi \Delta \log Y_{t-1} + \varepsilon_t$$

- Where:

$\Delta \log C_t$: Growth rate of household consumption
$\Delta \log S_{t-1}$: Lagged growth rate of stock market wealth
$\Delta \log H_{t-1}$: Lagged growth rate of housing wealth
$\Delta \log Y_{t-1}$: Lagged growth rate of employment income
ε_t	: Error term

Main Focus

- Assess short-run impacts of asset and income growth on consumption growth:

γ	: Short-run elasticity of consumption with respect to housing wealth growth
β	: Short-run elasticity with respect to stock market wealth growth
ϕ	: Short-run elasticity with respect to income growth

Regression Japan

OLS Regression Results

Dep. Variable:	logdiff_household_consumption	R-squared:	0.104			
Model:	OLS	Adj. R-squared:	-0.008			
Method:	Least Squares	F-statistic:	0.7477			
Date:	Mon, 16 Jun 2025	Prob (F-statistic):	0.534			
Time:	17:01:20	Log-Likelihood:	72.272			
No. Observations:	28	AIC:	-136.5			
Df Residuals:	24	BIC:	-131.2			
Df Model:	3					
Covariance Type:	HC3					
	coef	std err	z	P> z	[0.025	0.975]
const	0.0047	0.004	1.245	0.213	-0.003	0.012
logdiff_stock_asset	0.0189	0.013	1.457	0.145	-0.007	0.044
logdiff_fixed_asset	0.2395	0.603	0.397	0.691	-0.942	1.421
logdiff_employment_income	-0.1399	0.363	-0.385	0.700	-0.851	0.571
Omnibus:	10.650	Durbin-Watson:		1.961		
Prob(Omnibus):	0.005	Jarque-Bera (JB):		12.859		
Skew:	-0.808	Prob(JB):		0.00161		
Kurtosis:	5.900	Cond. No.		85.7		

Notes:

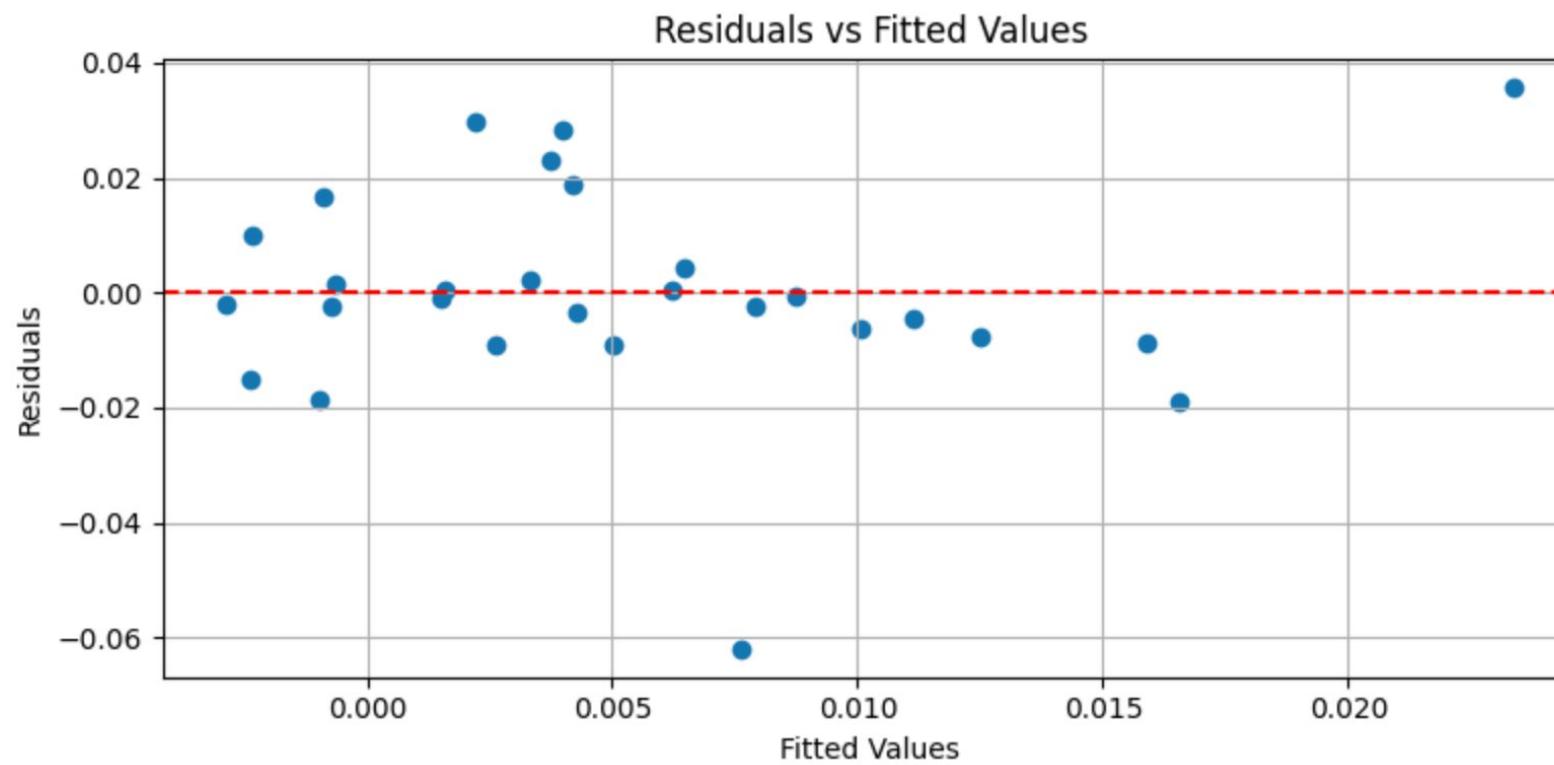
[1] Standard Errors are heteroscedasticity robust (HC3)

MPC (Short-run) - Income: -0.1493

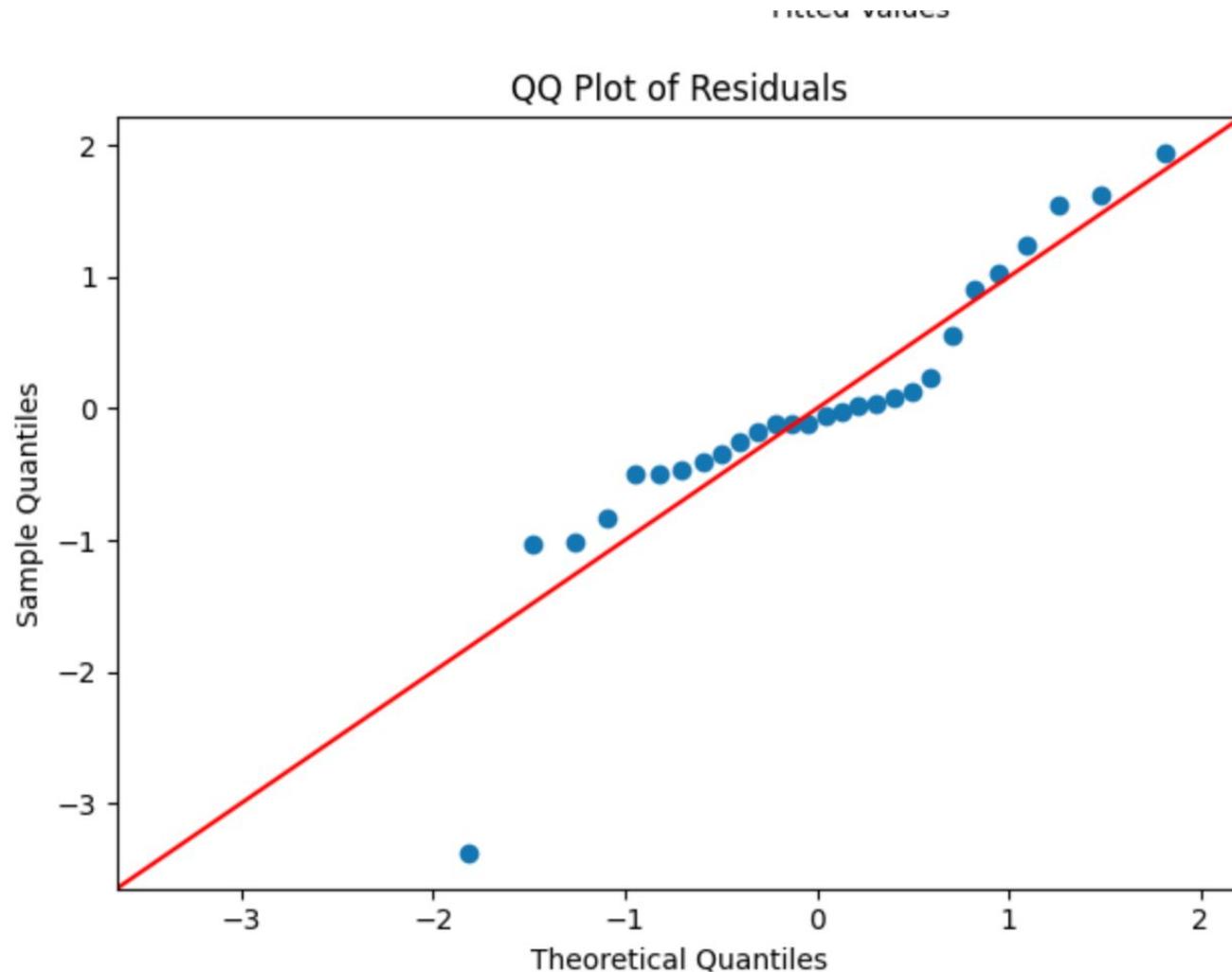
MPC (Short-run) - Housing Wealth: 0.0132

MPC (Short-run) - Financial Wealth: 0.4816

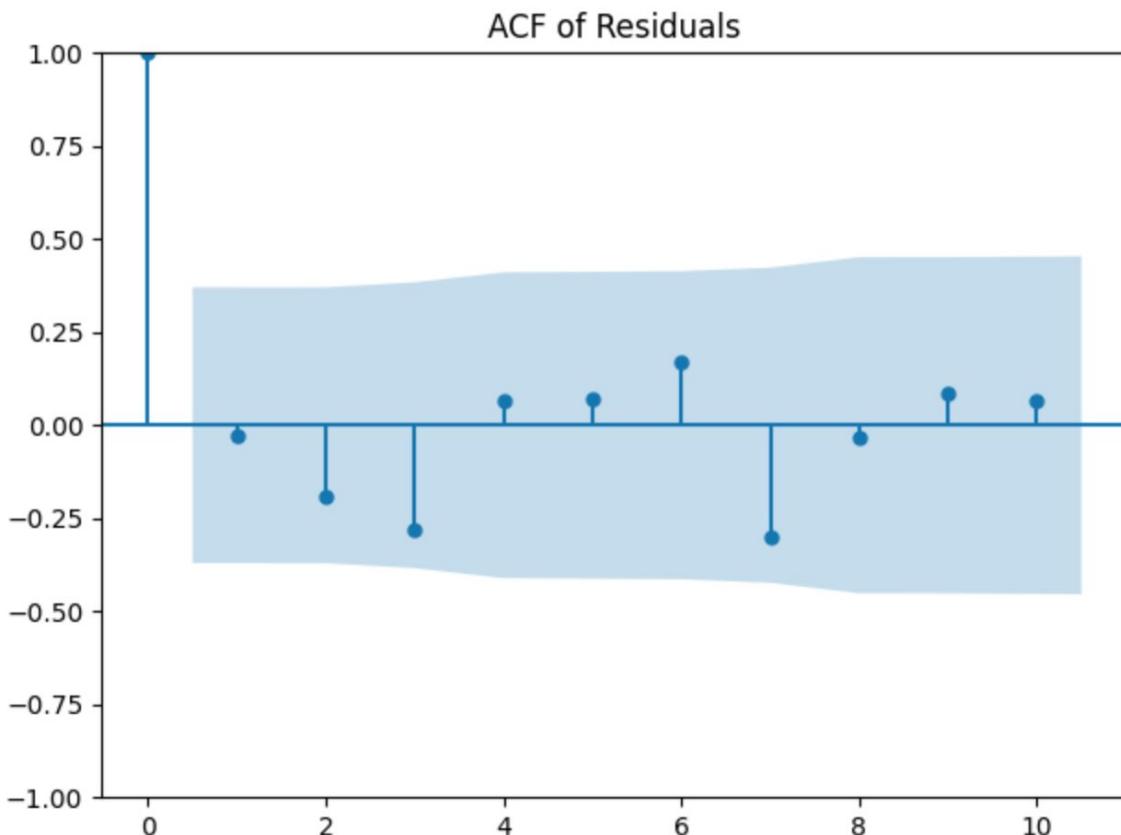
Regression Japan



Regression Japan



Regression Japan



Ljung-Box Test for Autocorrelation (lag=1):
lb_stat lb_pvalue
1 0.023 0.879

Regression Japan

Regression Diagnostics Summary

- **Residuals vs Fitted Values:** The plot shows no clear patterns or funnel shapes, suggesting that the residuals have constant variance and that the model is correctly specified.
- **QQ Plot of Residuals:** Most residuals lie along the 45-degree line, indicating approximate normality. Some deviations at the tails suggest mild non-normality, which is addressed by using robust standard errors (HC3).
- **ACF Plot:** The autocorrelation function shows no significant autocorrelation in residuals up to 10 lags. This confirms the independence assumption holds.

Overall, diagnostic plots support the validity of the linear regression model with robust standard errors.

Regression Japan

- Regression with Lagged Dependent Variable (AR(1) Model)

OLS with AR(1) Term:

OLS Regression Results							
Dep. Variable:	logdiff_household_consumption	R-squared:	0.426	Model:	OLS	Adj. R-squared:	0.326
Method:	Least Squares	F-statistic:	3.129	Date:	Mon, 16 Jun 2025	Prob (F-statistic):	0.0342
Time:	15:59:08	Log-Likelihood:	78.500	No. Observations:	28	AIC:	-147.0
Df Residuals:	23	BIC:	-140.3	Df Model:	4		
Covariance Type:	HC3						
	coef	std err	z	P> z	[0.025	0.975]	
const	0.0016	0.003	0.468	0.640	-0.005	0.008	
logdiff_stock_asset	0.0194	0.009	2.052	0.040	0.001	0.038	
logdiff_fixed_asset	0.4323	0.181	2.385	0.017	0.077	0.787	
logdiff_employment_income	0.1038	0.151	0.686	0.493	-0.193	0.400	
logdiff_household_consumption_lag1	0.2497	0.206	1.212	0.226	-0.154	0.653	
Omnibus:	8.503	Durbin-Watson:	1.769	Prob(Omnibus):	0.014	Jarque-Bera (JB):	10.408
Skew:	-0.545	Prob(JB):	0.00549	Kurtosis:	5.781	Cond. No.	103.

Notes:

[1] Standard Errors are heteroscedasticity robust (HC3)

Finding and Summary

Table: Wealth Effects on Consumption — EU vs Japan (OLS Estimates)

Variable	Elasticity ^(LR) (EU)	MPC ^(LR) (EU)	Elasticity ^(sR) (EU)	MPC ^(sR) (EU)	Elasticity ^(LR) (Japan)	MPC ^(LR) (Japan)	Elasticity ^(sR) (Japan)	MPC ^(sR) (Japan)
Income	0.4694***	0.4078	0.0828	0.0719	-0.280	-0.2988	-0.1399	-0.1493
Financial Wealth	0.0966***	0.0386	0.3650*	0.1458	0.0632***	0.1271	0.2395	0.4816
Housing Wealth	0.2114***	0.0106	0.8499***	0.0428	0.2371	0.1653	0.0189	0.0132

Finding and Summary

Key Findings (Robust OLS – HC3):

- None of the explanatory variables has a statistically significant impact on short-term consumption changes.
- The coefficient on logdiff_fixed_asset is relatively large (0.24), but is unreliable due to large uncertainty.
- The short-term model (log-diff) does not explain the growth rate of consumption well for either finance, housing, or income.

Finding and Summary

Table 1: Elasticity and MPC Estimates by Country and Variable

Country	Variable	Elasticity (LR)	MPC (LR)	Elasticity (SR)	MPC (SR)
EU	Income	0.4694***	0.4078***	0.0828	0.0719
	Financial Wealth	0.0966***	0.0386***	0.3650*	0.1458*
	Housing Wealth	0.2114***	0.0106***	0.8499***	0.0428***
Japan	Income	-0.280	-0.2988	-0.1399	-0.1493
	Financial Wealth	0.0632***	0.1271***	0.2395	0.4816
	Housing Wealth	0.2371	0.1653	0.0189	0.0132

Notes: LR = Long-run estimates from log-level models; SR = Short-run estimates from log-difference models. MPC is calculated as elasticity divided by average wealth-to-consumption ratio. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Finding and Summary

EU:

- Household consumption exhibits a steady upward trend over time, closely tracking the rise in employment income and housing wealth.
- A sharp decline in 2020, followed by a swift rebound, reflects the consumption shock caused by the COVID-19 pandemic and subsequent recovery.
- In the long-run model:
 - Employment income, housing wealth, and financial assets are all positively and significantly associated with household consumption.
 - Among these, income has the largest and most statistically robust effect, indicating a strong long-run income-consumption linkage.
 - The long-run marginal propensity to consume (MPC) out of income is notably higher than that from either form of wealth.
- In the short-run model:
 - Only housing wealth growth is significantly correlated with changes in consumption.
 - Changes in income and financial wealth do not exhibit significant short-term impacts on consumption growth.

Finding and Summary

Japan:

- In the short-run model, stock market wealth (financial assets) has a statistically significant positive effect on household consumption, suggesting capital gains may directly influence consumer behavior.
- Although housing wealth has a relatively larger coefficient, it is not statistically significant, implying that short-run consumption is less responsive to real estate fluctuations.
- Employment income shows no significant short-run effect, possibly reflecting Japan's stable and slowly adjusting wage system.
- The short-run MPC from financial wealth is larger than that from income, indicating a stronger sensitivity of consumption to asset changes in the Japanese context.

Conclusion

Does household consume more when their wealth increases?

- For EU, yes. They have Strong Long-Run Relationship
- For Japan, Partially. They have Short-Run Sensitivity to Financial Wealth.

Conclusion

- In the EU, household consumption increases with household wealth in the long run, especially with stable income and rising real estate and financial asset values.
- In Japan, short-term consumption responds mainly to financial wealth, not housing or income.

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