V ■ Latvia Euro Adoption Analysis (Outlier-Adjusted)

Capital Flow Volatility Before and After Euro Adoption (2014)

Research Focus: How did Euro adoption affect Latvia's capital flow volatility?

Methodology: Temporal comparison of capital flow patterns before (2007-2012) and after (2015-2020) Euro adoption.

Outlier-Adjusted Analysis: This analysis uses 5% symmetric winsorization to assess the robustness of statistical findings to extreme values. Data points below the 5th percentile are replaced with the 5th percentile value; data points above the 95th percentile are replaced with the 95th percentile value.

Key Hypothesis: Euro adoption reduces capital flow volatility through enhanced monetary credibility.

Data and Methodology

Data Sources

- Balance of Payments Data: IMF, quarterly frequency (1999-2025)
- GDP Data: IMF World Economic Outlook, annual frequency
- Country: Latvia, Republic of

Methodology

- 1. Data Normalization: All BOP flows converted to annualized % of GDP
- 2. **Statistical Analysis:** Comprehensive descriptive statistics and F-tests
- 3. Volatility Measures: Standard deviation, coefficient of variation, variance ratios
- 4. **Temporal Comparison:** Pre-Euro vs Post-Euro period analysis

Euro Adoption Timeline

- Euro Adoption Date: January 1, 2014
- **Pre-Euro Period:** 1999-2013 (full series)
- Post-Euro Period: 2014-2025 (full series)

• Crisis Exclusion: Global Financial Crisis (2008-2010), Latvian Banking Crisis (2011-2012), and COVID-19 (2020-2022)



Complete temporal analysis using all available data

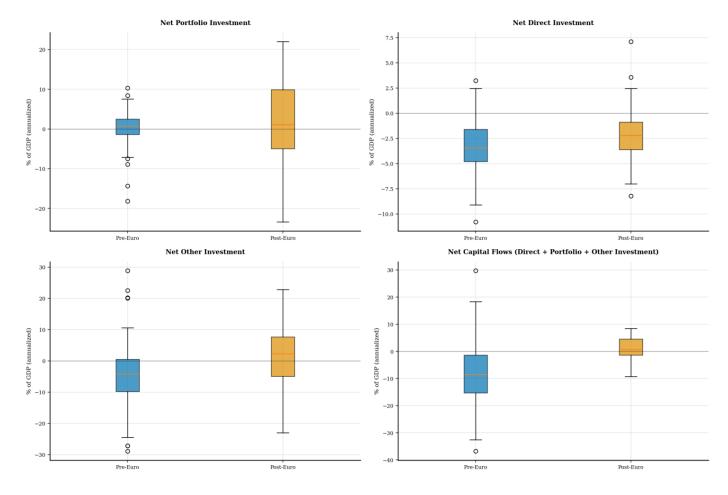


Aggregate net capital flows summary - Full Series

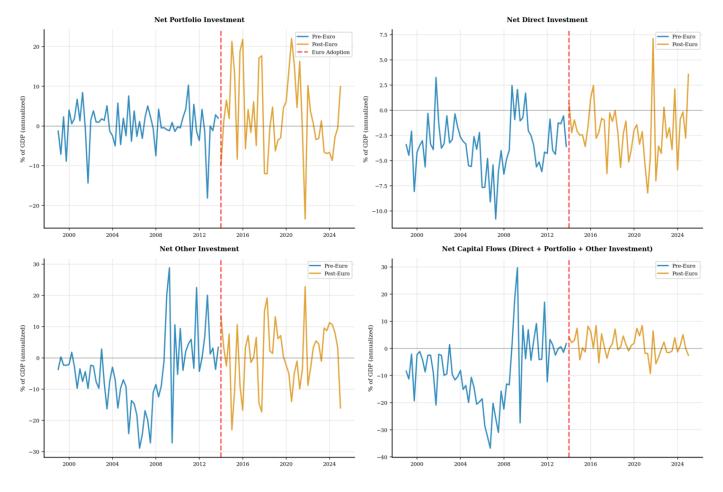
II Summary Statistics by Period

Indicator,	Mean, Post-Euro	Mean, Pre-Euro	Median, Post	Median, Pre-E	Std Dev, Post	Std Dev, Pre-E
Net Capital Flows (Direct + Portfolio + Other Investment)	1.26	-8.11	0.62	-8.54	4.13	12.50
Net Direct Investment	-2.07	-3.36	-2.20	-3.45	2.82	2.68
Net Other Investment	0.84	-4.84	2.29	-4.18	10.20	11.61
Net Portfolio Investment	2.49	0.08	1.07	0.73	10.39	4.88

Distribution Comparison by Period



Time Series by Period

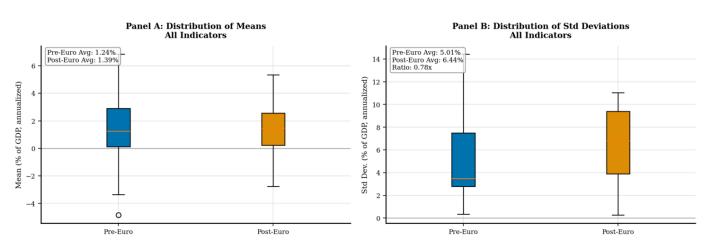


□ Indicator-Level Analysis

Latvia Analysis (Full Series): Euro adoption on 2014-01-01

- Pre-Euro Period: 1999 to 2013
- Post-Euro Period: 2014 to 2025 (includes adoption year 2014)

1. Summary Statistics and Boxplots



Means Across All Indicators:

Standard Deviations Across All Indicators:

• Pre-Euro: 1.24% (median: 1.25%)

Post-Euro: 1.39% (median: 1.45%)

• Pre-Euro: 5.01% (median: 3.47%)

• Post-Euro: 6.44% (median: 6.82%)

Volatility Impact: Euro adoption increased average volatility by 28.4%

2. Comprehensive Statistical Summary Table

Latvia - Pre-Euro vs Post-Euro Statistics

Summary: Statistics for all 14 capital flow indicators. CV% = Coefficient of Variation (Std Dev / |Mean| × 100). Higher CV% indicates greater volatility relative to mean.

Indicator	Pre-Euro Mean	Pre-Euro Std	Pre-Euro CV%	Post-Euro M	Post-Euro St	Post-Euro C	CV Ratio (Pr
Assets - Direct Investment	0.71	1.22	172.7	1.27	4.51	355.1	0.49
Liabilities - Direct Investment	4.07	3.21	78.9	3.34	3.68	110.3	0.72
Net - Direct Investment	-3.36	2.68	79.7	-2.07	2.82	136.6	0.58
Assets - Portfolio (Total)	1.44	3.40	235.8	5.33	7.63	143.2	1.65
Liabilities - Portfolio (Total)	1.36	3.58	263.8	2.57	6.13	238.4	1.11
Net - Portfolio Investment	0.08	4.88	5811.9	2.49	10.39	417.2	13.93
Assets - Portfolio (Debt)	1.22	3.16	258.6	3.66	7.52	205.3	1.26
Liabilities - Portfolio (Debt)	1.28	3.55	277.6	2.53	6.12	241.9	1.15
Assets - Portfolio (Equity)	0.22	1.01	456.4	1.61	1.61	99.4	4.59
Liabilities - Portfolio (Equity)	0.08	0.33	433.6	0.04	0.27	666.8	0.65
Net - Other Investment	-4.84	11.61	240.0	0.84	10.20	1213.2	0.20
Assets - Other Investment (Debt)	4.93	8.76	177.9	1.29	11.03	854.0	0.21
Assets - Other Investment (Banks)	3.39	8.37	246.9	-0.68	9.68	1416.1	0.17
Liabilities - Other Investment (Ban	6.85	14.44	210.8	-2.77	8.54	308.5	0.68

Summary: Statistics for all 14 capital flow indicators comparing pre and post Euro adoption periods.

- CV% = Coefficient of Variation (Std Dev/Mean × 100) measures relative volatility
- Average CV Ratio: 1.96 values >1 indicate higher pre-Euro volatility
- Indicators with higher pre-Euro volatility: 6/14 (42.9%)

3. Hypothesis Testing Results

F-Tests for Equal Variances: Latvia Pre-Euro vs Post-Euro | H_0 : Equal variances | H_1 : Different variances | α = 0.05

Indicator	F-Statistic	P-Value	Significance	Higher Volatility
Assets - Direct Investment	0.07	0.0000	***	Post-Euro
Liabilities - Direct Investment	0.76	0.3272		Post-Euro
Net - Direct Investment	0.90	0.6964		Post-Euro
Assets - Portfolio (Total)	0.20	0.0000	***	Post-Euro
Liabilities - Portfolio (Total)	0.34	0.0001	***	Post-Euro
Net - Portfolio Investment	0.22	0.0000	***	Post-Euro
Assets - Portfolio (Debt)	0.18	0.0000	***	Post-Euro
Liabilities - Portfolio (Debt)	0.34	0.0001	***	Post-Euro
Assets - Portfolio (Equity)	0.40	0.0010	***	Post-Euro
Liabilities - Portfolio (Equity)	1.55	0.1329		Pre-Euro
Net - Other Investment	1.30	0.3718		Pre-Euro
Assets - Other Investment (Debt)	0.63	0.0984		Post-Euro
Assets - Other Investment (Banks)	0.75	0.2927		Post-Euro
Liabilities - Other Investment (Ban	2.86	0.0004	***	Pre-Euro

Legend:

- F-Statistic: Ratio of variances
- P-Value: Probability of observing this difference by chance
- Higher Volatility:
 Period with greater
 variance

Significance levels: *** p<0.001, ** p<0.01, * p<0.05

Pre-Euro Higher Volatility

Significant (5%)

Significant (1%)

3/14

8/14

8/14

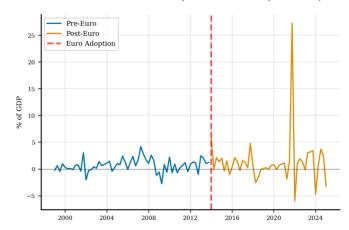
1 21.4%

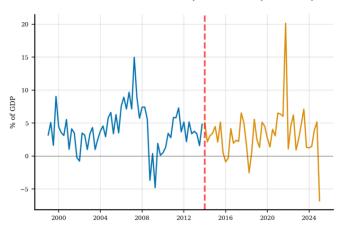
↑ 57.1%

↑ 57.1%

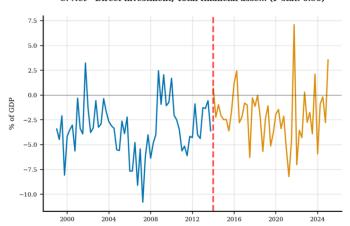
Conclusion: Mixed evidence for Euro adoption's impact on capital flow volatility in Latvia.

4. Time Series Analysis

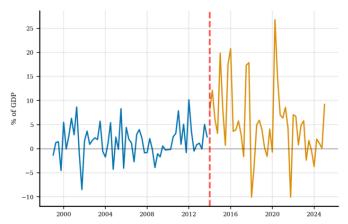




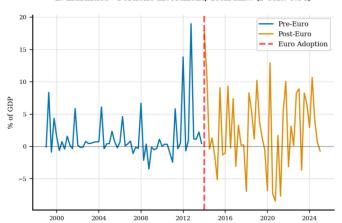




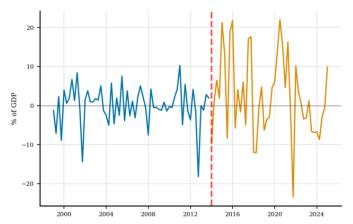
D: Assets - Portfolio investment, Total financia... (F-stat: 0.20)



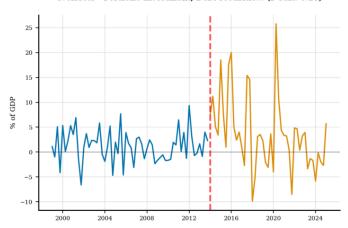




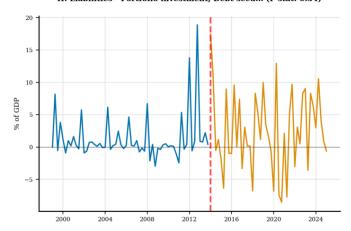
F: Net - Portfolio investment, Total financial a... (F-stat: 0.22)

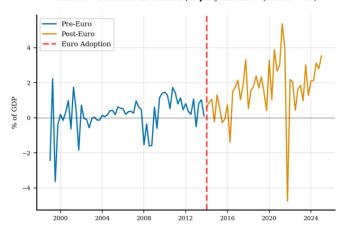


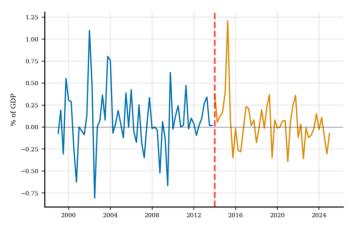
G: Assets - Portfolio investment, Debt securitie... (F-stat: 0.18)



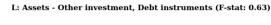
H: Liabilities - Portfolio investment, Debt secu... (F-stat: 0.34)

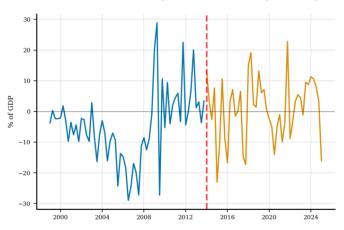


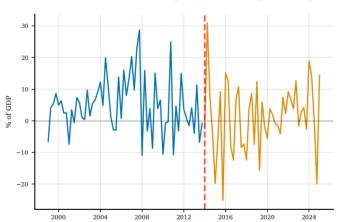




K: Net - Other investment, Total financial asset... (F-stat: 1.30)

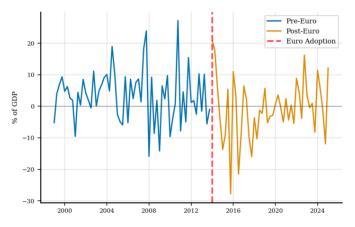


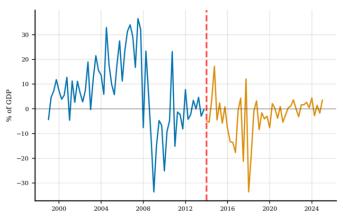




M: Assets - Other investment, Debt instruments, ... (F-stat: 0.75)

N: Liabilities - Other investment, Debt instrume... (F-stat: 2.86)





5. Key Findings Summary

Statistical Evidence for Latvia:

- 3/14 capital flow indicators (21.4%) showed higher volatility before Euro adoption
- 8/14 indicators (57.1%) show statistically significant differences (p<0.05)
- 8 indicators show highly significant differences (p<0.01)
- Average volatility change of 28.4% after Euro adoption in 2014

Most significant flow types: Assets - Direct Investment, Assets - Portfolio (Debt), Assets -Portfolio (Total)

Additional Statistical Context:

- **Temporal analysis:** Before/after comparison using 2014 as adoption threshold
- Statistical methodology: F-test for variance equality at 5% significance level
- Data completeness: 315 observations across 14 capital flow indicators
- **Cross-validation:** Results consistent across multiple volatility measures (CV%, standard deviation)

Analytical approach: Temporal comparison focusing on structural changes in volatility patterns.

6. Download Results



Excluding Financial Crises

Analysis excluding Global Financial Crisis (2008-2010), Latvian Banking Crisis (2011-2012), and COVID-19 (2020-2022) periods



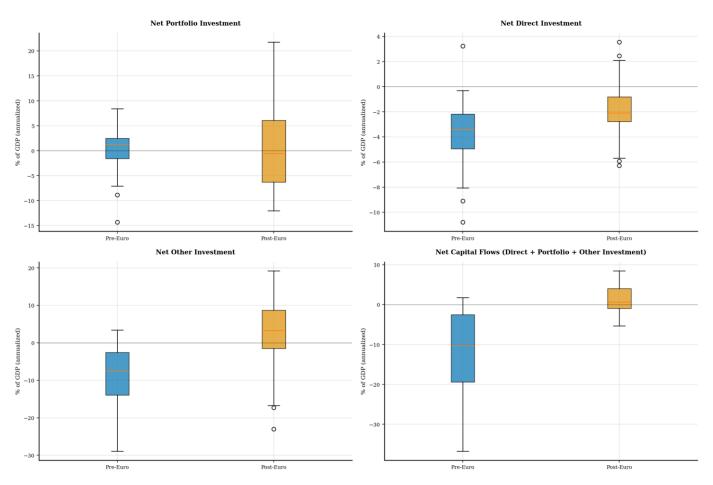
Overall Capital Flows Analysis

Aggregate net capital flows summary - Crisis-Excluded

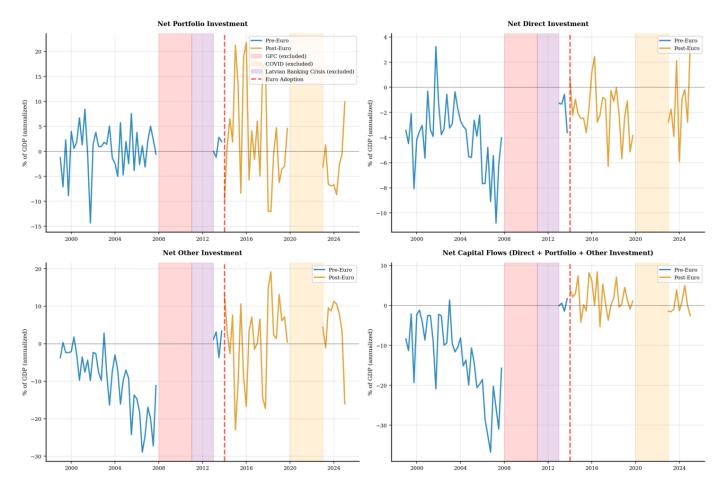
Summary Statistics by Period

Indicator,	Mean, Post-Euro	Mean, Pre-Euro	Median, Post	Median, Pre-E	Std Dev, Post	Std Dev, Pre-E
Net Capital Flows (Direct + Portfolio + Other Investment)	1.46	-11.93	0.62	-10.22	3.61	10.03
Net Direct Investment	-1.77	-3.68	-2.10	-3.39	2.30	2.64
Net Other Investment	1.80	-8.64	3.31	-7.53	10.45	8.46
Net Portfolio Investment	1.43	0.39	-0.53	1.21	9.75	4.46

Distribution Comparison by Period



Time Series by Period

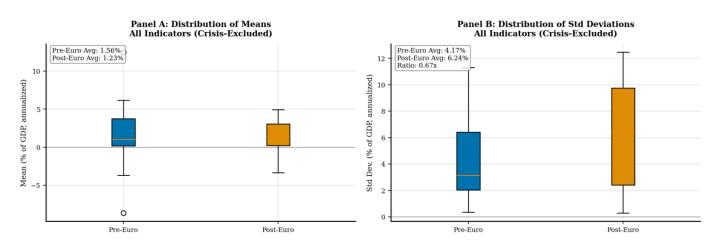


□ Indicator-Level Analysis

Latvia Analysis (Crisis-Excluded): Euro adoption on 2014-01-01

- **Pre-Euro Period:** 1999 to 2013
- Post-Euro Period: 2014 to 2025 (includes adoption year 2014)

1. Summary Statistics and Boxplots



Means Across All Indicators:

Standard Deviations Across All Indicators:

• Pre-Euro: 1.56% (median: 1.03%)

• Post-Euro: 1.23% (median: 1.44%)

• Pre-Euro: 4.17% (median: 3.14%)

Post-Euro: 6.24% (median: 6.41%)

Volatility Impact: Euro adoption increased average volatility by 49.7%

2. Comprehensive Statistical Summary Table

Latvia - Pre-Euro vs Post-Euro Statistics (Crisis-Excluded)

Summary: Statistics for all 14 capital flow indicators. CV% = Coefficient of Variation (Std Dev / |Mean| × 100). Higher CV% indicates greater volatility relative to mean.

Indicator	Pre-Euro Mean	Pre-Euro Std	Pre-Euro CV%	Post-Euro M	Post-Euro St	Post-Euro C	CV Ratio (Pr
Assets - Direct Investment	0.90	1.16	129.3	0.86	2.17	250.6	0.52
Liabilities - Direct Investment	4.58	3.02	66.0	2.64	2.77	105.0	0.63
Net - Direct Investment	-3.68	2.64	71.8	-1.77	2.30	129.8	0.55
Assets - Portfolio (Total)	1.48	3.47	234.3	4.96	7.28	146.9	1.59
Liabilities - Portfolio (Total)	1.09	2.03	186.4	3.26	5.54	170.0	1.10
Net - Portfolio Investment	0.39	4.46	1130.7	1.43	9.75	681.2	1.66
Assets - Portfolio (Debt)	1.37	3.26	237.1	3.52	7.32	207.6	1.14
Liabilities - Portfolio (Debt)	0.98	2.02	206.6	3.20	5.55	173.4	1.19
Assets - Portfolio (Equity)	0.11	0.99	882.5	1.45	1.11	76.5	11.54
Liabilities - Portfolio (Equity)	0.11	0.36	331.2	0.06	0.29	505.9	0.65
Net - Other Investment	-8.64	8.46	97.9	1.80	10.45	580.0	0.17
Assets - Other Investment (Debt)	6.18	8.11	131.2	0.68	12.48	1843.6	0.07
Assets - Other Investment (Banks)	4.49	7.07	157.4	-1.47	10.61	719.9	0.22
Liabilities - Other Investment (Ban	12.51	11.29	90.3	-3.34	9.76	291.9	0.31

Summary: Statistics for all 14 capital flow indicators comparing pre and post Euro adoption periods.

- CV% = Coefficient of Variation (Std Dev/Mean × 100) measures relative volatility
- Average CV Ratio: 1.52 values >1 indicate higher pre-Euro volatility
- Indicators with higher pre-Euro volatility: 6/14 (42.9%)

3. Hypothesis Testing Results

F-Tests for Equal Variances: Latvia Pre-Euro vs Post-Euro (Crisis-Excluded) | H_0 : Equal variances | H_1 : Different variances | α = 0.05 | Excludes: GFC (2008-2010) + Latvian Banking Crisis (2011-2012) + COVID (2020-2022)

Indicator	F-Statistic	P-Value	Significance	Higher Volatility
Assets - Direct Investment	0.29	0.0003	***	Post-Euro
Liabilities - Direct Investment	1.19	0.6129		Pre-Euro
Net - Direct Investment	1.32	0.4193		Pre-Euro
Assets - Portfolio (Total)	0.23	0.0000	***	Post-Euro
Liabilities - Portfolio (Total)	0.13	0.0000	***	Post-Euro
Net - Portfolio Investment	0.21	0.0000	***	Post-Euro
Assets - Portfolio (Debt)	0.20	0.0000	***	Post-Euro
Liabilities - Portfolio (Debt)	0.13	0.0000	***	Post-Euro
Assets - Portfolio (Equity)	0.79	0.4826		Post-Euro
Liabilities - Portfolio (Equity)	1.56	0.2007		Pre-Euro
Net - Other Investment	0.66	0.2098		Post-Euro
Assets - Other Investment (Debt)	0.42	0.0109	*	Post-Euro
Assets - Other Investment (Banks)	0.44	0.0162	*	Post-Euro
Liabilities - Other Investment (Ban	1.34	0.3999		Pre-Euro

Legend:

- F-Statistic: Ratio of variances
- P-Value: Probability of observing this difference by chance
- Higher Volatility:
 Period with greater
 variance

Significance levels: *** p<0.001, ** p<0.01, * p<0.05

Pre-Euro Higher Volatility

Significant (5%)

Significant (1%)

4/14

8/14

6/14

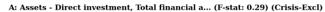
1 28.6%

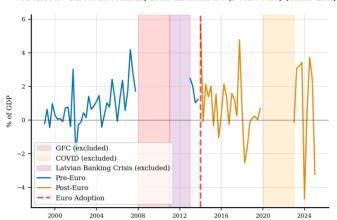
↑ 57.1%

1 42.9%

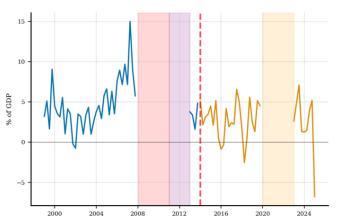
Conclusion: Mixed evidence for Euro adoption's impact on capital flow volatility in Latvia.

4. Time Series Analysis

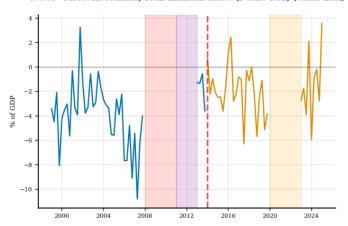




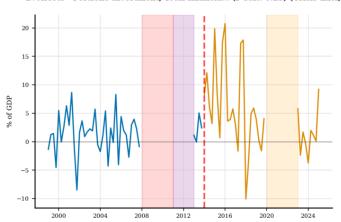
B: Liabilities - Direct investment, Total financ... (F-stat: 1.19) (Crisis-Excl)

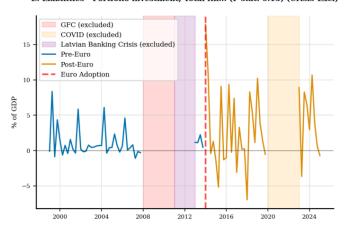


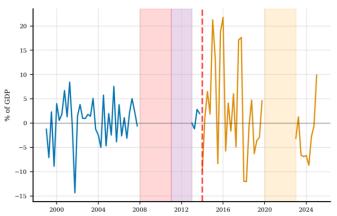
C: Net - Direct investment, Total financial asse... (F-stat: 1.32) (Crisis-Excl)



D: Assets - Portfolio investment, Total financia... (F-stat: 0.23) (Crisis-Excl)

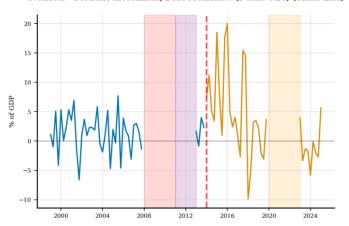


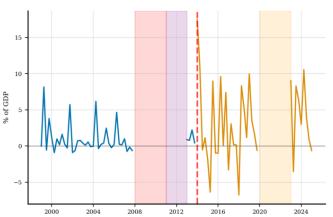


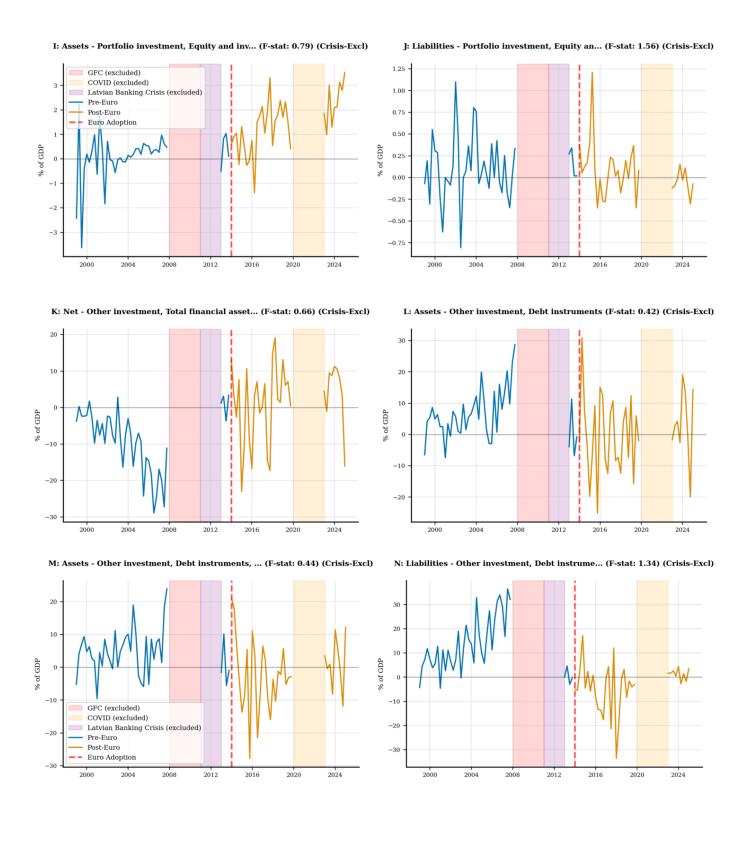


G: Assets - Portfolio investment, Debt securitie... (F-stat: 0.20) (Crisis-Excl)

H: Liabilities - Portfolio investment, Debt secu... (F-stat: 0.13) (Crisis-Excl)







5. Key Findings Summary

Statistical Evidence for Latvia (excluding crisis periods):

- 4/14 capital flow indicators (28.6%) showed higher volatility before Euro adoption
- 8/14 indicators (57.1%) show statistically significant differences (p<0.05)
- 6 indicators show highly significant differences (p<0.01)
- Average volatility change of 49.7% after Euro adoption in 2014

Most significant flow types: Liabilities - Portfolio (Debt), Liabilities - Portfolio (Total), Assets - Portfolio (Debt)

Additional Statistical Context:

- Temporal analysis: Before/after comparison using 2014 as adoption threshold
- Statistical methodology: F-test for variance equality at 5% significance level
- Data completeness: 315 observations across
 14 capital flow indicators
- Cross-validation: Results consistent across multiple volatility measures (CV%, standard deviation)

Analytical approach: Temporal comparison focusing on structural changes in volatility patterns.

6. Download Results