Sovereign Debt Relief and Its Aftermath Replication Report Presentation

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May 28, 2025

Outline

Introduction

Key Question

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Should countries with a heavy debt burden and little prospect of repayment receive debt forgiveness?

- Literature has mostly focused on the *occurrence* of debt crises, not on their *resolution*.
- **Contribution of this paper:** Filling this gap by studying two 20th century instances of debt relief encompassing a substantial number of countries.

Key Challenges and Methodological Solutions

1. **Timing of debt relief may be endogenous.**
   - *Solution:* Focus on episodes of debt reduction synchronously applied across debtor countries, regardless of individual economic circumstances.
   - Examples:
     - 1931 Hoover Moratorium (cash flow relief)
     - 1934 General Default on War Debts (debt stock relief)
     - 1986 Baker Plan (reducing interest rates, lengthening maturities)
     - 1990 Brady Initiative (face value debt reduction)
2. **Omitted variables and other factors.**
   - *Solution:*
     - Add time and country fixed effects (core to DiD).
     - Robustness checks: adding controls for inflation, banking/currency crises, wars, political shocks.

Basic Facts

The 1934 General Default on War Debts

- In 1934, all European countries (except Finland) stopped paying their war debts to the US and UK.
- The US, despite strong opposition, could not enforce repayment.
- This event is characterized as a form of 'debt relief'.
- The US Treasury still lists these unpaid 1934 war debt obligations.
- **Notable Exception**: Finland was the only country that paid off its war debts.

Data Resources

- **Primary Sources**:
  - United Nations 1948 publication: *Public Debt, 1914-1946*.
  - Annual financial reports by the US Treasury Department.
- **Data Consistency**:
  - Numbers across sources are generally similar, with slight differences.
  - Authors attribute differences to exchange rates or other factors.
- **Valuation of Debt Relief**:
  - The exchange rate of 1934 is used to estimate the value of debt relief, as 1934 is the 'formal' year of relief.
- **Estimation Approach**:
  - Authors use the most conservative estimates of debt relief when best sources are unavailable.

Key Mathematical Model

Haircut Calculations: Identification Challenge

- **Main Identification Challenge**: The timing of debt relief events might be endogenous to a country's economic situation.
- **Authors' Approach**:
  - Use four major debt relief events as quasi-natural experiments.
  - These events were coordinated by governments and involved multiple debtor countries.
  - Argued to be principally exogenous to the economic situation of individual countries.
  - Events not related to specific debt negotiations that could be endogenous.
  - Example: Hoover Moratorium (1931) began after 15 countries had already defaulted for 2 years; all 18 countries defaulted by 1934 (Cruces and Trebesch, 2013, Appendix B).

Heterogeneous Haircuts

- **Debt Flow Relief (Rescheduling & Delayed Repayments)**:
  - Hoover operations
  - Baker operations
- **Debt Stock Relief (Reduced Nominal Value)**:
  - 1934 default operations
  - Brady operations
- **Analytical Advantage**: This heterogeneity allows comparison of the effects of debt relief within the same countries over time, shedding light on the aftermath of intermediate versus decisive debt relief.

Difference-in-Differences (DID) Model

The authors use a standard DID model due to cross-sectional variation (target vs. non-target) and a common intervention year for episodes:

$$Y_{it} = \beta_0 + \beta_1 \text{after}_t + \beta_2(\text{treat}_i \times \text{after}_t) + \delta_i + \gamma_t + \varepsilon_{it}$$

Where:

- Y_{it}: Outcome variable for country i at time t.
- treat_i: 1 if country i is in treatment group (received debt relief), 0 otherwise.
- after_t: 1 for years post-debt relief initiative, 0 for years pre-initiative.
- $\text{treat}_i \times \text{after}_t$: Interaction term; β_2 captures the DID effect.
- δ_i: Country fixed effects (time-invariant country-specific factors).
- γ_t: Time fixed effects (common shocks and trends).
- ε_{it}: Error term.

Derivation of β_2 (Average Treatment Effect)

The DID estimator β_2 is derived as:

$$\begin{aligned}\Delta Y_{\text{treat}} &= \mathbb{E}[Y_{it}|\text{treat}_i = 1, \text{after}_t = 1] - \mathbb{E}[Y_{it}|\text{treat}_i = 1, \text{after}_t = 0] \\ &= \beta_1 + \beta_2 + (\bar{\gamma}_{\text{post}} - \bar{\gamma}_{\text{pre}})\end{aligned}$$

$$\begin{aligned}\Delta Y_{\text{control}} &= \mathbb{E}[Y_{it}|\text{treat}_i = 0, \text{after}_t = 1] - \mathbb{E}[Y_{it}|\text{treat}_i = 0, \text{after}_t = 0] \\ &= \beta_1 + (\bar{\gamma}_{\text{post}} - \bar{\gamma}_{\text{pre}})\end{aligned}$$

DID Estimator:

$$\begin{aligned}\text{DID} &= \Delta Y_{\text{treat}} - \Delta Y_{\text{control}} \\ &= (\beta_1 + \beta_2 + (\bar{\gamma}_{\text{post}} - \bar{\gamma}_{\text{pre}})) - (\beta_1 + (\bar{\gamma}_{\text{post}} - \bar{\gamma}_{\text{pre}})) \\ &= \beta_2\end{aligned}$$

Thus, β_2 measures the average effect of treatment, relying on the parallel trends assumption.

Wealth Conservation Ratio (WCR) and Haircuts

Wealth Conservation Ratio (WCR) of a Single Restructuring Event (j):

$$WCR_{i,j} = \frac{\text{Debt Affected}_{i,j}}{\text{Total Debt}_{t-1}}(1 - H_{i,j}) + \left(1 - \frac{\text{Debt Affected}_{i,j}}{\text{Total Debt}_{t-1}}\right) \quad (1)$$

Alternatively:

$$WCR_{i,j} = 1 - \left(\frac{\text{Debt Affected}_{i,j}}{\text{Total Debt}_{t-1}} \times H_{i,j}\right) = 1 - \text{Effective } H_{i,j}$$

- $H_{i,j}$: nominal haircut rate.
- Meaning: Affected debt reduced by $H_{i,j}$, unaffected debt remains.

Cumulative Effective Haircut for Entire Default Episode (i with J_i restructurings):

$$\text{Cumulative WCR}_i = \prod_{j=1}^{J_i} WCR_{i,j}$$

$$\text{Cumulative Effective } H_i = 1 - \text{Cumulative WCR}_i$$

Debt Relief to GDP

Two methods to calculate Debt Relief (DR) to GDP ratio:

1. **More Common Method (Method 1)**:

$$DR_{i,\text{METHOD 1}} = \text{Cumulative Effective } H_i \times \frac{\text{Debt Affected}_{i,J_i}}{\text{Nominal GDP}_i}$$

(Debt Affected$_{i,J_i}$ is debt affected in *last* restructuring; Nominal GDP$_i$ in year of *last* restructuring).

2. **More Robust Method (Method 2) - Considering dynamic GDP**:

$$DR_{i,\text{METHOD 2}} = \text{Cumulative Effective } H_i \times \sum_{j=1}^{J_i} \frac{\text{Debt Affected}_{i,j}}{\text{Nominal GDP}_j}$$

(Nominal GDP$_j$ in year of j-th restructuring).

Staggered DID: When and Why?

- **When do Staggered DID designs arise?**
  - Classic DID: All treated units start treatment simultaneously.
  - Staggered DID: Units adopt treatment at *different* times (e.g., Brady Plan countries restructured 1989-1995).
- **Why Traditional Two-Way Fixed Effects (TWFE) Fail in Staggered Settings?**
  - Canonical TWFE: $Y_{it} = \alpha_i + \lambda_t + \beta D_{it} + \varepsilon_{it}$
  - If treatment effects are time-varying or heterogeneous across cohorts, TWFE averages 2×2 DIDs with potentially *negative* weights.
  - $\widehat{\beta}$ may lack causal interpretation or even have the wrong sign.
  - Key references: Goodman-Bacon (2021), Callaway & Sant'Anna (2021), Sun & Abraham (2021), Borusyak et al. (2021).

Staggered DID: Modern Estimators

Estimators avoiding negative-weight pathology by comparing newly treated cohorts to not-yet-treated or never-treated units:

- **Callaway & Sant'Anna (2021) [CS]**: Computes cohort- and period-specific $ATT(g,t)$, then aggregates.
- **Sun & Abraham (2021) [SA]**: Provides bias-corrected, cohort-specific event-study coefficients.

Conceptual Derivation (Callaway-Sant'Anna):

- G_i: first period unit i is treated.
  $ATT(g,t) = \mathbb{E}[Y_{it}(g) - Y_{it}(\infty)|G_i = g]$.
- Identification under: (i) Conditional parallel trends, (ii) No anticipation, (iii) Overlap.
- Estimation: $\widehat{ATT}(g,t) = [\hat{\Delta}_{gt} - \hat{\Delta}_{g,g-1}] - [\hat{\Delta}_{Ct} - \hat{\Delta}_{C,g-1}]$.
- Aggregation: $ATT^{\text{Overall}}(k) = \sum_g \omega_g \widehat{ATT}(g, g+k)$.

Staggered DID: Application and Considerations

Applying Staggered DID to the Brady Plan:

1. Define treatment timing G_i (year of Brady bonds issuance).
2. Construct event-study window (e.g., $e = t - G_i \in [-5, 5]$).
3. Estimate dynamic effects (SA or BJS for unbiased θ_e).

Further Econometric Considerations:

- Anticipation and spillovers.
- Treatment reversals (Brady mostly irreversible).
- Weight diagnostics (Goodman-Bacon decomposition).
- Robust inference (block bootstrap, CS multiplier bootstrap).

Key Takeaways for Practitioners:

a. Align strategy with true adoption pattern.
b. Report dynamic and cohort-specific estimates.
c. Complement with narrative evidence.

Code Replication

War Period: Sample Definition

Define War Samples & Counterfactuals:

- **Defaulters (18 countries)**: Austria, Belgium, Czechoslovakia, Estonia, France, Greece, Yugoslavia, Hungary, Italy, Latvia, Lithuania, Poland, Romania, UK, Germany, Australia, Portugal, New Zealand.
- **No credit event (Europe)**: Finland, Norway, Sweden, Switzerland, Denmark, Ireland, Spain.
- **Extension countries**: Russia, Japan, China, Bulgaria, Turkey, Thailand; Argentina, Uruguay, Chile, Brazil, Colombia, Mexico, Peru, Venezuela.

Final Data Samples Used:

- WarSmallSample: Defaulters and non-defaulters from Europe.
- WarLatAmSample: Adds Latin America to WarSmallSample.
- WarNonLatAmSample: Adds non-Latin America (excl. Europe) to WarSmallSample.
- WarAllSample: All defaulters and non-defaulters.
- WarCounterfactual: Non-defaulters from Europe, Latin America, and Non-Latin America.

War Period: Time Windows & Indices

- **Baselines**: 1931 Hoover Moratorium and 1934 Default as T.
- **Time Window**: $T-5$ to $T+5$.
- **Normalized Indices (w.r.t. baselines)**:
  - Debt index: -5 to 5 (relative to baseline event year).
  - GDP index: Real GDP / baseline real GDP.
  - Rating index: Moody's rating / baseline Moody's rating (numerical 1-9, 9=AAA based on Switzerland).

Figure 3 & 4: GDP and External Debt/GDP around Relief

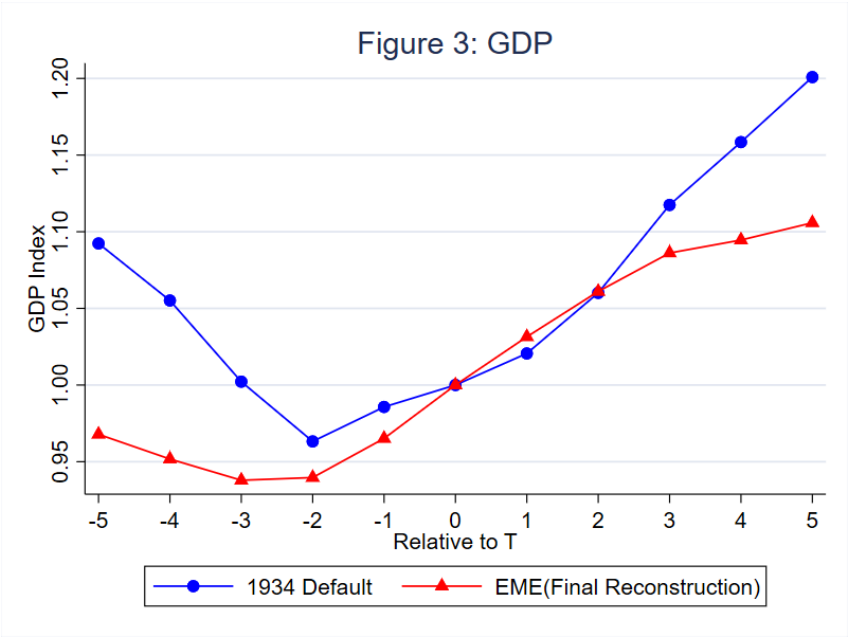


Figure: Real p.c. GDP around debt relief (EM 1978-2010 vs. AE 1934).

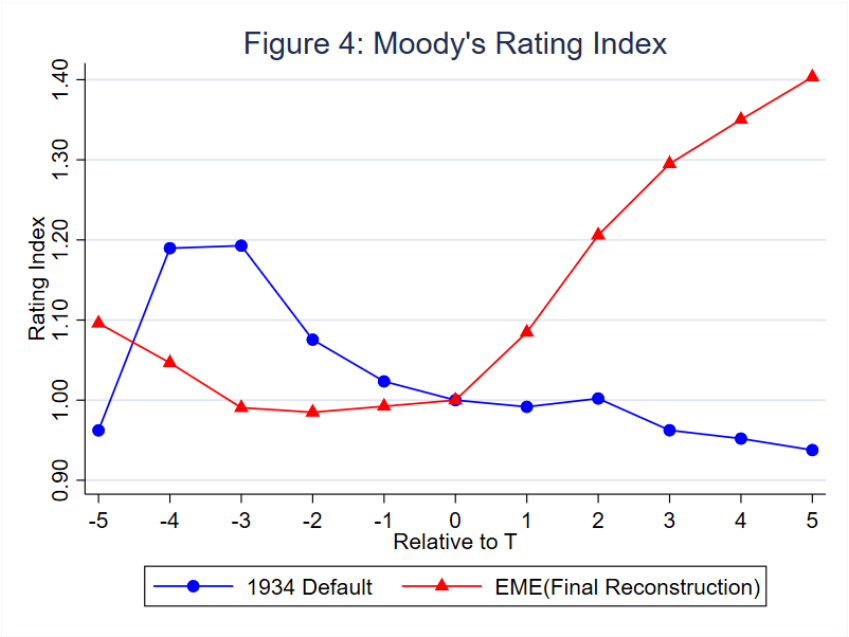


Figure: Total external debt to GDP around debt relief (EM 1978-2010 vs. AE 1934).

Report Figure 3 caption: Real per capita GDP around debt relief events (exit from default) in middle- to high-income emerging markets (1978-2010) and advanced economies (1934). Report Figure 4 caption: Total external debt to GDP (in %) around debt relief events (exit from default) in middle- to high-income emerging markets (1978-2010) and advanced economies (1934). I used the text caption.

Figure 5 & 6: Debt Service/GDP and Debt/GDP around Relief

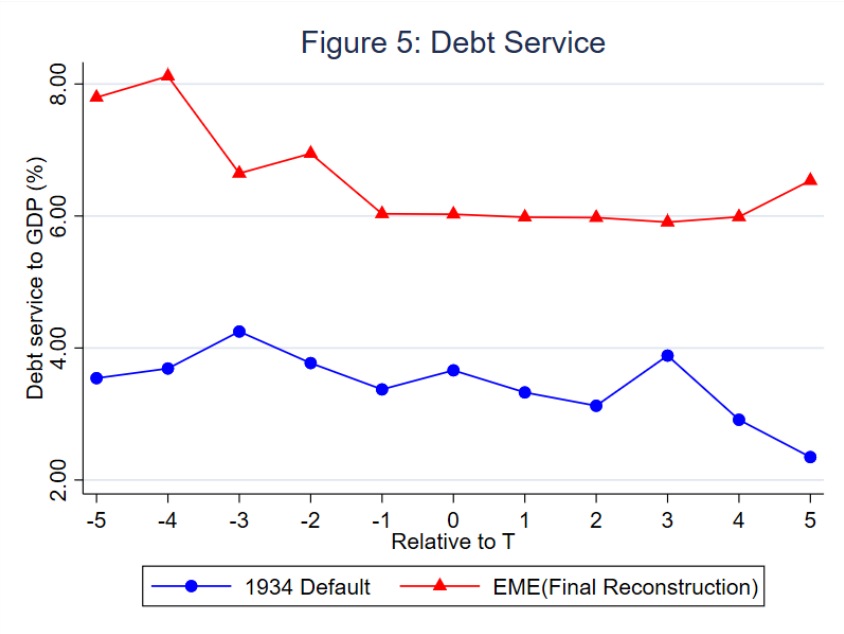


Figure: Total debt service to GDP around debt relief (EM 1978-2010 vs AE 1934).

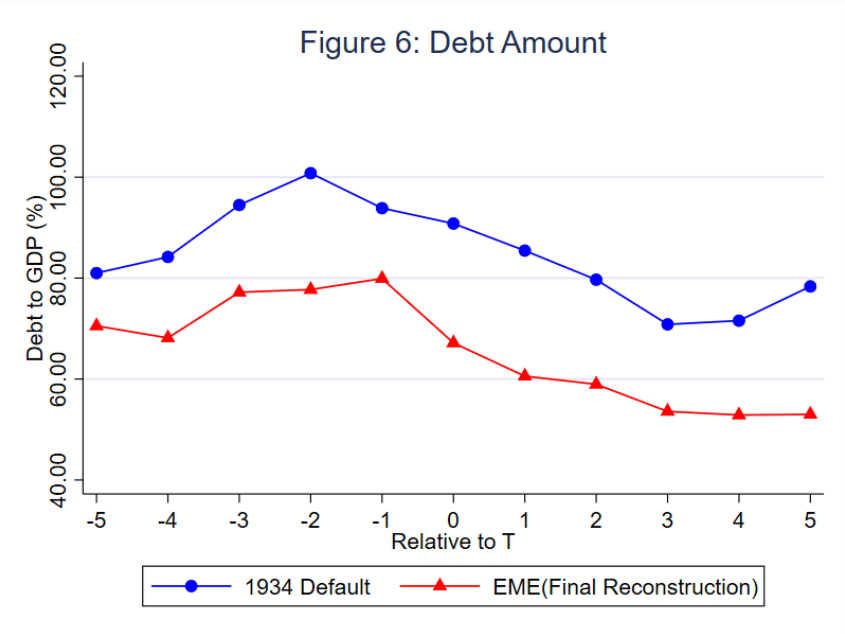


Figure: Debt to GDP around debt relief (EM 1978-2010 vs AE 1934).

DID Analysis: Context - Hoover Moratorium 1931

- Brady target group: Various EMs (Argentina, Brazil, etc.).
- Baker sample: Similar to Brady, and Chile.
- Baseline counterfactual: Middle/high-income non-defaulters (China, Colombia, etc.).

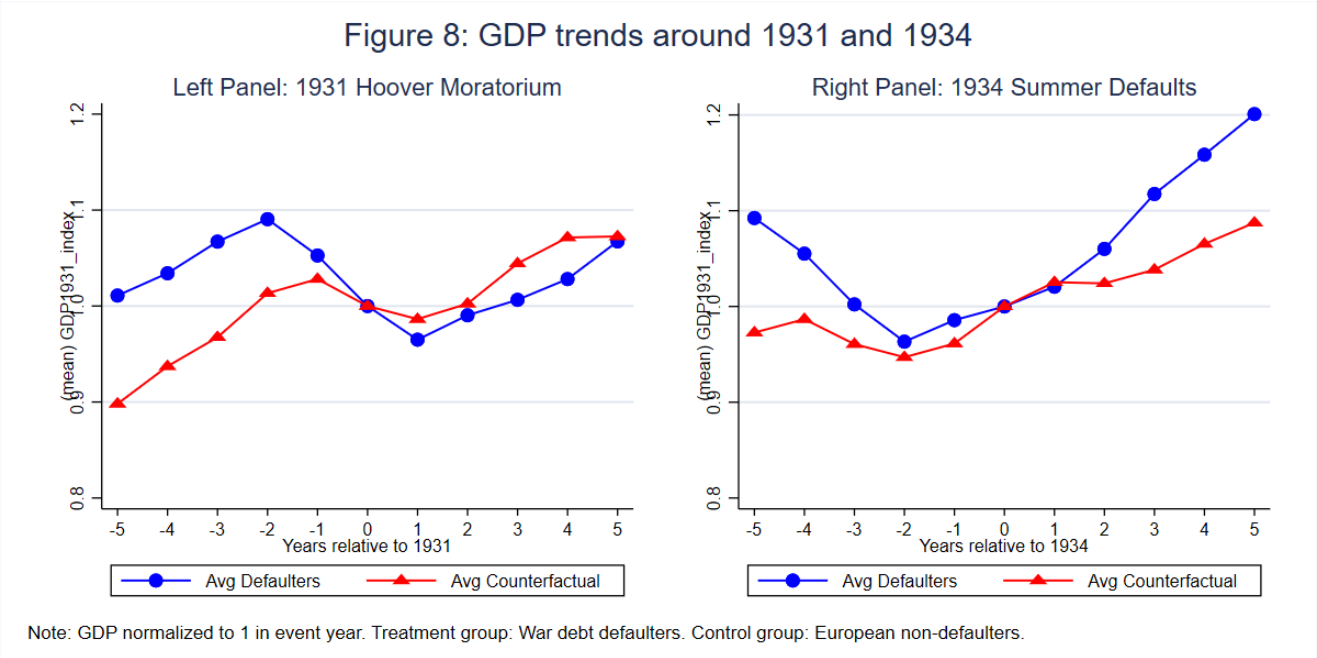
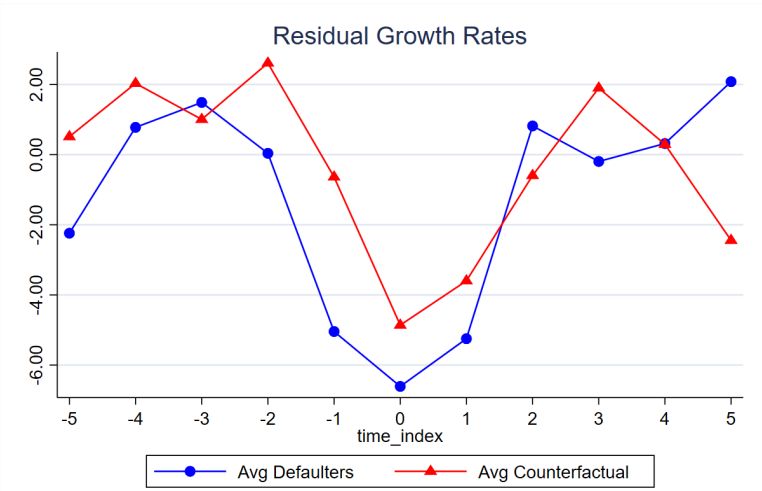
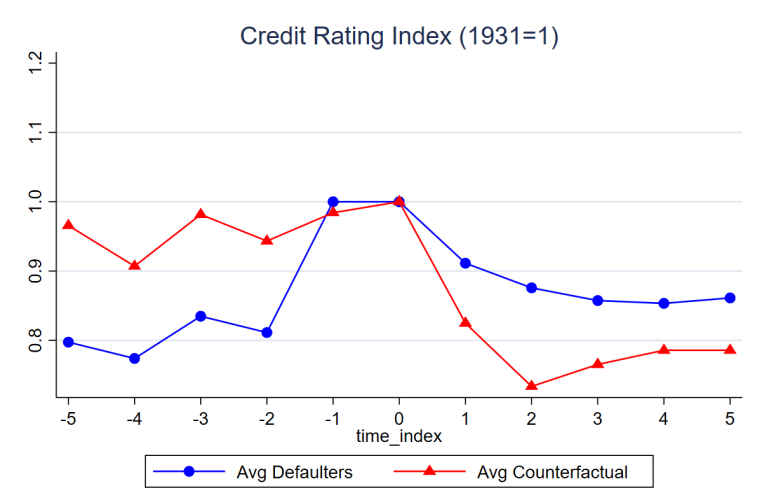
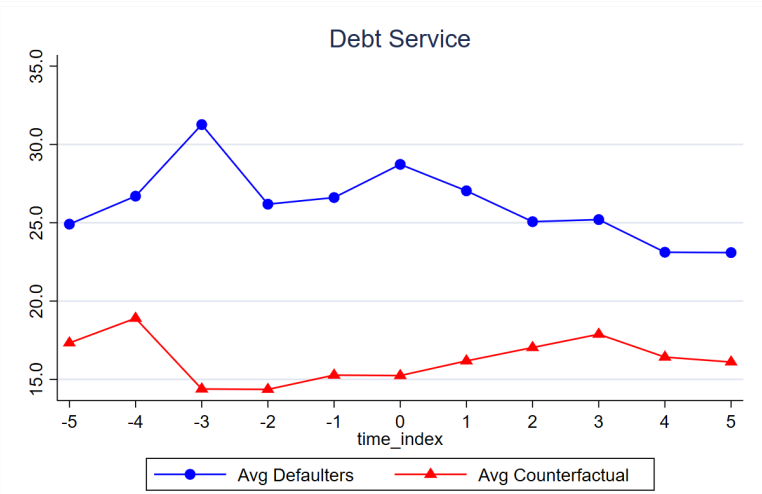


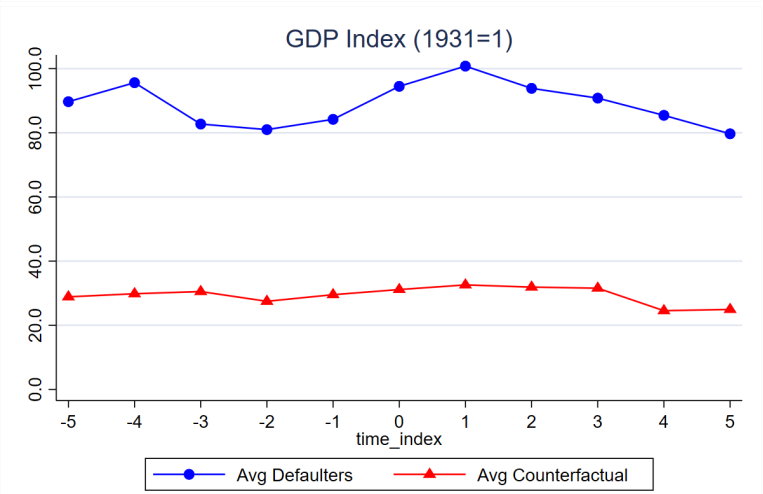
Figure: GDP trends around 1931 and 1934.

Economic Indicators: Treatment vs. Control (Europe Non-Defaulters)







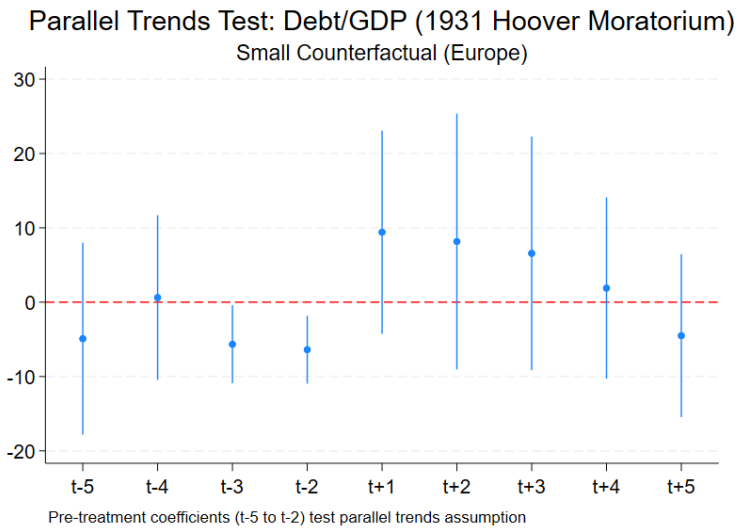


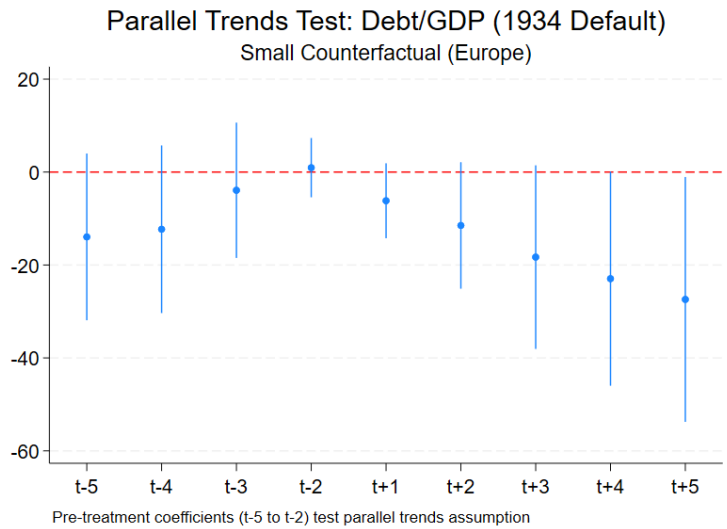
Summary for 1931: Treatment group growth worse. Residual growth declines for both, recovers, no better performance for treatment. Ratings decline across board. Debt/GDP no significant difference. Debt servicing improves more for treatment.

Parallel Trend Test (Self-Conducted)

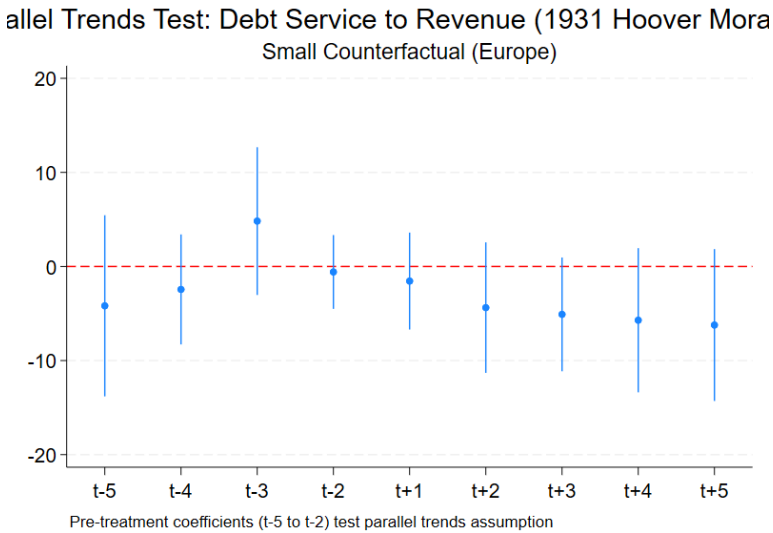
We conducted parallel trend tests since the original paper only performed descriptive analysis.

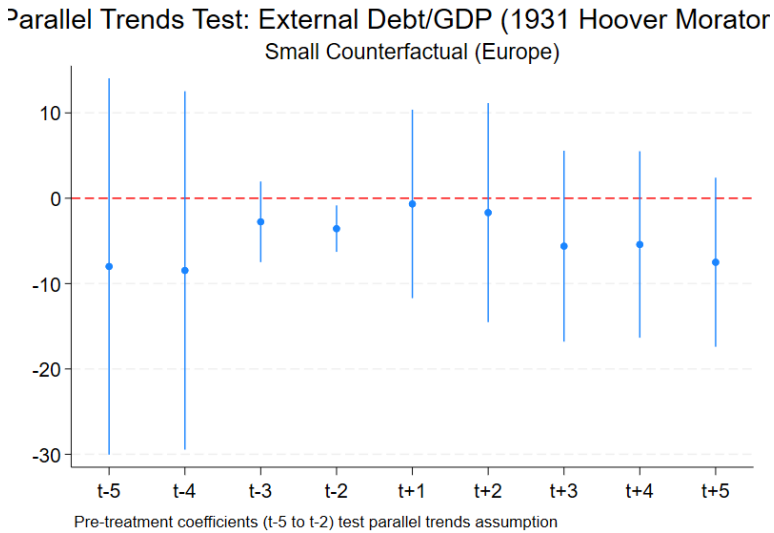
- **Key Findings**:
  - Most variables passed the parallel trend assumption.
  - Interpret with caution for:
    - Credit rating results for 1934.
    - Debt/GDP ratio and external debt/GDP ratio results for 1931.

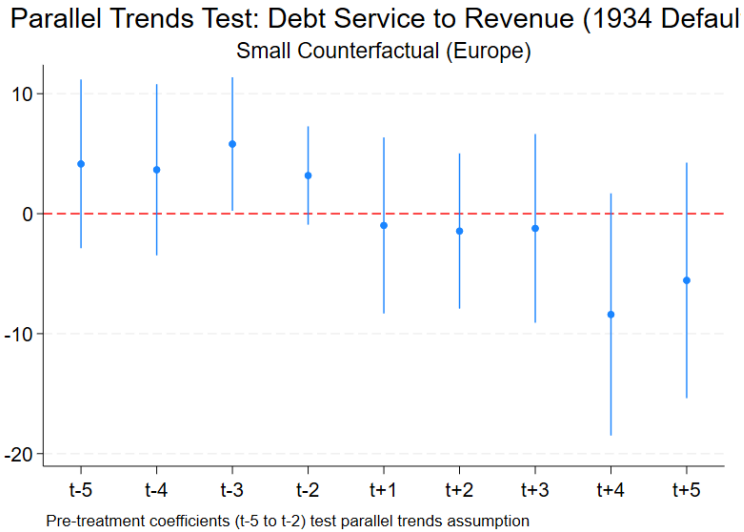


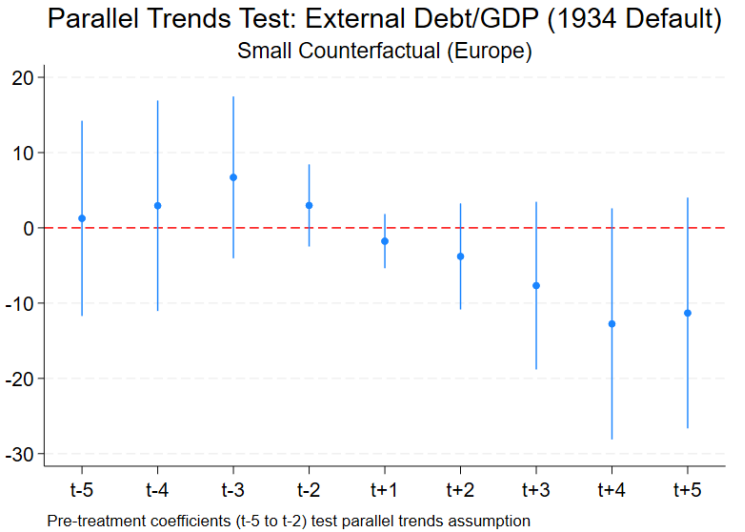


Parallel Trend Test (Cont'd)

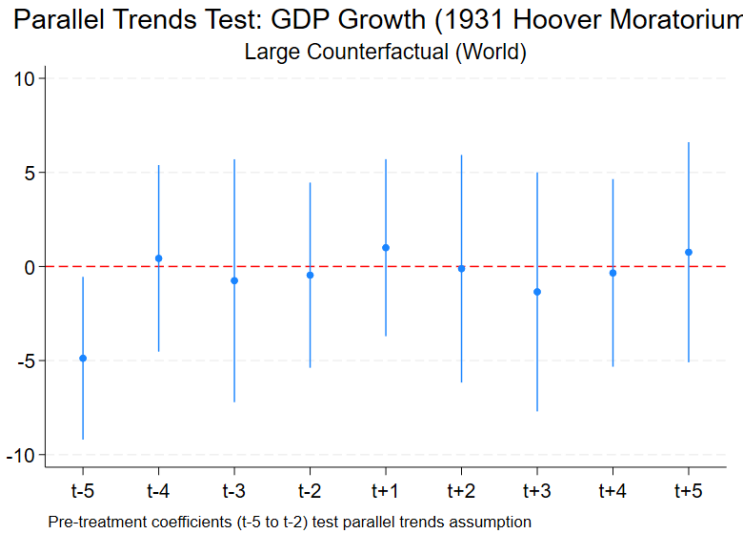


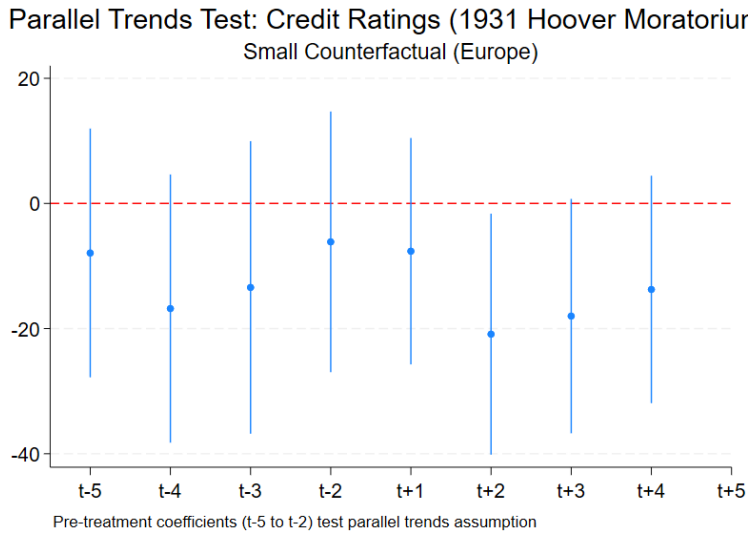


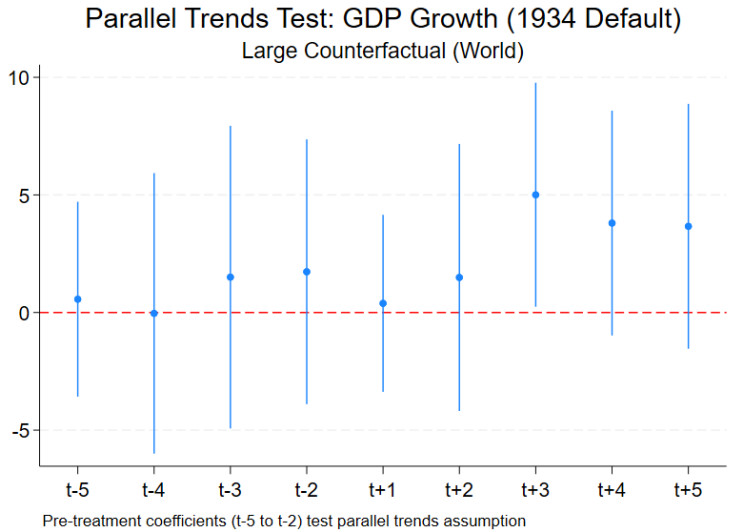


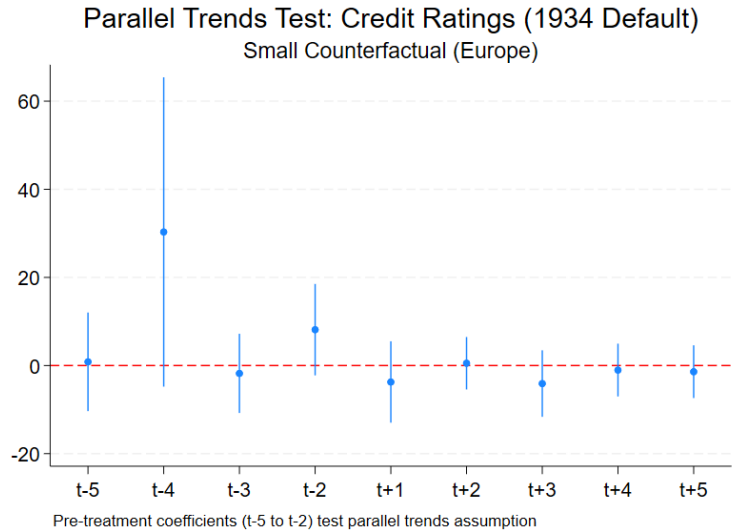


Parallel Trend Test (Cont'd)









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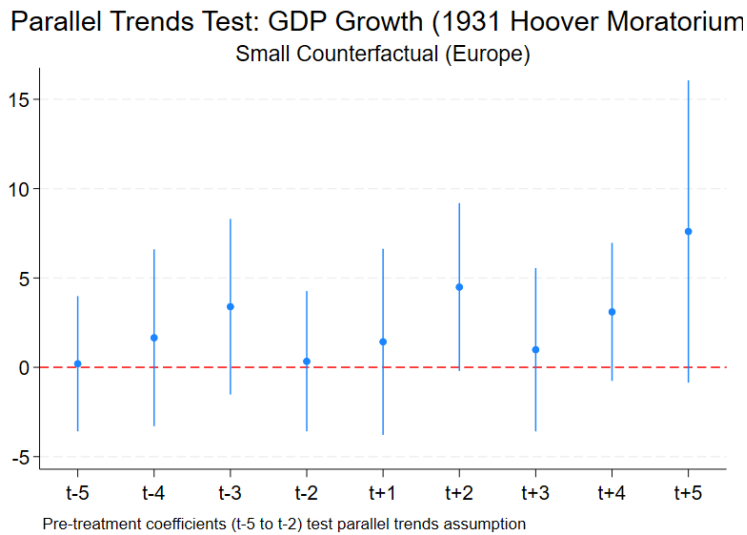
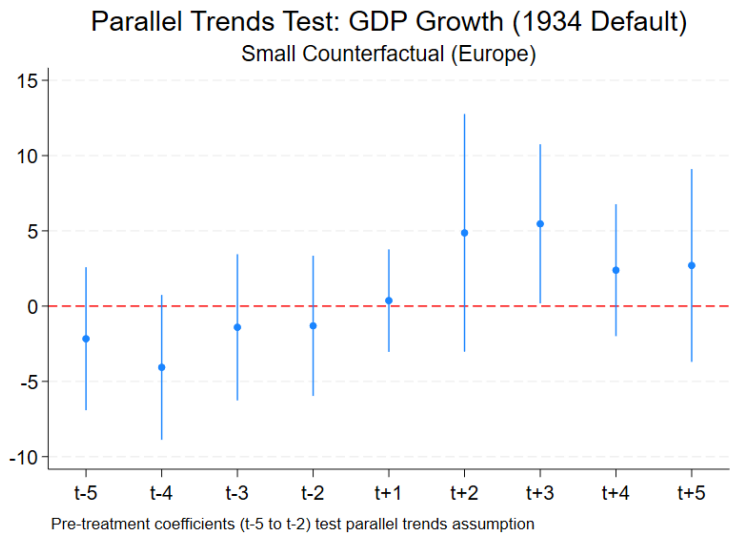




War period: PT Test

Variable	P-Value	Pass (5%)	Pass (10%)
GDP_Growth_1934_l	0.52529567	1	1
GDP_Growth_1934_e	0.94559858	1	1
Ratings_1934	0.04996219	0	0
DebtServ_1934_l	0.13978740	1	1
DebtServ_1934_e	0.51155188	1	1
Debt_GDP_1934_l	0.12776463	1	1
Debt_GDP_1934_e	0.25006164	1	1
ExtDebt_1934	0.06999843	1	0
GDP_Growth_1931_l	0.57373095	1	1
GDP_Growth_1931_e	0.23592213	1	1
Ratings_1931	0.41062027	1	1
DebtServ_1931_l	0.28772333	1	1
DebtServ_1931_e	0.39504800	1	1
Debt_GDP_1931_l	0.01403155	0	0
Debt_GDP_1931_e	0.07416818	1	0

Table 3 1931 Hoover Replication

Table 4.2: Table 3: 1931 Hoover Moratorium - Difference-in-Difference Analysis

	(1) Growth, real p.c. Small (Europe)	(2) Growth, real p.c. Large (World)	(3) Credit Ratings (change) Small (Europe)	(4) Debt Service to Revenue Small (Europe)	(5) Debt Service to Revenue Large (World)	(6) Total Public Debt/GDP Small (Europe)	(7) Total Public Debt/GDP Large (World)	(8) External Debt/GDP Small (Europe)
Post-intervention dummy (after 1931)	4.922**	8.329***	3.752	−1.064	−3.882**	−10.011*	−7.900*	−9.086**
	(2.335)	(1.724)	(3.377)	(1.880)	(1.854)	(4.854)	(4.240)	(3.687)
Treatment (war debt moratorium) × post-intervention dummy	2.598*	0.862	−5.655	−4.310*	−3.390	7.312	3.822	−0.508
	(1.360)	(1.333)	(4.202)	(2.392)	(2.335)	(6.936)	(6.899)	(5.610)
Constant	−4.072***	−4.489***	0.906	24.360***	23.973***	69.849***	61.471***	32.183***
	(0.839)	(1.160)	(2.058)	(1.215)	(0.990)	(1.872)	(1.695)	(2.174)
Observations	237	373	230	223	326	172	248	167
Adjusted R^2	0.237	0.206	0.185	0.043	0.062	0.166	0.199	0.007

Notes: This table reports difference-in-difference estimates of the effect of the 1931 Hoover Moratorium on various economic outcomes. Treatment group consists of 18 countries that received war debt relief. Small counterfactual includes European non-defaulters; Large counterfactual adds Latin American and other countries. All regressions include country and year fixed effects. Standard errors clustered at country level in parentheses. * p<0.10, ** p<0.05, *** p<0.01

Figure: Table 3: Replication of 1931 Hoover Moratorium Results

Comparison: Published vs. Replicated Results

TABLE 3. 1931 Hoover Moratorium: DiD regressions.

Dependent variable	Growth, real p.c.	Growth, real p.c.	Credit Ratings (change)	Debt Service to Revenue	Debt Service to Revenue	Total Public Debt/GDP	Total Public Debt/GDP	External Debt/GDP
Counterfactual	Small (Europe)	Large (World)	Small (Europe)	Small (Europe)	Large (World)	Small (Europe)	Large (World)	Small (Europe)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post-intervention dummy (after 1931)	0.03	0.82	2.19	−0.00	3.75	4.54	6.16*	−0.70
	(1.27)	(1.55)	(2.05)	(1.62)	(3.38)	(2.70)	(3.23)	(4.21)
Treatment (moratorium) × post-intervention dummy	2.60*	0.86	−4.31*	−3.39	−5.65	7.31	3.82	−0.51
	(1.36)	(1.33)	(2.39)	(2.34)	(4.20)	(6.94)	(6.90)	(5.61)
Constant	0.55	3.03**	21.11***	20.09***	0.91	65.22***	50.21***	23.80***
	(0.78)	(1.12)	(1.68)	(1.20)	(2.06)	(3.41)	(3.00)	(4.93)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	237	373	223	326	230	172	248	167
Countries	22	35	23	21	31	18	27	16
Adjusted R^2	0.237	0.206	0.043	0.062	0.185	0.166	0.199	0.007

Notes: The table shows results from a DiD fixed effects panel regression as in equation (1). All specifications include country and year fixed effects. The dependent variable in columns (1) and (2) are annual real growth rates based on the Maddison data set; column (3) shows credit ratings (yoy changes in %) using Moody's ratings and transforming these to a numerical scale from 0 (lowest) to 9 (highest, Aaa); columns (4) and (5) give external debt service to government revenue from various sources (see Online Appendix C); columns (6) and (7) are total public debt to GDP from Abbas et al. (2010); and column (8) is external debt to GDP from Reinhart and Rogoff (2009, 2011). Robust standard errors clustered on the country level in parentheses.
***Significant at 1%; **significant at 5%; *significant at 10%.

- **Key Observation**: Substantial differences in coefficient magnitudes and significance levels
- **Implication**: Results interpretation and economic conclusions may need revision

Major Discrepancies in Table 3 Results

- **Column Order Issue**:
  - Original Table 3 columns (3), (4), (5) appear to be in wrong order
  - Correct data order should be: (5), (3), (4)
  - This affects interpretation of debt service and debt level results
- **Post-intervention Dummy Coefficients**:
  - Our replicated "after 1931" coefficients differ substantially from published results
  - Issue persists even when dropping year fixed effects
  - Authors' original code produces same results as our replication, not published table
- **Statistical Significance Mismatch**:
  - Authors claim: "Only β_2 coefficients marginally significant are GDP and credit ratings"
  - Our results: Only credit ratings and debt service to revenue are *insignificant*
  - This is a fundamental contradiction in interpretation

Column 4 Detailed Analysis

```
. xtreg interrating_growth after1931 after_Hoover _Iyear_* if DiD1931_5year==1 & WarSmallSample==1, fe cluster(codeid)
note: _Iyear_1920 omitted because of collinearity.
note: _Iyear_1921 omitted because of collinearity.
note: _Iyear_1922 omitted because of collinearity.
note: _Iyear_1923 omitted because of collinearity.
note: _Iyear_1924 omitted because of collinearity.
note: _Iyear_1925 omitted because of collinearity.
note: _Iyear_1926 omitted because of collinearity.
note: _Iyear_1931 omitted because of collinearity.
note: _Iyear_1936 omitted because of collinearity.
note: _Iyear_1937 omitted because of collinearity.
note: _Iyear_1938 omitted because of collinearity.
note: _Iyear_1939 omitted because of collinearity.
note: _Iyear_1940 omitted because of collinearity.

Fixed-effects (within) regression               Number of obs      =       230
Group variable: codeid                          Number of groups   =        23

R-squared:                                      Obs per group:
     Within  = 0.2209                                         min =        10
     Between = 0.1260                                         avg =      10.0
     Overall = 0.1927                                         max =        10

                                                F(10, 22)          =      6.19
corr(u_i, Xb) = -0.0685                         Prob > F           =    0.0002

                                    (Std. err. adjusted for 23 clusters in codeid)
------------------------------------------------------------------------------
             |               Robust
interratin~h | Coefficient  std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
   after1931 |   3.752489   3.376874     1.11   0.278    -3.250719    10.7557
after_Hoover |   -5.65462    4.20233    -1.35   0.192    -14.36972    3.060479
------------------------------------------------------------------------------
```

Figure: Table 3 Col 3 (Our Replication)

```
. xtreg debtservRevenue_interwar after1931 after_Hoover _Iyear_* if DiD1931_5year==1 & WarSmallSample==1, fe cluster(codeid)
note: _Iyear_1920 omitted because of collinearity.
note: _Iyear_1921 omitted because of collinearity.
note: _Iyear_1922 omitted because of collinearity.
note: _Iyear_1923 omitted because of collinearity.
note: _Iyear_1924 omitted because of collinearity.
note: _Iyear_1925 omitted because of collinearity.
note: _Iyear_1931 omitted because of collinearity.
note: _Iyear_1936 omitted because of collinearity.
note: _Iyear_1937 omitted because of collinearity.
note: _Iyear_1938 omitted because of collinearity.
note: _Iyear_1939 omitted because of collinearity.
note: _Iyear_1940 omitted because of collinearity.

Fixed-effects (within) regression               Number of obs      =       223
Group variable: codeid                          Number of groups   =        21

R-squared:                                      Obs per group:
     Within  = 0.0906                                         min =         8
     Between = 0.1048                                         avg =      10.6
     Overall = 0.0021                                         max =        11

                                                F(11, 20)          =      3.88
corr(u_i, Xb) = -0.1703                         Prob > F           =    0.0042

                                    (Std. err. adjusted for 21 clusters in codeid)
------------------------------------------------------------------------------
             |               Robust
debtservRe~r | Coefficient  std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
   after1931 |  -1.064489   1.880416    -0.57   0.578    -4.986969    2.857991
after_Hoover |  -4.310318   2.392076    -1.80   0.087      -9.3001    .6794647
------------------------------------------------------------------------------
```

Figure: Table 3 Col 4 (Our Replication)

- **Critical Finding**: Running authors' *original code* reproduces our results, not the published table
- **Methodological Concern**: Suggests potential data processing or reporting errors in original paper
- **Research Integrity**: Highlights importance of code and data transparency in replication studies

Impact on Economic Interpretation

Original Paper Claims vs. Our Findings:

- **Authors' Interpretation**:
  - Limited significant effects from 1931 moratorium
  - Only GDP growth and credit ratings show marginal significance
- **Our Replication Findings**:
  - Broader pattern of significant effects
  - Multiple debt-related variables show statistical significance
  - Suggests more substantial impact of 1931 intervention than originally concluded
- **Research Implications**:
  - Calls into question the paper's conclusions about 1931 vs. 1934 effectiveness
  - Emphasizes need for **robust replication practices** in economic history

Results of DID: 1934 Debt Relief Replication

Table 4.3: Table 4: 1934 Summer Defaults - Difference-in-Difference Analysis

	(1) Growth, real p.c. Small (Europe)	(2) Growth, real p.c. Large (World)	(3) Credit Ratings (change) Small (Europe)	(4) Debt Service to Revenue Small (Europe)	(5) Debt Service to Revenue Large (World)	(6) Total Public Debt/GDP Small (Europe)	(7) Total Public Debt/GDP Large (World)	(8) External Debt/GDP Small (Europe)
Post-intervention dummy (after 1934)	−1.905	−0.772	4.527*	−4.284	−5.094***	−9.030	−9.602**	−3.487
	(1.320)	(1.398)	(2.601)	(2.789)	(1.837)	(5.566)	(4.246)	(3.260)
Treatment (debt relief) × post-intervention dummy	4.658***	2.208*	−8.182***	−6.025*	−2.744	−12.206**	−7.932	−9.512**
	(1.437)	(1.245)	(2.664)	(2.989)	(2.926)	(5.666)	(6.180)	(3.835)
Constant	2.399***	3.148***	0.247	23.094***	21.260***	69.716***	59.571***	25.866***
	(0.643)	(1.056)	(2.176)	(0.950)	(0.786)	(3.166)	(2.382)	(1.746)
Observations	237	378	249	216	324	175	258	162
Adjusted R^2	0.270	0.226	0.199	0.167	0.153	0.283	0.243	0.342

Notes: This table reports difference-in-difference estimates of the effect of the 1934 summer debt defaults on various economic outcomes. Treatment group consists of 18 countries that defaulted on war debt. Small counterfactual includes European non-defaulters; Large counterfactual adds Latin American and other countries. All regressions include country and year fixed effects. Standard errors clustered at country level in parentheses. * p<0.10, ** p<0.05, *** p<0.01

Figure: Replication of 1934 Debt Relief Results

Results of DID: 1934 Debt Relief Replication

TABLE 4. 1934 Default/relief: DiD regressions.

Dependent variable	Growth, real p.c.	Growth, real p.c.	Credit Ratings (change)	Debt Service to Revenue	Debt Service to Revenue	Total Public Debt/GDP	Total Public Debt/GDP	External Debt/GDP
Counterfactual	Small (Europe)	Large (World)	Small (Europe)	Small (Europe)	Large (World)	Small (Europe)	Large (World)	Small (Europe)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post-intervention dummy (after 1934)	−1.91	−0.39	−4.28	−5.09***	4.53*	−9.03	0.29	−3.49
	(1.32)	(1.07)	(2.79)	(1.84)	(2.60)	(5.57)	(2.47)	(3.26)
Treatment (debt relief) × post-intervention dummy	4.66***	2.21*	−6.03*	−2.74	−8.18***	−12.21**	−7.93	−9.51**
	(1.44)	(1.24)	(2.99)	(2.93)	(2.66)	(5.67)	(6.18)	(3.83)
Constant	2.40***	2.77***	23.09***	21.26***	0.25	69.72***	59.57***	25.87***
	(0.64)	(0.76)	(0.95)	(0.79)	(2.18)	(3.17)	(2.38)	(1.75)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	237	378	216	324	249	175	258	162
Countries	22	35	23	21	31	18	27	16
Adjusted R^2	0.270	0.226	0.167	0.153	0.199	0.283	0.243	0.342

Notes: The table shows results from a DiD fixed effects panel regression as in equation (1). All specifications include country and year fixed effects. The dependent variable in columns (1) and (2) are annual real growth rates based on the Maddison data set; column (3) shows credit ratings (yoy changes in %) using Moody's ratings and transforming these to a numerical scale from 0 (lowest) to 9 (highest, Aaa); columns (4) and (5) show external debt service to government revenue from various sources (see Appendix C); columns (6) and (7) show total public debt to GDP from Abbas et al. (2010); and column (8) shows external debt to GDP from Reinhart and Rogoff (2009, 2011). Robust standard errors clustered on the country level in parentheses.
***Significant at 1%; **significant at 5%; *significant at 10%.

Figure: 1934 Debt Relief Results

Major Discrepancies in Table 4 Results

- **Column Order Issue**:
  - Original Table 3 columns (3), (4), (5) appear to be in wrong order
  - Correct data order should be: (5), (3), (4)
  - This affects interpretation of debt service result

Results of DID: 1934 Debt Relief Robustness Check

Specification	Treatment Effect	Std. Error	Observations	Adjusted R^2
Baseline	4.658^{***}	(1.437)	237	0.270
No Year FE	4.667^{***}	(1.392)	237	0.135
3-Year Window	4.002^{*}	(2.013)	132	0.186
4-Year Window	3.952^{**}	(1.845)	175	0.272
6-Year Window	4.658^{***}	(1.437)	237	0.270
Placebo 1933	—	—	218	—
Excl. Treat Year	4.625^{***}	(1.533)	215	0.265
With Inflation	4.405^{**}	(1.873)	170	0.275
With Crises	4.437^{**}	(1.556)	217	0.295
With Wars	5.448^{***}	(1.619)	215	0.249

Results of DID: 1934 Debt Relief Robustness Check

Specification	Treatment Effect	Std. Error	Observations	Adjusted R^2
With Politics	3.933^{**}	(1.684)	215	0.281
No East Europe	3.921^{**}	(1.607)	187	0.271
Europe Only	4.553^{***}	(1.583)	215	0.245
No Germany	4.440^{***}	(1.487)	226	0.261
No Aus/NZ	4.553^{***}	(1.583)	215	0.246
No Large Relief	5.192^{***}	(1.639)	204	0.261
No Small Relief	4.203^{**}	(1.543)	204	0.281
No Best GDP	3.577^{**}	(1.473)	204	0.244
No Worst GDP	5.872^{***}	(1.412)	204	0.199

Notes: This table presents robustness checks for the main result on the effect of the 1934 summer defaults on real per capita GDP growth. The baseline specification includes country and year fixed effects with standard errors clustered at the country level. Row (1) replicates the main result from Table 4. Rows (2)-(19) show results under various alternative specifications and sample restrictions. Treatment effect measures the impact of war debt default on GDP growth in the post-1934 period. The placebo test (row 6) uses 1933 as the false treatment year and shows no significant effect. Standard errors in parentheses. Significance levels: * p<0.10, ** p<0.05, *** p<0.01

Results of DID: 1934 Debt Relief

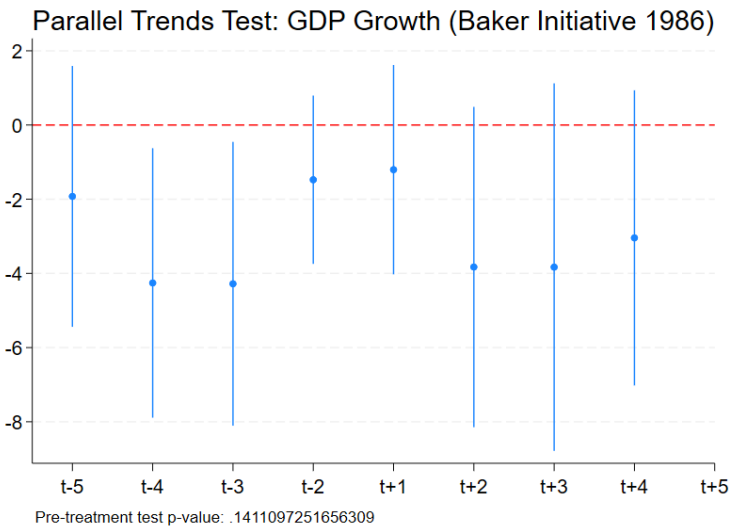
Key findings from Table 4 (DID estimates):

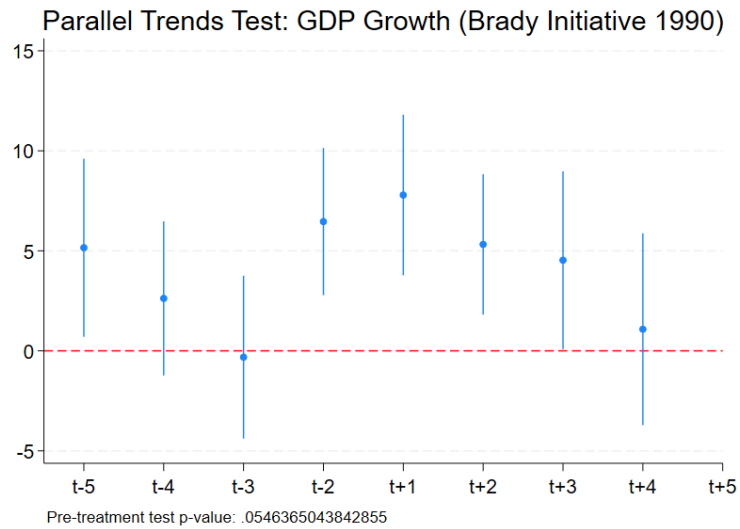
- **Real per capita growth**:
  - +4.7% higher for treated countries post-1934 (highly significant, vs. European non-defaulters).
  - Remains large and significant across various counterfactuals (sometimes at 10% level).
- **Debt levels**:
  - Decrease significantly (vs. European non-defaulters).
  - Turns insignificant with "World" counterfactual.
- **Debt servicing**:
  - Highly significant and large (improvement) (vs. European non-defaulters).
  - Becomes insignificant with “World” counterfactual.
- **Ratings**:
  - Significant negative coefficient.

Parallel Trend Test (Self-Conducted for EME)

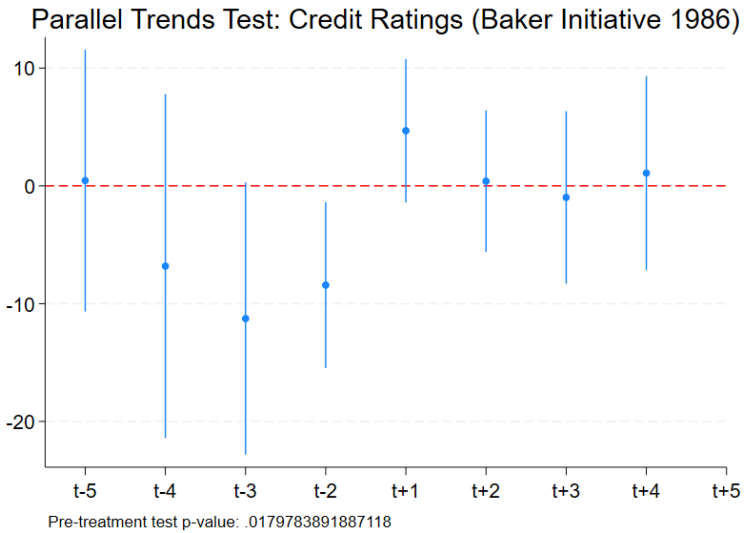
Authors didn't construct PT tests for Baker and Brady initiatives either, only descriptive analysis.

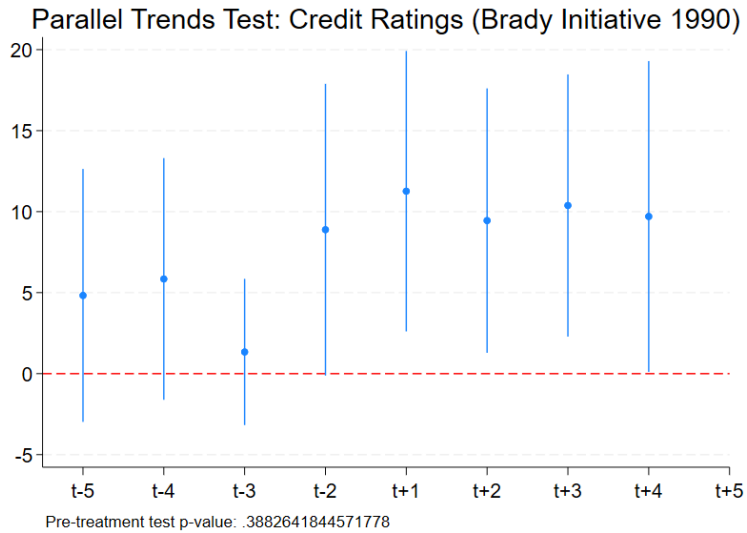
- **Key Findings**:
  - Most variables passed the parallel trend assumption.
  - Interpret with caution for Baker Policy:
    - Credit rating results.
    - Debt/GDP ratio results.

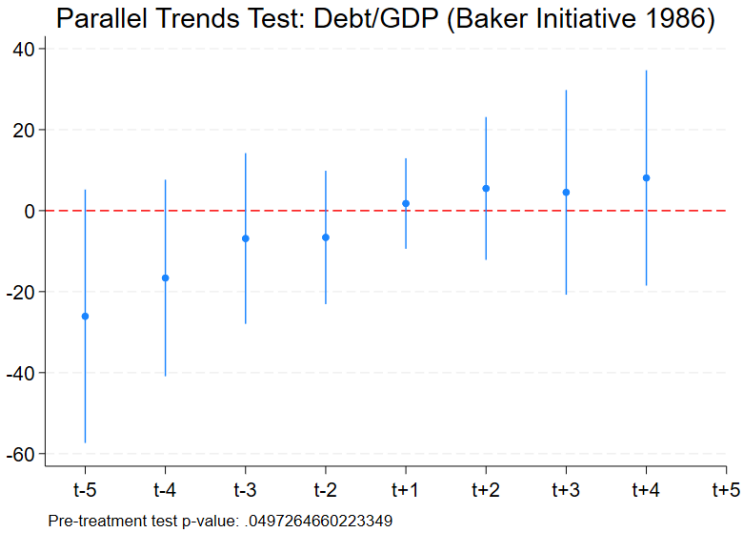


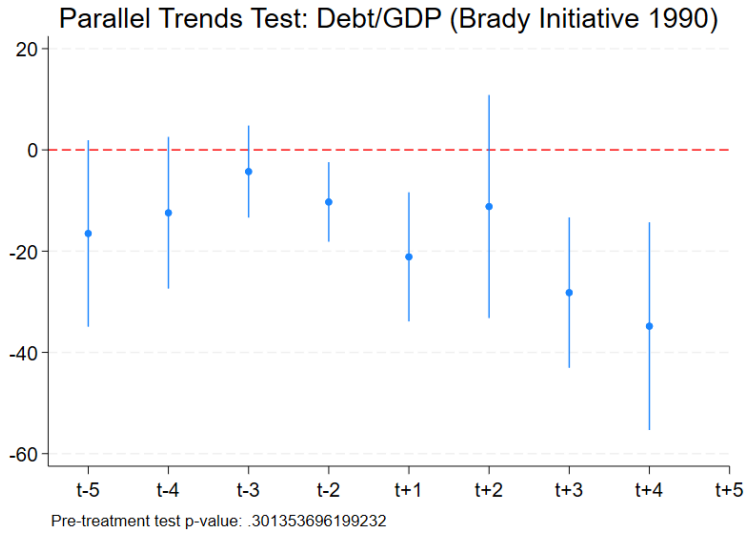


Parallel Trend Test (Cont'd)









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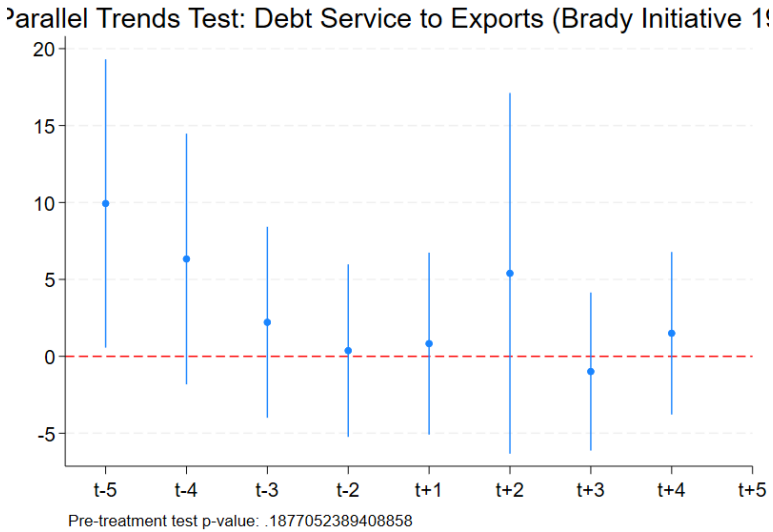
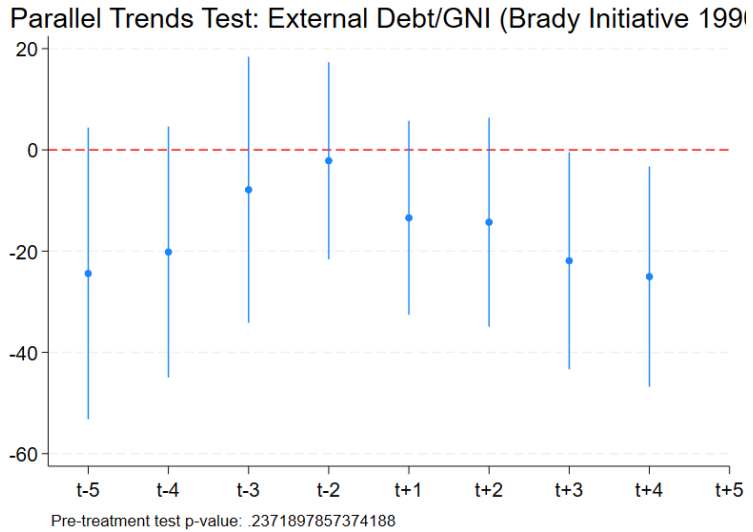
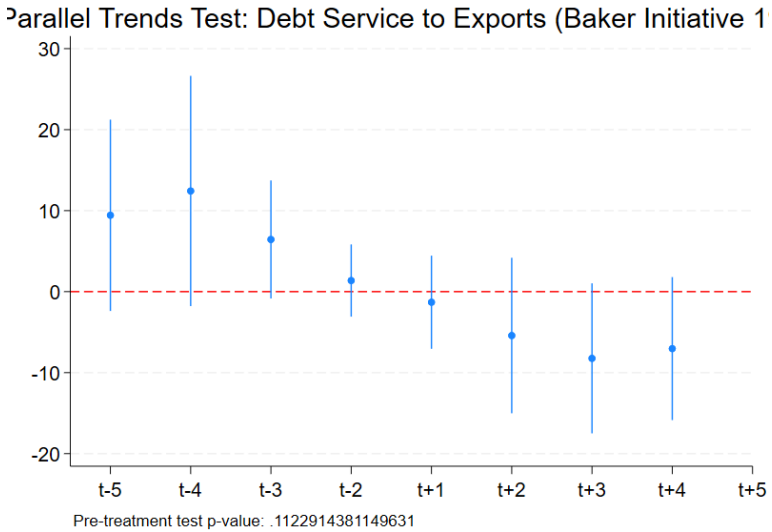
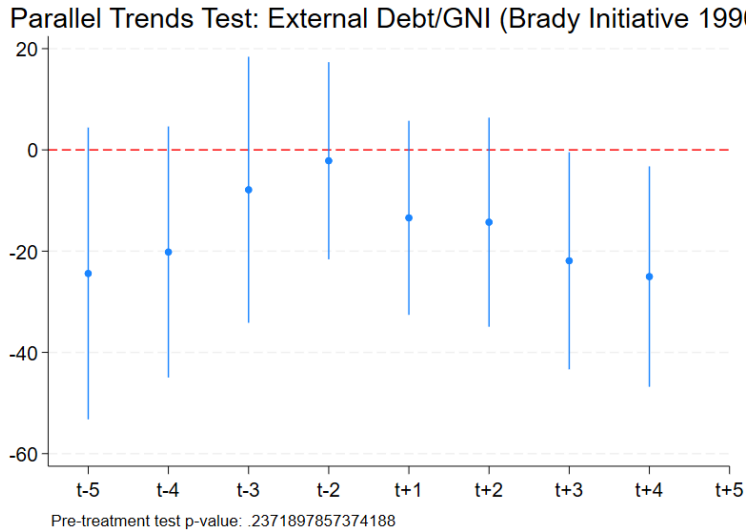








Brady Episode DID Results

	(1) Growth, real p.c.	(2) Credit Ratings (change)	(3) Debt Service to Exports	(4) Total Public Debt/GDP	(5) External Debt/GNI
Post-1986 dummy	−1.976	−5.968**	−5.758	−17.214**	−8.881
	(1.292)	(2.328)	(3.426)	(7.106)	(6.251)
Baker Treatment × Post-1986	−1.918	6.305*	−9.049*	22.988**	17.432
	(1.329)	(3.121)	(4.720)	(9.360)	(10.802)
Observations	275	279	189	226	199
Adjusted R^2	0.077	0.170	0.106	0.203	0.145

Baker Episode DID Results

TABLE 5. Baker initiative (1986): DiD regressions.

Dependent variable	Growth, real p.c. (1)	Credit Ratings (change) (2)	Debt Service to Exports (3)	Total Public Debt/GDP (4)	External Debt/GNI (5)
Post-intervention dummy (after 1986)	0.82	4.53	−5.76	−10.25	−8.88
	(1.26)	(3.16)	(3.43)	(10.20)	(6.25)
Treatment (Baker plan) × post-intervention dummy	−1.92	6.31*	−9.05*	22.99**	17.43
	(1.33)	(3.12)	(4.72)	(9.36)	(10.80)
Constant	2.55***	−8.88***	33.54***	65.26***	61.66***
	(0.65)	(2.53)	(1.72)	(4.59)	(2.35)
Country fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	275	279	189	226	199
Number of countries	28	28	19	26	20
Adjusted R^2	0.077	0.170	0.106	0.203	0.145

Table 4.5: Table 5: Baker Initiative (1986) - Difference-in-Difference Analysis

	(1) Growth, real p.c.	(2) Credit Ratings (change)	(3) Debt Service to Exports	(4) Total Public Debt/GDP	(5) External Debt/GNI
Post-1986 dummy	−1.976	−5.968**	−5.758	−17.214**	−8.881
	(1.292)	(2.328)	(3.426)	(7.106)	(6.251)
Baker Treatment × Post-1986	−1.918	6.305*	−9.049*	22.988**	17.432
	(1.329)	(3.121)	(4.720)	(9.360)	(10.802)
Observations	275	279	189	226	199
R-squared	0.111	0.200	0.154	0.238	0.189
Adjusted R^2	0.077	0.170	0.106	0.203	0.145

Notes: This table reports difference-in-difference estimates of the effect of the Baker Initiative on various economic outcomes. Treatment group consists of countries that received Baker Plan debt relief. All regressions include country and year fixed effects. Time window: 1981-1990 (5 years before and after 1986). Standard errors clustered at country level in parentheses. * p<0.10, ** p<0.05, *** p<0.01

Key findings from Table 5:

- **Output growth**: Negative and insignificant treatment coefficient.
- **Debt/GDP**: Continues to grow post-treatment.
- **Credit ratings**: Increase significantly more for Baker countries than counterfactual (window includes early Brady years).
- **Debt servicing**: Treatment coefficient negative and marginally significant (cash flow relief).

Brady Episode DID Results

	(1) Growth, real p.c.	(2) Credit Ratings (change)	(3) Debt Service to Exports	(4) Total Public Debt/GDP	(5) External Debt/GNI
Post-1990 dummy	1.207	5.061*	−1.884	−15.324**	−10.819
	(1.350)	(2.505)	(2.461)	(7.101)	(9.069)
Brady Treatment × Post-1990	3.094***	6.991**	−1.565	−14.514*	−1.821
	(1.046)	(3.095)	(3.542)	(7.377)	(10.677)
Observations	270	270	190	233	200
Adjusted R^2	0.099	0.213	0.259	0.242	0.041

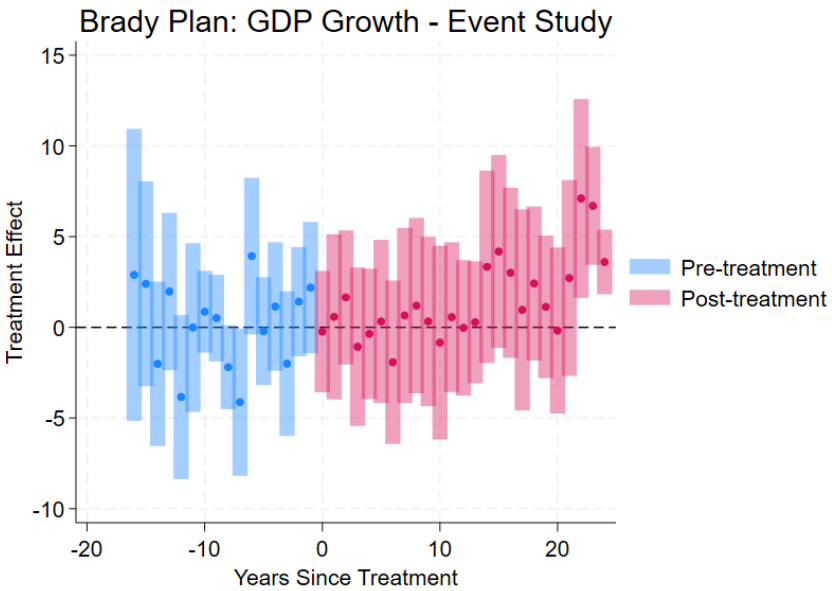
Emerging Markets: Brady Episode

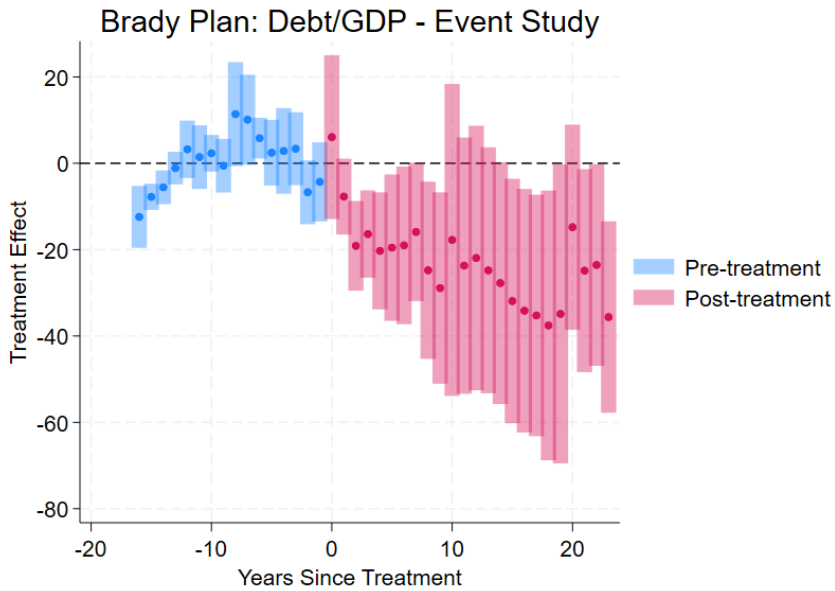
Key findings from Table 6 (compared to Baker):

- **Real per capita GDP growth**:
  - Treatment coefficient turns positive and highly significant.
  - Indicates ∼3 % higher growth for Brady countries vs. counterfactual.
  - Resembles 1934 episode.
- **Credit ratings**: Large improvement relative to counterfactual
- **Government debt levels**: Drop significantly more (by 15 %).
- **Debt servicing & Total external debt/GDP**: Surprisingly, no significant effect.
  - Possible reason: Actual Brady restructurings occurred with a lag in many countries.

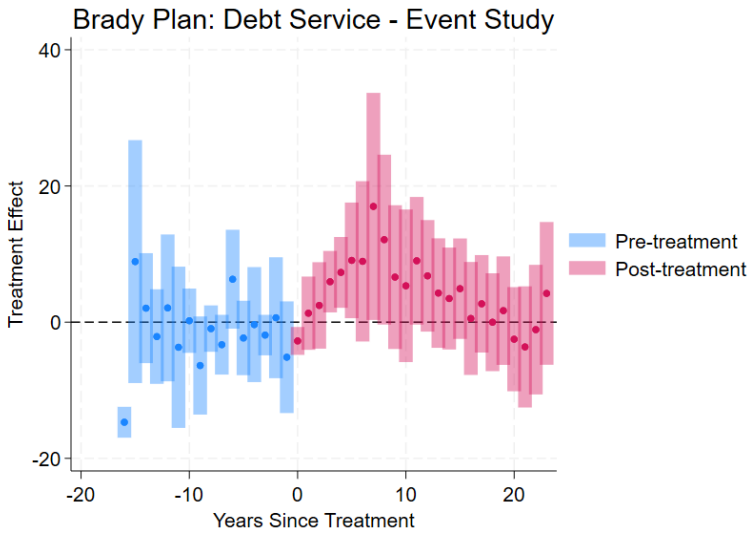
Staggered DID Analysis: Brady Plan Context

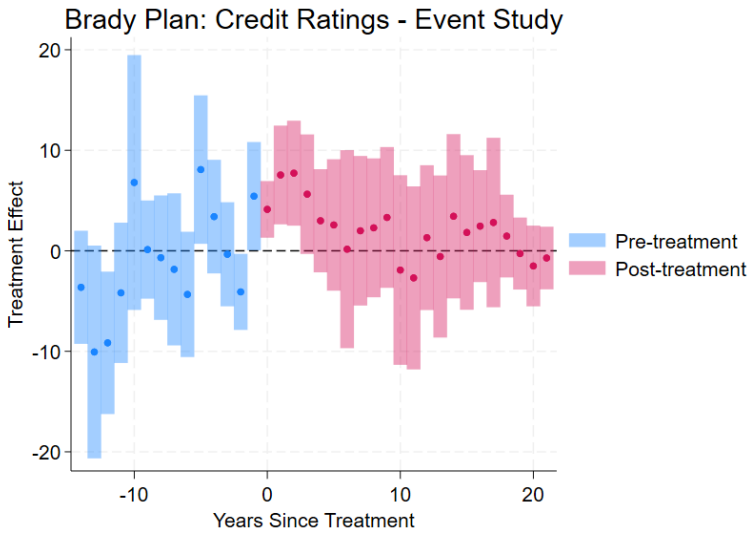
- **Motivation**: Brady Plan implemented in a staggered fashion (from Arslanalp and Henry (2005)).
- **Methodology**: Callaway-Sant'Anna (2021) staggered DID (CSDID) estimator.
  - Allows for heterogeneous and dynamic treatment effects.

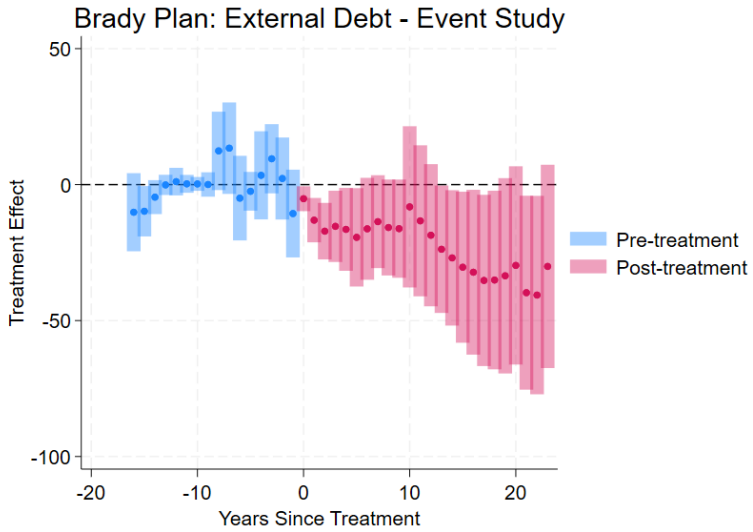




Staggered DID Analysis: Brady Plan Context







CSDID Results for Brady Plan

	(1) Growth, real p.c.	(2) Credit Ratings (change)	(3) Debt Service to Exports	(4) Total Public Debt/GDP	(5) External Debt/GNI
Average Treatment Effect on Treated (ATT)	1.005	2.331	5.047	-22.587^{**}	-20.799^{**}
	(1.923)	(2.494)	(3.299)	(9.722)	(9.550)
Treatment Countries	16	16	16	16	16
Control Countries	24	24	24	24	24

Notes: Average treatment effects on the treated (ATT) from Callaway-Sant'Anna (2021) staggered DID estimator. Treatment timing: 1989-1995. Control group: emerging markets that never implemented Brady agreements. Standard errors clustered

CSDID Results for Brady Plan (Summary)

Key findings

- **Real p.c. GDP growth**: $ATT = 1.005$ $(s.e. 1.923)$ $\rightarrow$ Small, insignificant.
- **Credit-rating upgrades**: $ATT = 2.331$ $(s.e. 2.494)$ $\rightarrow$ Imprecisely measured.
- **Debt-service to exports ratio**: $ATT = 5.047$ $(s.e. 3.299)$ $\rightarrow$ Rises, but insignificant (plausible due to front-loaded Brady bond coupons).
- **Public-debt burden (to GDP)**: $ATT = -22.587$ $(s.e. 9.722)$ $\rightarrow$ Statistically significant fall.
- **External indebtedness (to GNI)**: $ATT = -20.799$ $(s.e. 9.550)$ $\rightarrow$ Statistically significant fall.

Overall ATT from event study aggregation. Double stars (**) in report text indicate significance.

Staggered DID Analysis: Implications & Limitations

Methodological Strengths:

- CSDID avoids negative-weight bias of TWFE in staggered settings.
- Doubly robust inverse-probability weighting (DRIPW) enhances credibility.

Economic Implications:

- *Debt relief first, growth later*: Significant debt reduction, but immediate growth dividends limited.
- *Market sentiment lags policy action*: Ratings agencies reacted cautiously.
- *Policy design*: Future restructurings should pair with complementary reforms.

Limitations:

- Macro-shocks in early 1990s (e.g., Tequila crisis) may attenuate observed effects despite DID controls.

Conclusion

Summary of Replication Findings

This presentation summarized a detailed replication effort covering:

- **Econometric Models**:
  - Standard DID for analyzing debt relief events (1931, 1934, Baker, Brady).
  - Extended discussion on Staggered DID for events like the Brady Plan.
- **Empirical Replication**:
  - Sample definitions and time windows for war period and EME analysis.
  - Self-conducted Parallel Trend Tests for various episodes and samples.
  - DID results:
    - 1934: Positive growth effects, debt reduction (sensitive to counterfactual).
    - Baker: Limited positive impact, some cash flow relief.
    - Brady (standard DID): Positive growth, improved ratings, debt reduction.
  - Staggered DID for Brady: Significant debt reduction, but less clear immediate impact on growth or ratings in the short-term.

Thank You!