

ECON B225: ECONOMIC DEVELOPMENT

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Trade Liberalization

Theoretical Motivation

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- **Trade liberalization**
 - ▣ Policies that make trade easier between countries
- **Classic trade models (Ricardo, Heckscher-Ohlin, others)**
 - ▣ Countries, on net grow, from more free trade through efficiency gains as countries specialize in what they do well and trade with other countries for what they produce well
 - ▣ Implications for winners and losers in this process
 - Those participating in inefficient sector of the economy prior to liberalization lose from free trade and must transition into efficient sector (easier said than done)
- **Big policy push since the 80s and 90s for trade liberalization**
 - ▣ Part of structural adjustment programs in the 80s for poor countries

Policy History

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- **1948:** General Agreement on Tariffs and Trade (GATT)
- **1995:** World Trade Organization
 - ▣ Sets rules for trade policies countries must follow
 - ▣ Provides arbitration process for countries when disputes occur
 - ▣ Forum for negotiations
- **Various Years:** Regional Trade Agreements
 - ▣ **1957:** Treaty of Rome (European Economic Community)
 - ▣ **1993:** European Union formed
 - ▣ **1994:** North American Free Trade Agreement (NAFTA)

Trade as a Development Strategy

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□ Trade liberalization as a development strategy

□ Idea:

1. Poor country with no technological capacity has huge comparative advantage in unskilled labor $\Rightarrow$
2. Take advantage of comparative advantage in cheap labor to build domestic manufacturing $\Rightarrow$
3. Invest in human capital, technology, infrastructure $\Rightarrow$
4. Build capacity in sectors with no comparative advantage $\Rightarrow$
5. Eventually compete in high tech, high skilled sector (Now you are “developed”!)

Successful Case Studies

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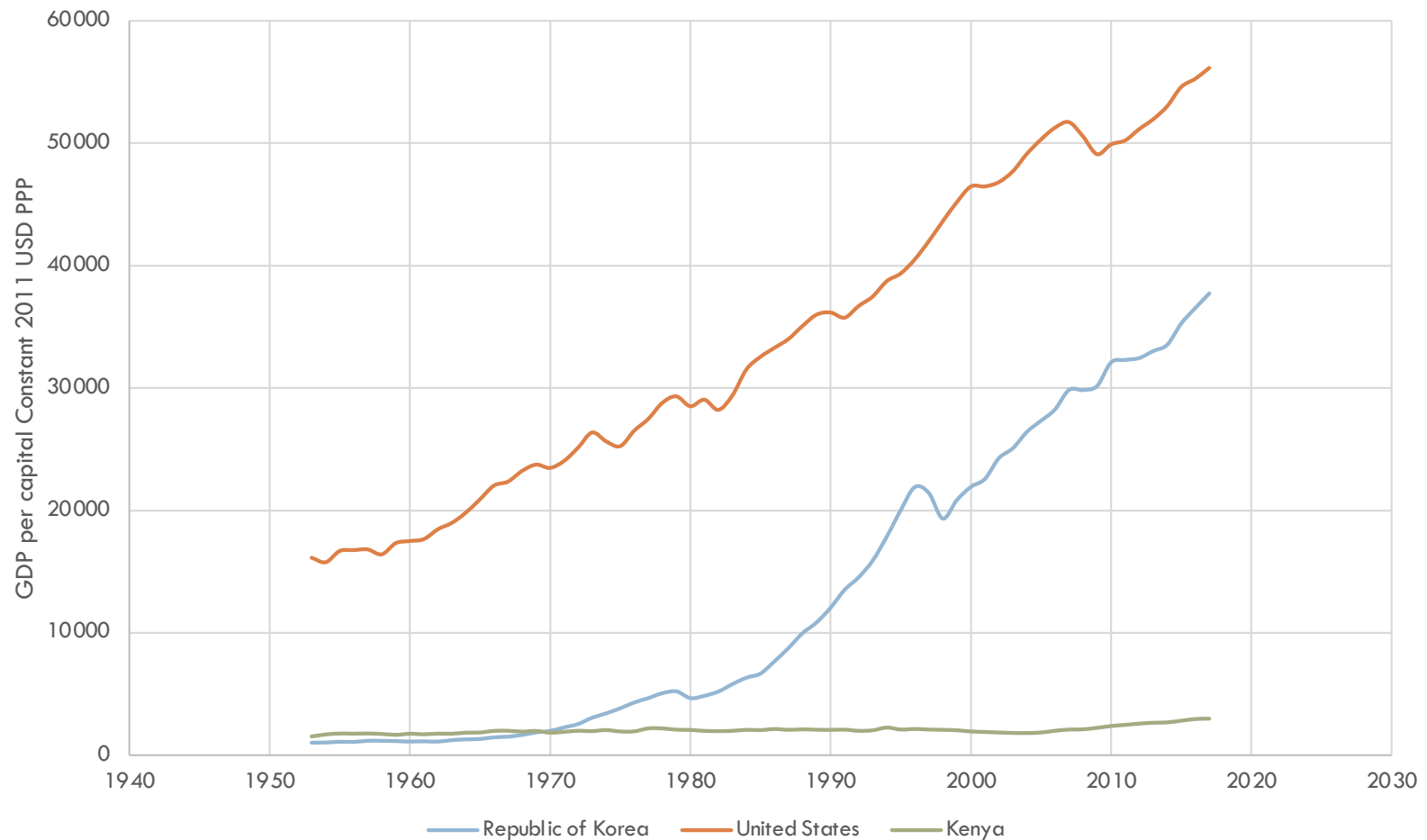
- **South Korea is the classic example**
 - ▣ Korean War ends in 1953 – South Korea one of poorest countries in the world.
 - ▣ 1960s government pursues export-led growth in cheap, labor-intensive products
 - Incentivizes domestic corporations to invest in technological capacity
 - Govt. invests in public projects and infrastructure
 - ▣ By 1990s South Korea has major companies capable of competing with US, European and Japanese firms in most technologically advanced sectors of the economy (Samsung, Hyundai, Daewoo, many others)
 - ▣ By 2000s Govt. limits its role in the economy. Economic structure resembles “developed” economy
- **Other countries following (or trying to follow) this path:**
 - ▣ Japan, Taiwan, Singapore, Malaysia, Indonesia, Vietnam, Rwanda, **China**

South Korea's Economic Performance

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Figure 1: GDP Per Capita PPP since 1953 (RoK, US, Kenya)

Data: Penn World Tables



Limitations of Case Studies

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- **South Korea seems pretty convincing, but...**
- **Many other poor countries have pursued trade liberalization since the 1980s**
 - ▣ Kenya itself liberalized in 1993 (Billmeier and Nannicini 2013)
- **Other reasons to explain South Korea's success:**
 - ▣ **Allies:** Important country in US Cold War strategy $\Rightarrow$ Large transfer of resources from US/favorable treatment
 - ▣ **Good neighborhood:** Close to important E. Asian trading partners: Japan, China, across an ocean from the US
 - ▣ **Good economic management:** Competent autocracy leads to peaceful transition to democratic system
- **Is trade liberalization the causal factor of this growth or does it just look this way due to simultaneity?**
 - ▣ Unclear from this simple case study

Billmeier and Nannicini (2013)

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- **Research Question:** Do trade liberalization policies affect economic growth, and if so how much?

Data

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- **Panel Data Structure**

- Each row is a country in a particular year

- **Outcome: GDP per capita**

- From IMF World Economic Outlook Database (similar to the WDI)

- **Controls: Common in growth literature**

- **Most from Penn World Tables**

- Secondary school enrollment (human capital proxy)
- Population growth (labor force)
- Inflation (economic stability)
- Investment
- Democracy

Data (cont.)

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- **Need to know whether a country liberalized or not**
 - ▣ From Sachs and Warner (1995) and Wacziarg and Welch (2003, 2008)
 - ▣ Country considered “closed” if any of the following are satisfied:
 - Average tariffs exceed 40%
 - Nontariff barriers cover more than 40% of imports
 - Has a “socialist” economic system
 - Black market premium on the exchange rate exceeds 20%, and
 - Many exports controlled by state monopolies.

Data Example

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Table 1: Example Data Excerpt from Billmeier and Nannicini (2013)

Country	Country ID	Year	GDP per capita PPP	Liberalized (=1 if yes, =0 if no)	Secondary School Enrollment	Inflation
Kenya	051	1953	1,307	0	.3	.02
Kenya	051	1954	1,465	0	.34	.02
Kenya	051	1955	1,503	0	.34	.01
Kenya	051	1956	1,496	0	.35	.03
Kenya	051	1957	1,657	0	.40	.04

Method: Synthetic Control Method (SCM)

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- **New econometric method. Not an OLS-related algorithm**
 - ▣ Relies on a parallel trends assumption to allow causal inference
- **Benefits:**
 - ▣ Provides neat graphs that allow for intuitive visual insights
 - ▣ Allows us to look at the effects of policies one country at a time, rather than the average across all countries
 - ▣ For those of you looking for original research projects: Easy to implement in R and Stata and low data requirements
 - (Penn World Tables are enough for a lot of SCM projects)

How Does SCM Work?

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- To estimate the effect of a policy change, we need to have a “counterfactual” for that country in the absence of the policy change in order to compare. RCTs use a control group. SCM takes a different approach
- **Idea:** A country that liberalizes can be approximated by a combination of other countries that didn’t liberalize
 - ▣ Look at GDP per capita and other controls, prior to liberalization like Kenya
 - Find a combination of countries that never liberalized whose GDP per capita, and control variables matches Kenya’s trend prior to liberalization most closely.

Synthetic Kenya

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- Uses weights ω for each non-treated unit d , such that $0 \leq \omega_d \leq 1$, and $\sum_{d=1}^D \omega_d = 1$
- The algorithm uses the data on the treated unit and untreated units in the pre-treatment period to determine the weights ω_d that solve the the following minimization problems for all time periods prior to treatment,

$$\begin{aligned} & \text{Min}_{\omega_1, \omega_2, \dots, \omega_D} \sum_{t=S}^K \left[Y_t - \sum_{d=1}^D \omega_d Y_{dt} \right], \text{ and} & \text{GDP per capita in} & \text{Kenya's GDP per capita in time t} \\ & & \text{non-treated} & \\ & & \text{country d in time t} & \\ & \text{Min}_{\omega_1, \omega_2, \dots, \omega_D} \sum_{t=S}^K \left[Z_t - \sum_{d=1}^D \omega_d Z_{dt} \right]. & & \end{aligned} \quad \begin{matrix} (1) \\ (2) \end{matrix}$$

Where S is the first time period in the data, K is the time period when treatment occurred, Y_t is an outcome of interest and Z_t are important determinants of the outcome.

- It then uses the weights and post-treatment covariates in the non-treated synthetic control group to project the trend for the synthetic unit in the post-treatment period

How Does SCM Work?

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- **Idea:** A country that liberalizes can be approximated by a combination of other countries that didn't liberalize
 - ▣ Look at GDP per capita and other controls, prior to liberalization like Kenya
 - Find a combination of countries that never liberalized whose GDP per capita, and control variables matches Kenya's trend prior to liberalization most closely.
 - This forms a “**synthetic Kenya**” – A unit of observation that behaves like Kenya in its GDP per capita measure and its controls, BUT unlike the real Kenya, it never went through trade liberalization
 - We then compare Kenya (who went through liberalization) to the synthetic Kenya (who didn't go through liberalization) to understand how liberalization affected Kenya's GDP per capita.
- ▣ **Data science terms:** We create an estimate of Kenya's counterfactual in the absence of the reform by “training the counterfactual's behavior” on Kenya's pre-reform data

Figure 2: GDP per Capita Constant USD PPP 1950-2017

Data: Penn World Tables

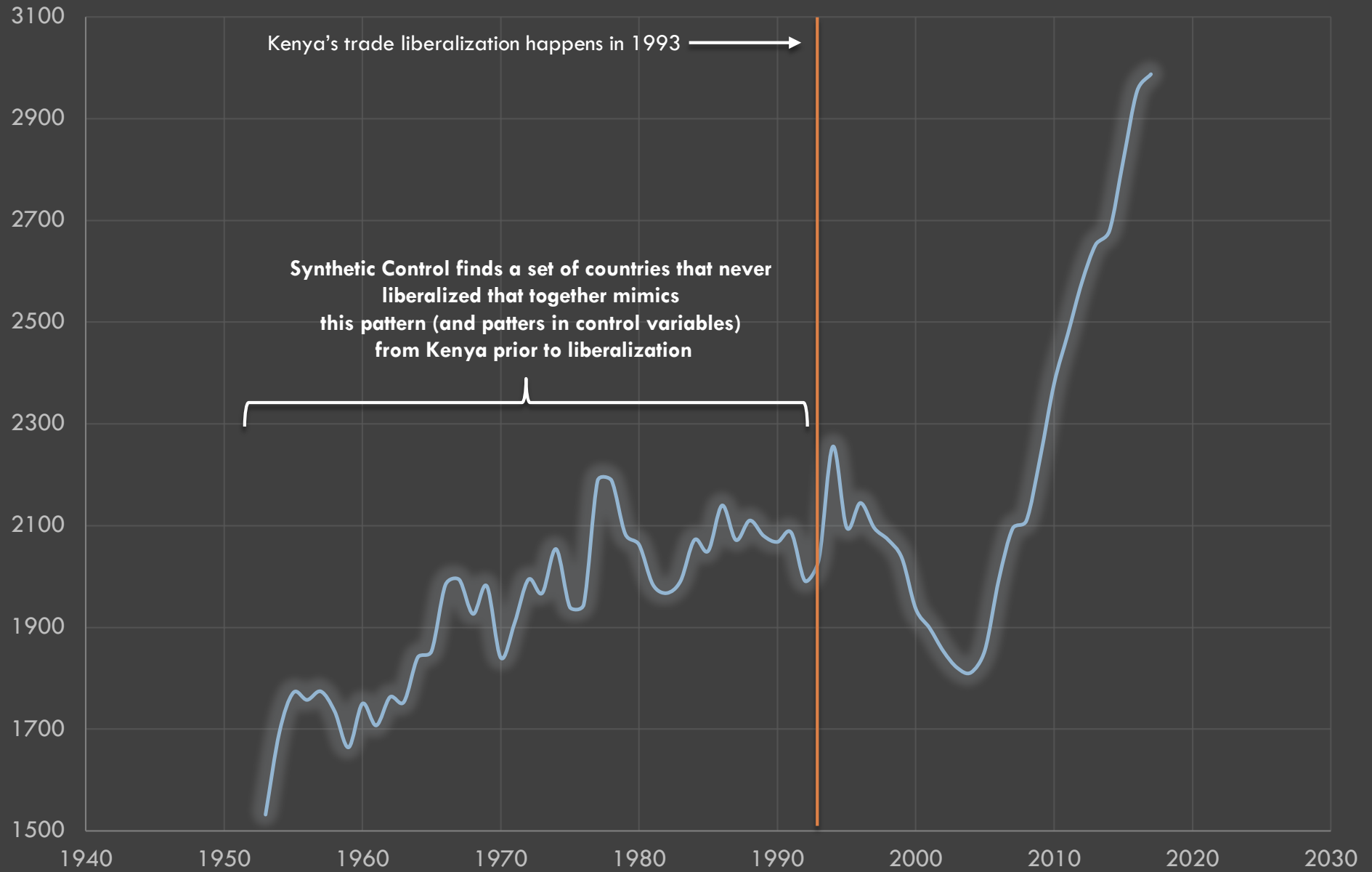


Figure 4: GDP per Capita Kenya vs. Synthetic Control before Liberalization in 1993

— Kenya — Synthetic Kenya

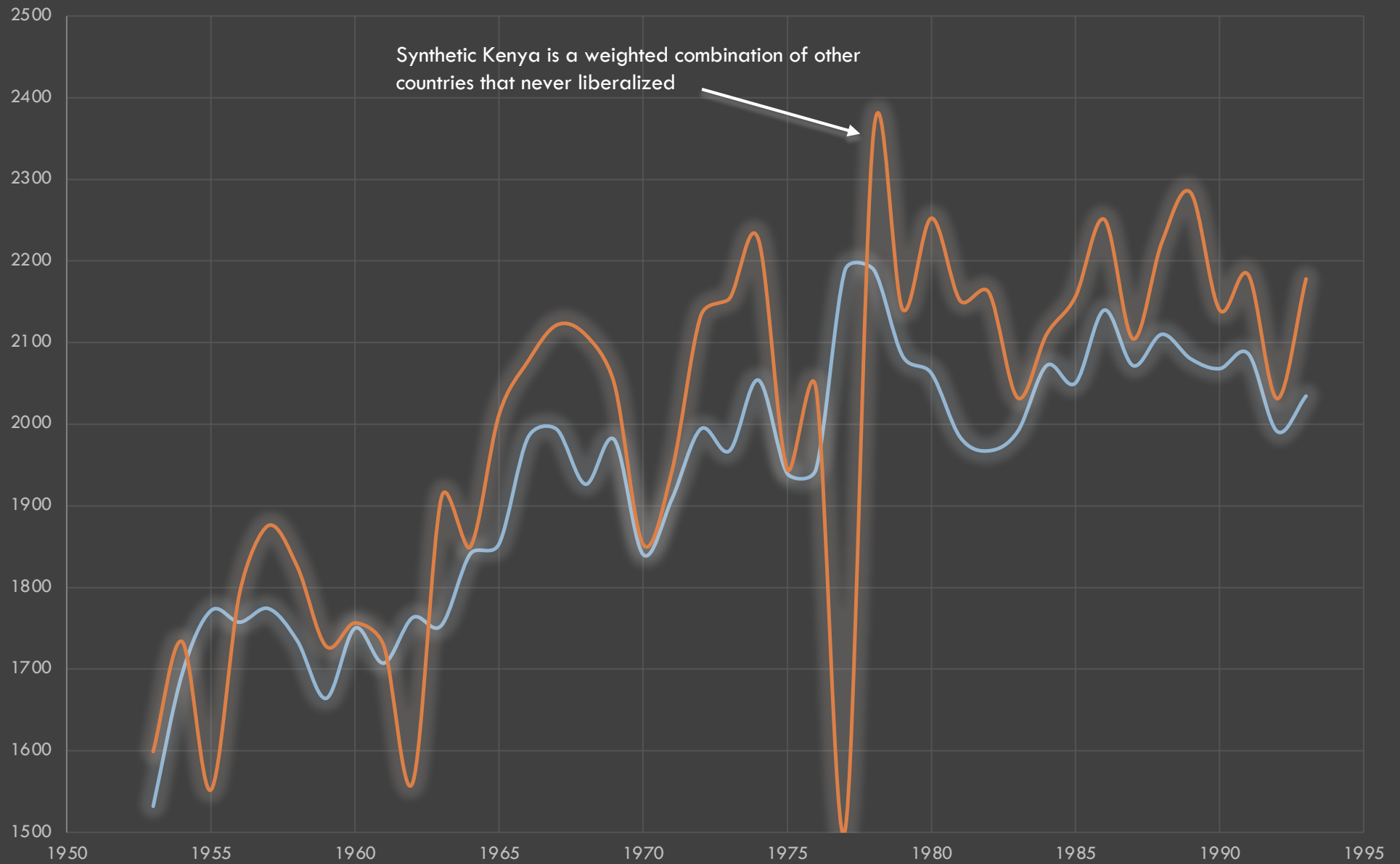
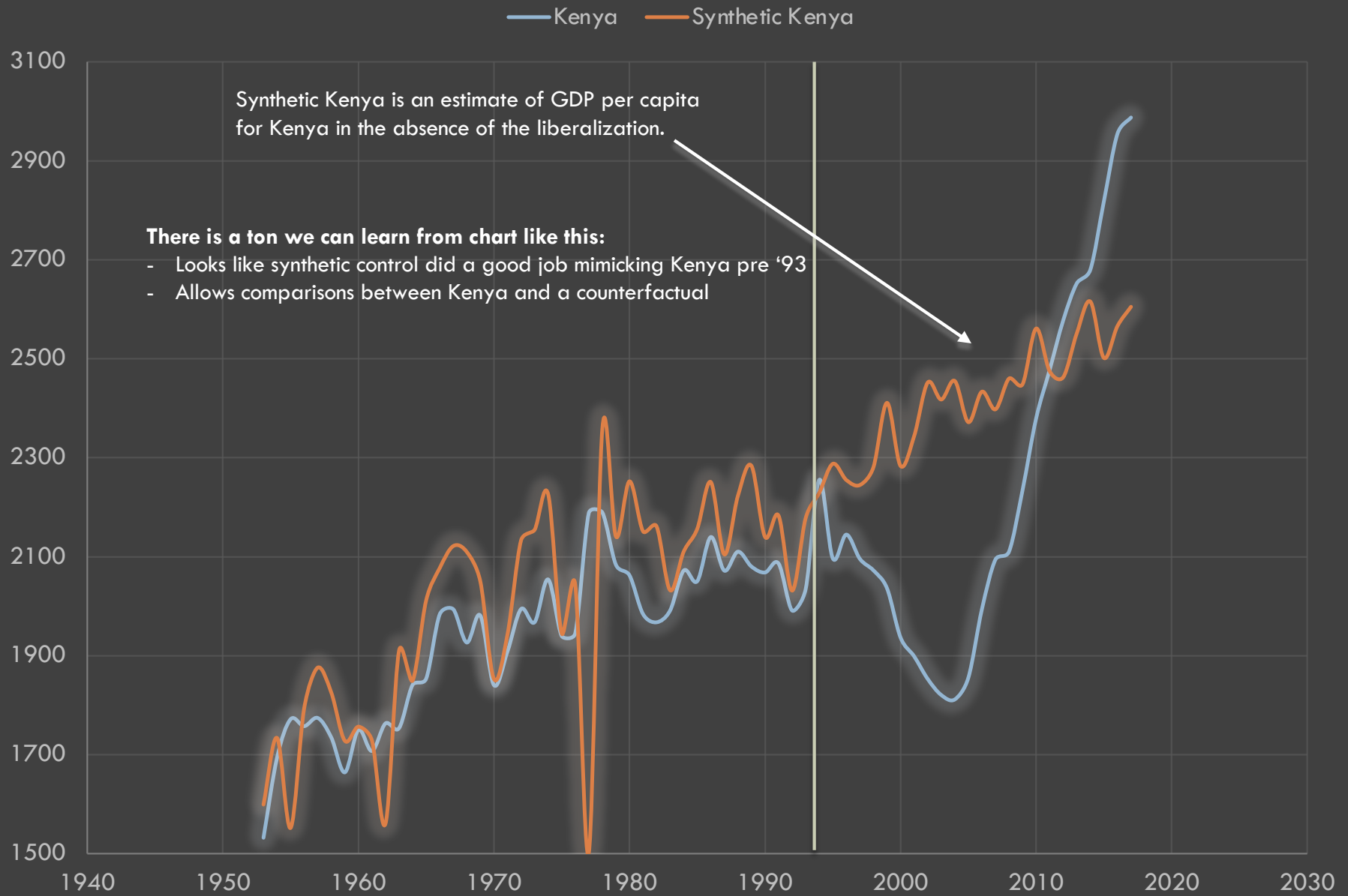


Figure 5: Synthetic Kenya vs. Kenya in GDP per capita

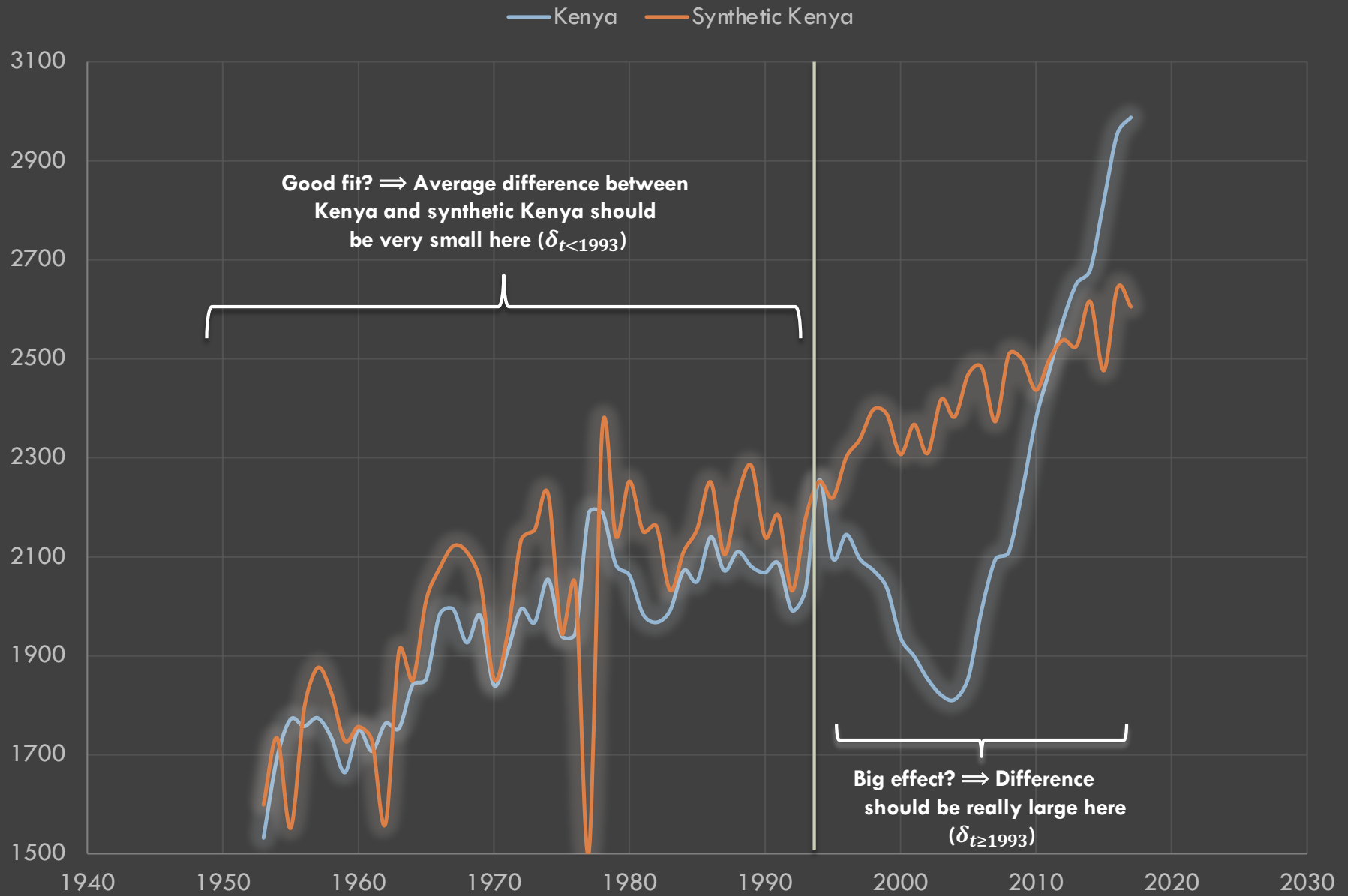


Estimates of the Effect

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- **Calculate the average difference in GDP per capita between Kenya and synthetic Kenya:**
 - ▣ Estimate of the effect of the liberalization on GDP per capita
- **Is this estimate just random noise?**

Figure 6: Synthetic Kenya vs. Kenya in GDP per capita

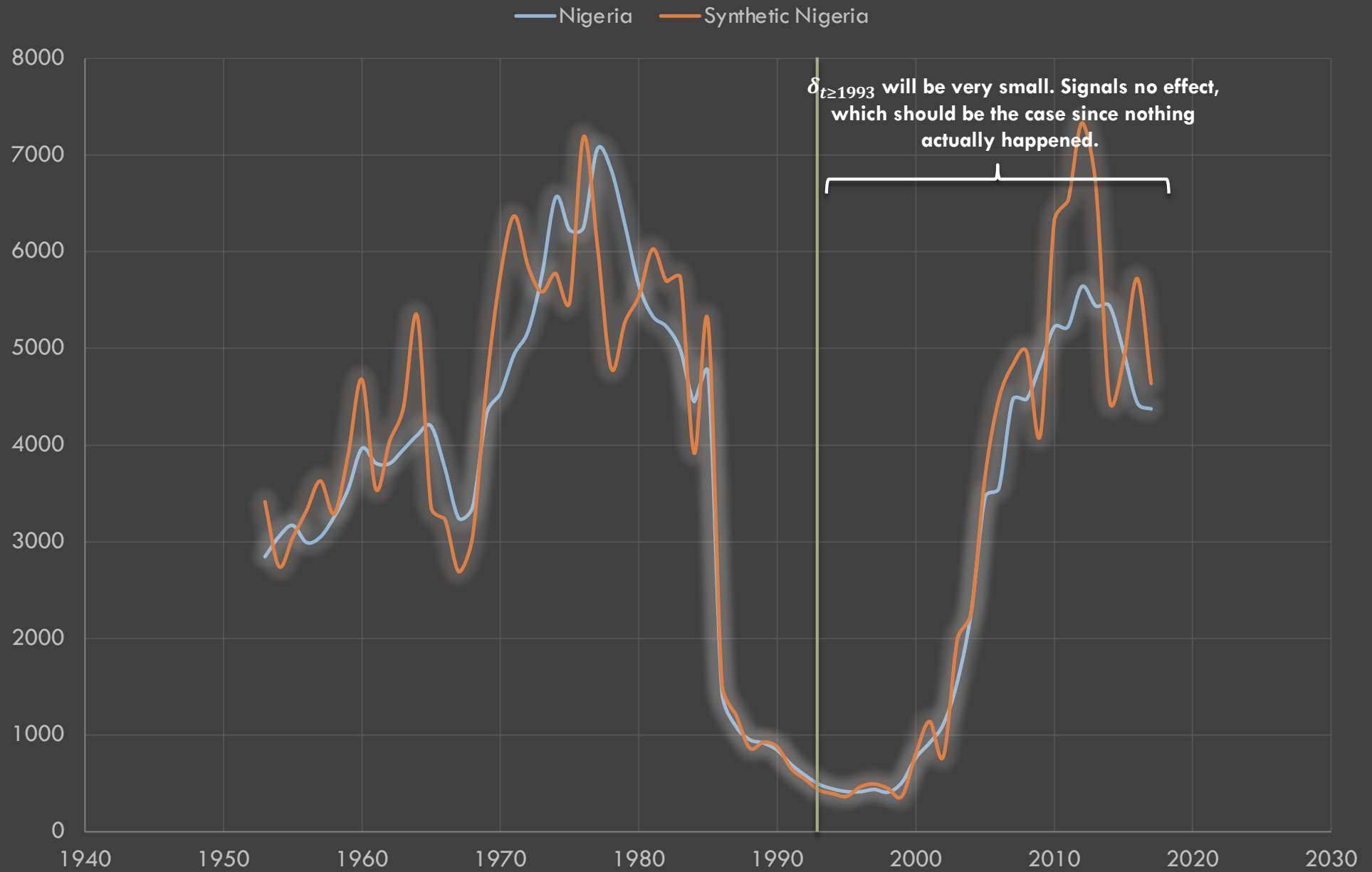


Estimates of the Effect

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- **Calculate the average difference in GDP per capita between Kenya and synthetic Kenya:**
 - ▣ Estimate of the effect of the liberalization on GDP per capita.
- **Is this estimate just random noise?**
 - ▣ Look at the size of the effect compared to the fit: $\frac{\delta_{t < 1993}}{\delta_{t \geq 1993}}$. This should be really big if the fit was good and the effect was large.
 - ▣ Pretend a country that never liberalized did liberalize in 1993 like Kenya. Run the synthetic control.
 - ▣ There should be no effect after 1993 and thus $\frac{\delta_{t < 1993}}{\delta_{t \geq 1993}}$ should be small. You do this for each country that didn't liberalize and you get a distribution of these fractions. If Kenya's fraction is out in the tails of that distribution it is statistically significant.

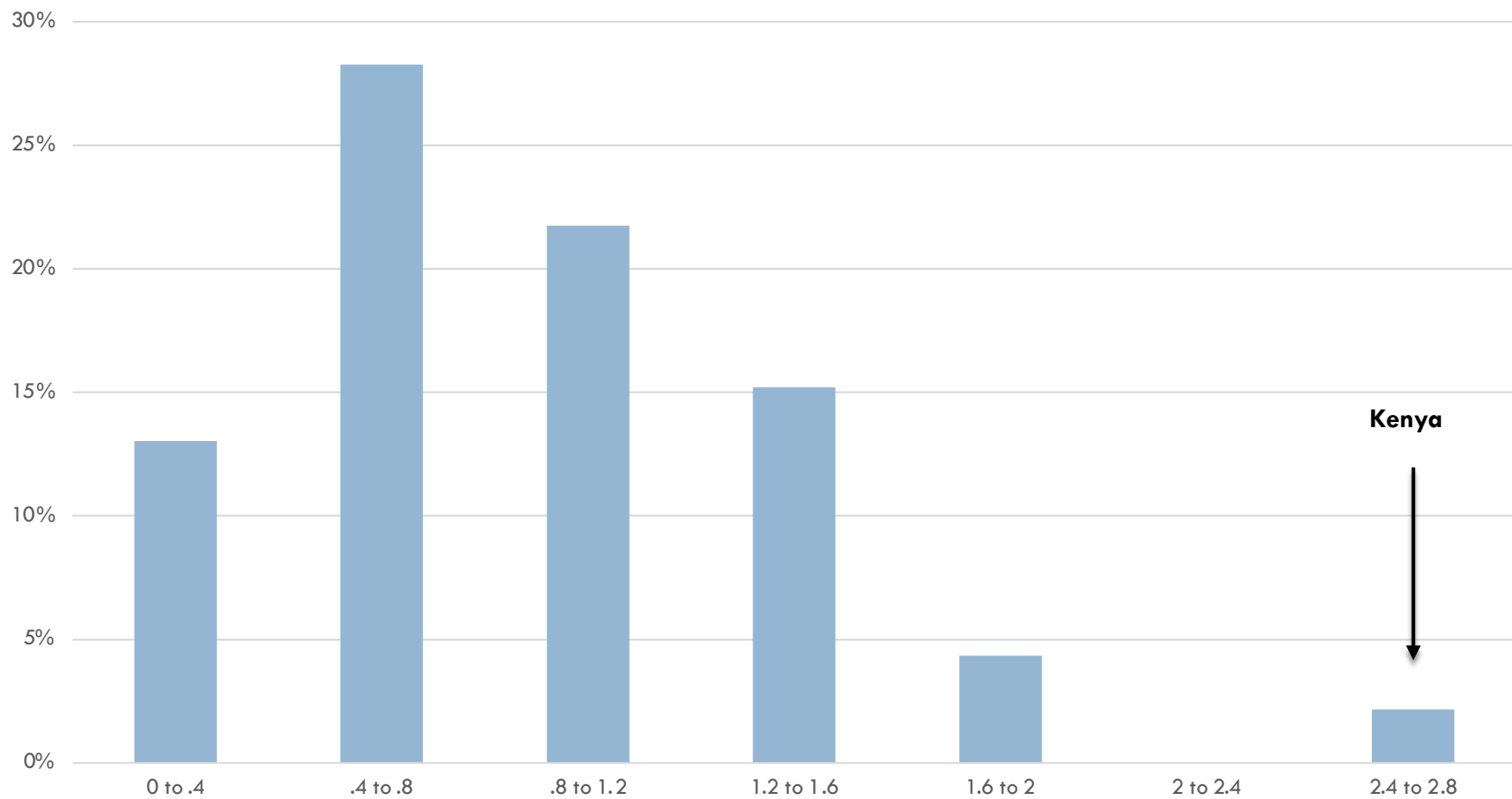
Figure 7: Synthetic Nigeria vs Nigeria (Nigeria never treated)



Histogram of these fractions $\frac{\delta_{t < 1993}}{\delta_{t \geq 1993}}$

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Figure 8: Distribution of the Ratio of Effect to Fit



Identification with Synthetic Control

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- **Pre-treatment parallel trend is a good fit**
 - ▣ this is more convincing that what is identified is a causal effect.
- **Also you need to buy that the countries making up the synthetic control are a legitimate approximation of the country you are studying**
 - ▣ Would you buy it if you were studying Kenya and all the countries in the Synthetic Kenya were from E. Asia?
Maybe not

How well does the Synthetic Unit Match the Real One?

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TABLE 5.—COVARIATES AND OUTCOME MEANS—ASIA

	Singapore 1965	Synthetic Control A	Synthetic Control B
Population growth	2.87	2.94	2.88
Pretreatment GDP	2,569.49	612.54	2,573.46
GDP at $T_0 + 5$	3,901.08	693.39	3,270.89
GDP at $T_0 + 10$	6,143.02	791.80	3,801.23
RMSPE		1,958.21	0.00
	South Korea 1968	Synthetic Control A	Synthetic Control B
Secondary school	31.00	33.50	11.87
Population growth	2.62	3.05	2.76
Investment share	0.17	0.15	0.17
Pretreatment GDP	1,290.43	631.62	1,290.46
GDP at $T_0 + 5$	2,045.33	731.28	1,612.73
GDP at $T_0 + 10$	3,008.49	890.37	1,572.70
RMSPE		663.59	12.82

Treated Countries and Non-treated Countries

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TABLE 3.—ECONOMIC LIBERALIZATIONS IN AFRICA

<i>Country</i>	<i>Treatment Status</i>
Mauritius	Open since 1968
Botswana	Open since 1979
Gambia	Open since 1985
Ghana	Open since 1985
Guinea	Open since 1986
Guinea-Bissau	Open since 1987
Mali	Open since 1988
Uganda	Open since 1988
Benin	Open since 1990
Cape Verde	Open since 1991
South Africa	Open since 1991
Cameroon	Open since 1993
Kenya	Open since 1993
Zambia	Open since 1993
Ivory Coast	Open since 1994
Niger	Open since 1994
Mozambique	Open since 1995
Tanzania	Open since 1995
Ethiopia	Open since 1996
Madagascar	Open since 1996
Burkina Faso	Open since 1998
Burundi	Open since 1999
Angola	Always closed
Central African Republic	Always closed
Chad	Always closed
Congo	Always closed
Gabon	Always closed
Lesotho	Always closed
Malawi	Always closed
Nigeria	Always closed
Rwanda	Always closed
Senegal	Always closed
Sierra Leone	Always closed
Togo	Always closed
Zimbabwe	Always closed

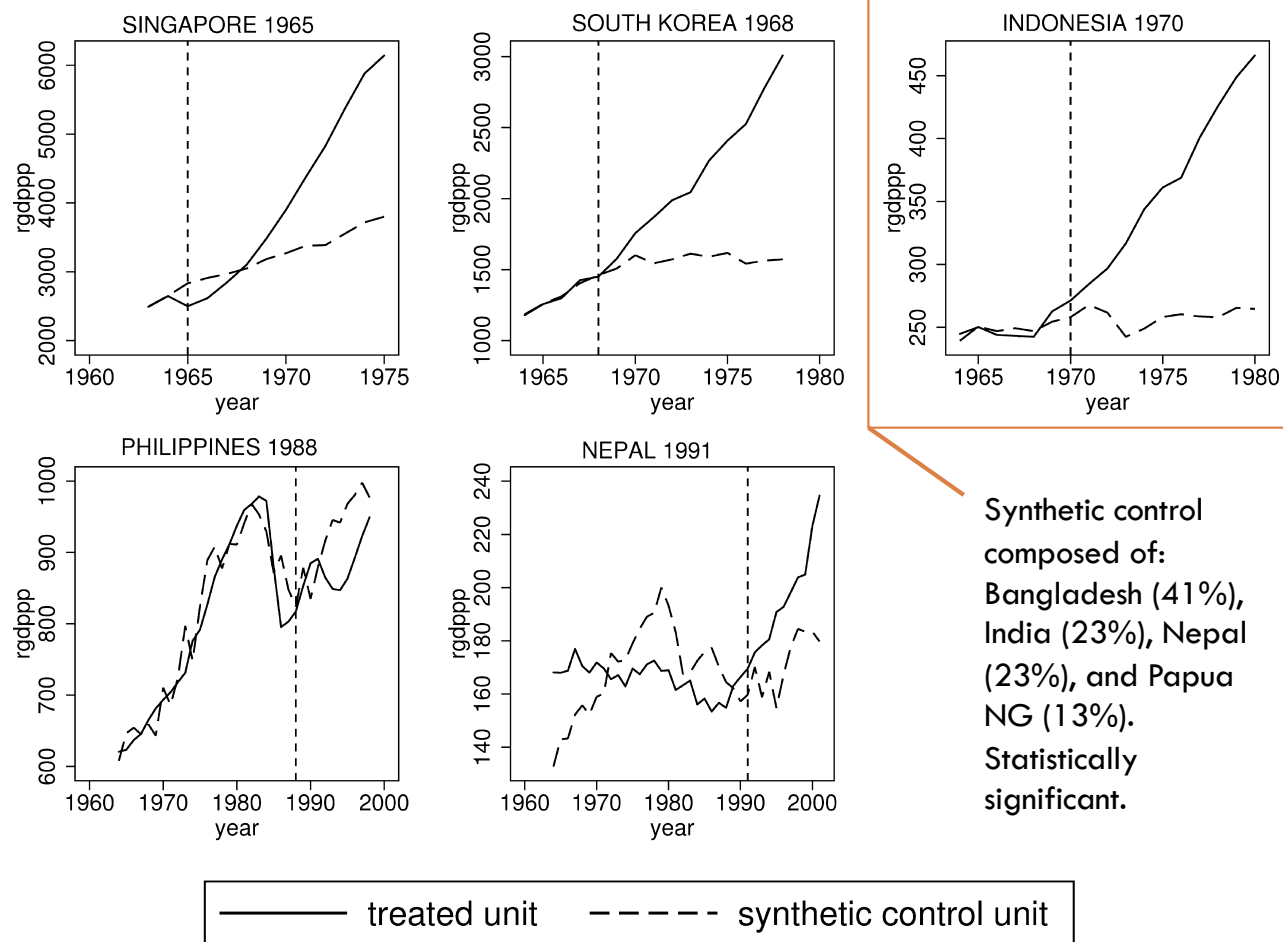
Treated Countries

Countries that could
potentially form the
synthetic unit.

Results (Asia)

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FIGURE 1.—GDP TRENDS, TREATED COUNTRY VERSUS SYNTHETIC CONTROL—ASIA

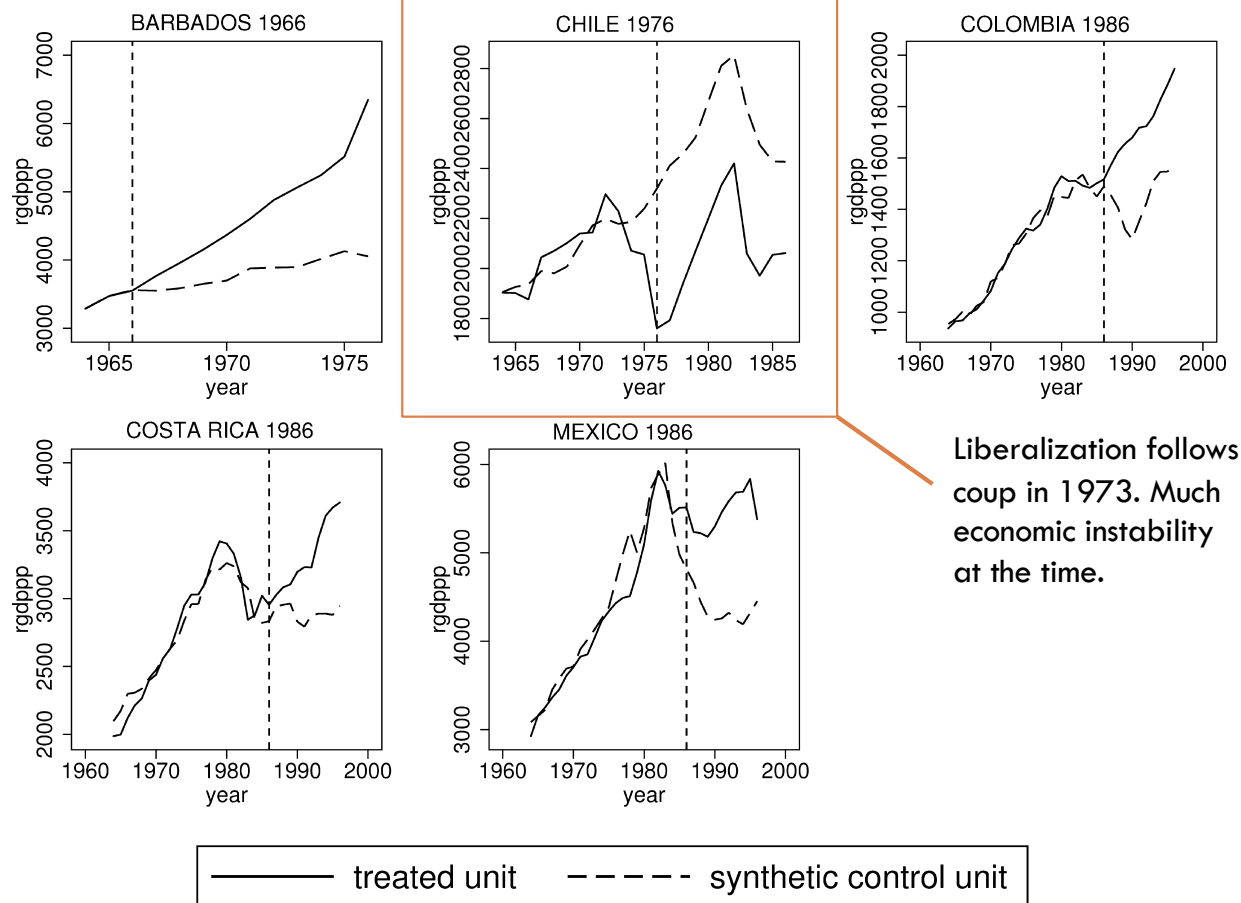


Authors' calculations based on data in Persson and Tabellini (2006). Outcome: real per capita GDP. Covariates (if available for at least one year before the treatment): secondary school enrollment, population growth, investment share, inflation, democracy, and pretreatment real GDP per capita. Synthetic control A for Indonesia; synthetic control B for Singapore, South Korea, Philippines, and Nepal. See tables 1 through 4 for the list of potential controls in each macroregion. See the online appendix for the list (and relative weights) of the countries included in each synthetic control.

Results (Latin America)

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FIGURE 2.—GDP TRENDS, TREATED COUNTRY VERSUS SYNTHETIC CONTROL—LATIN AMERICA

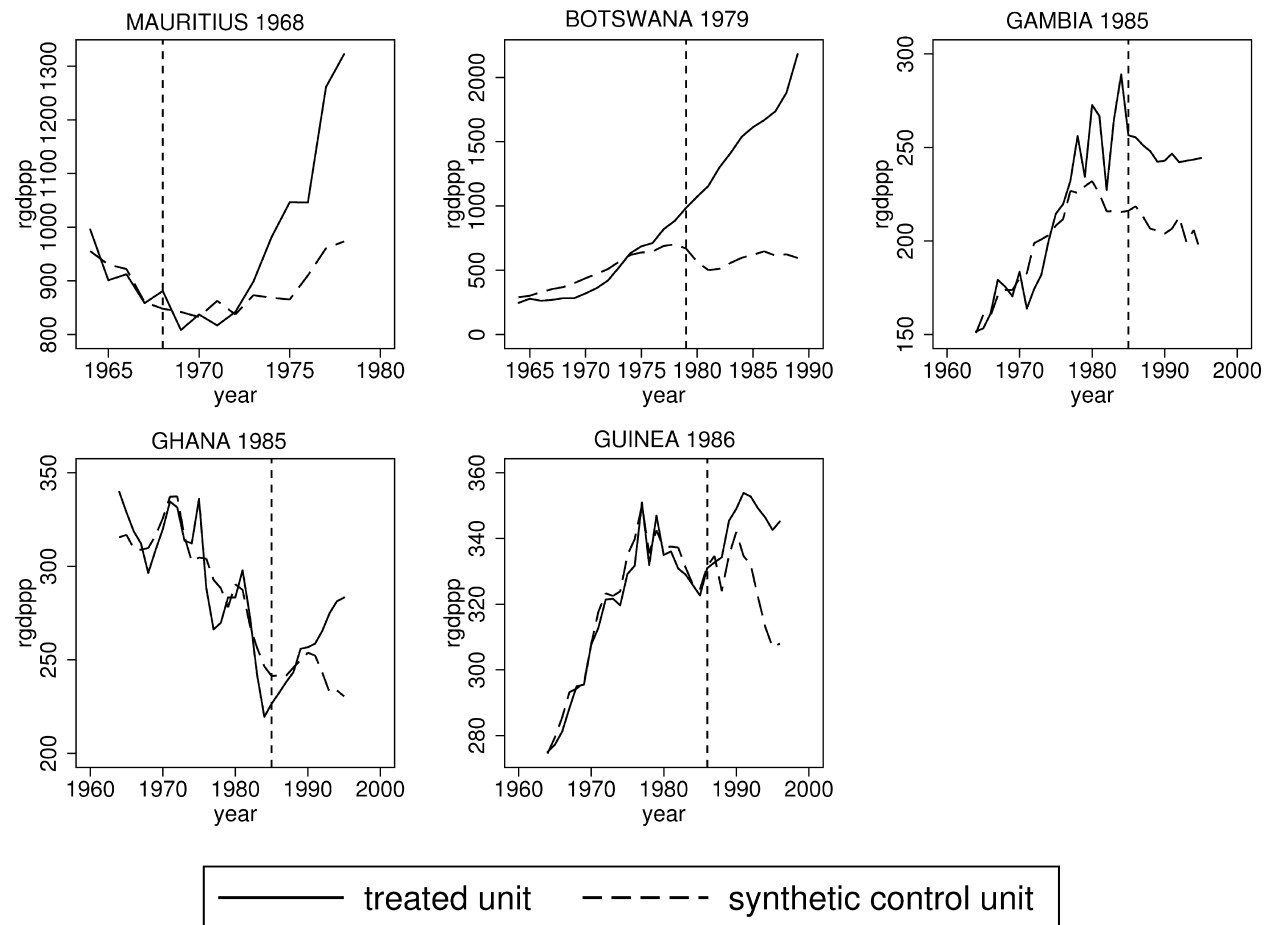


Authors' calculations based on data in Persson and Tabellini (2006). Outcome: real per capita GDP. Covariates (if available for at least one year before the treatment): secondary school enrollment, population growth, investment share, inflation, democracy, and pretreatment real GDP per capita. Synthetic control A for Barbados, Costa Rica, and Mexico; synthetic control B for Chile and Colombia. See tables 1 through 4 for the list of potential controls in each macroregion. See the online appendix for the list (and relative weights) of the countries included in each synthetic control.

Results (Africa – Early Liberalizations)

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FIGURE 3.—GDP TRENDS, TREATED COUNTRY VERSUS SYNTHETIC CONTROL—AFRICA BEFORE 1987

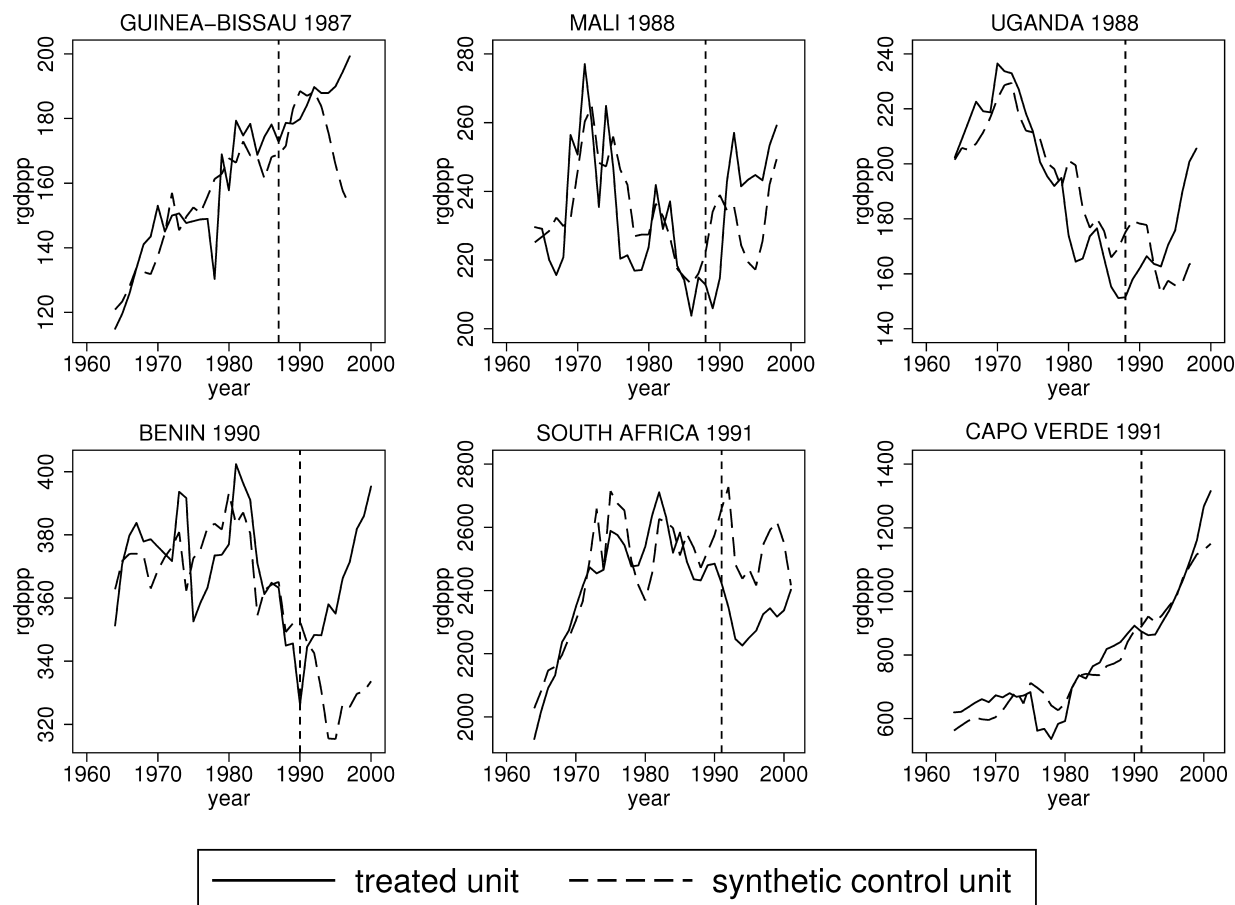


Authors' calculations based on data in Persson and Tabellini (2006). Outcome: real per capita GDP. Covariates (if available for at least one year before the treatment): secondary school enrollment, population growth, investment share, inflation, democracy, and pretreatment real GDP per capita. Synthetic control A for Gambia, Ghana, and Guinea; synthetic control B for Mauritius and Botswana. See tables 1 through 4 for the list of potential controls in each macroregion. See the online appendix for the list (and relative weights) of the countries included in each synthetic control.

Results (Africa – Later Liberalizations)

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FIGURE 4.—GDP TRENDS, TREATED COUNTRY VERSUS SYNTHETIC CONTROL—AFRICA BETWEEN 1987 AND 1991

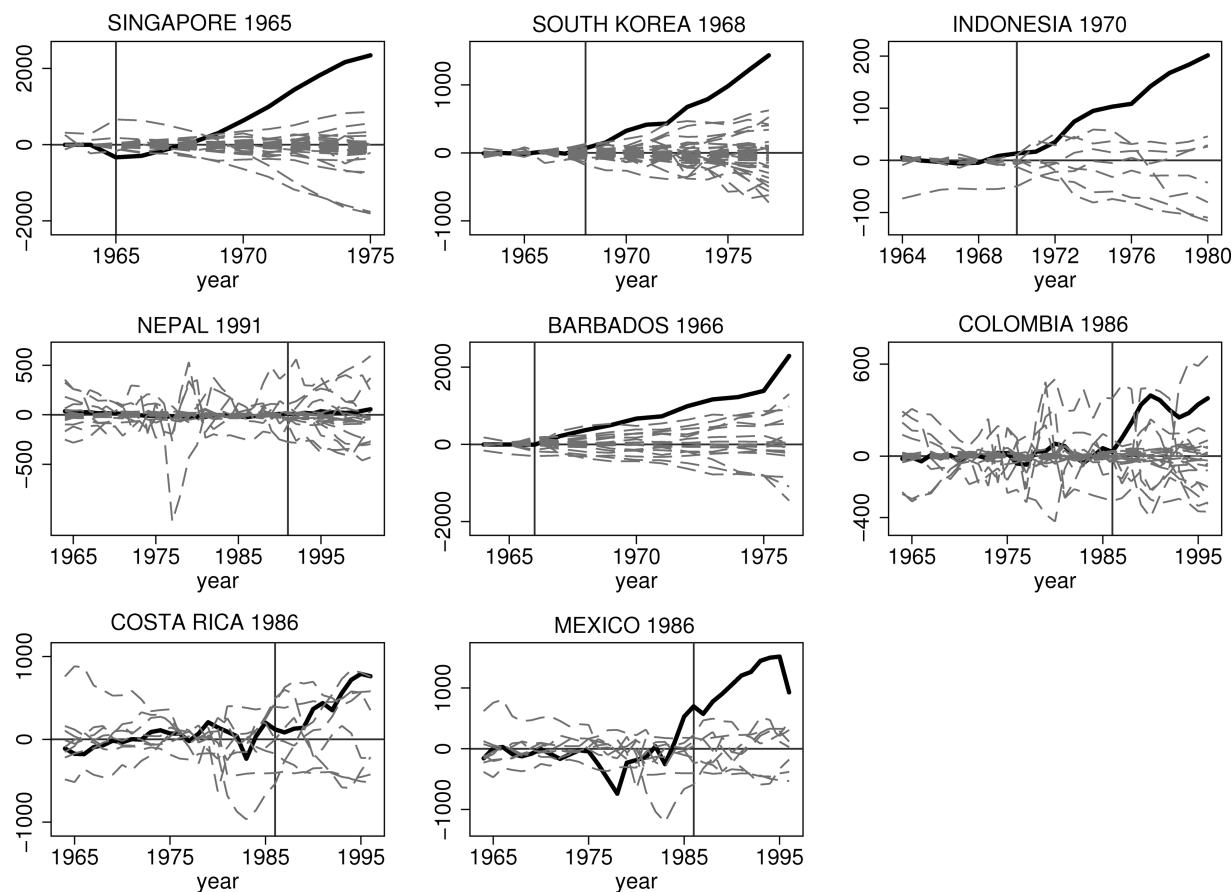


Authors' calculations based on data in Persson and Tabellini (2006). Outcome: real per capita GDP. Covariates (if available for at least one year before the treatment): secondary school enrollment, population growth, investment share, inflation, democracy, and pretreatment real GDP per capita. Synthetic control A for Guinea-Bissau, Mali, Uganda, and Benin; synthetic control B for South Africa and Cape Verde. See tables 1 through 4 for the list of potential controls in each macroregion. See the online appendix for the list (and relative weights) of the countries included in each synthetic control.

Statistical Inference

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FIGURE 7.—PLACEBO EXPERIMENTS—ASIA AND LATIN AMERICA



Authors' calculations based on data in Persson and Tabellini (2006). Solid line: outcome difference between each treated country and its synthetic control. Dashed lines: outcome difference between each of the treated country's potential controls and their synthetic control in placebo experiments. Outcome: real per capita GDP. Covariates (if available for at least one year before the treatment): secondary school enrollment, population growth, investment share, inflation, democracy, and pretreatment real GDP per capita. Synthetic control A for Indonesia, Barbados, Costa Rica, and Mexico; synthetic control B for Singapore, South Korea, Nepal, and Colombia.

Contributions

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- **SCM provides a way to systematically examine the effects of policy changes in an empirical way, case-by-case**
 - ▣ Normal econometrics just let's you see effects at the average. SCM let's you know (perhaps) a lot of detail over how policies affect different countries differently
- **Provides evidence that trade liberalization led to higher growth in GDP per capita for certain countries**
 - ▣ Left out Africa's late liberalizers

Reflections/Criticisms

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- **Is “liberalization” really a binary state** and have they measured it correctly?
- **Does liberalization coincide with other events** which may be driving the effects they are measuring?
- **SCM newer method.** So no traditional set of controls