Theories of change

Session 3

PMAP 8521: Program evaluation
Andrew Young School of Policy Studies

Plan for today

Reproducibility

Program theories

Logic models & results chains

Reproducibility

Why am I making you learn R?

More powerful

Free and open source

Reproducibility

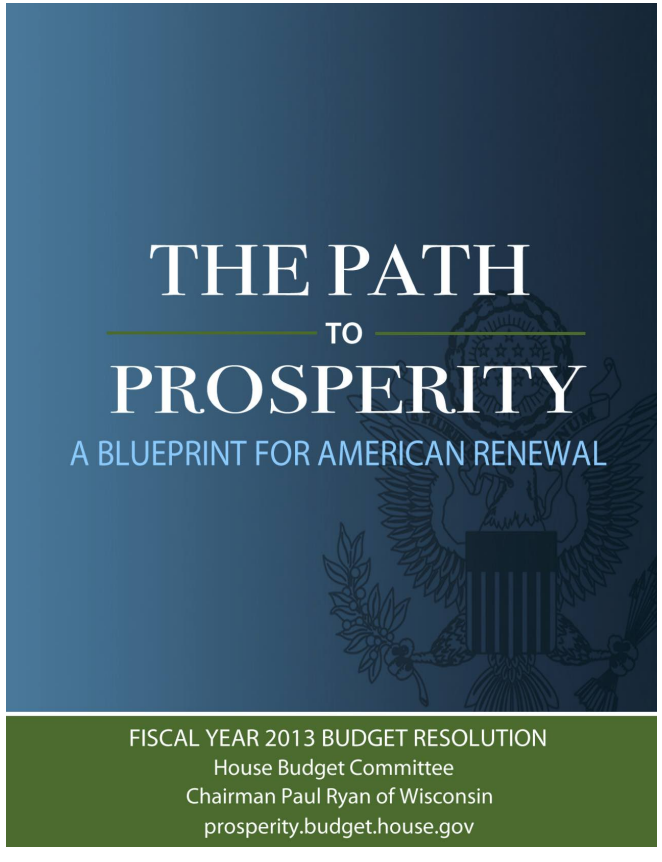
Austerity and Excel

Growth in a Time of Debt
Carmen M. Reinhart and Kenneth S. Rogoff
NBER Working Paper No. 15639
January 2010, Revised January 2010
JEL No. E2,E3,E6,F3,F4,N10

ABSTRACT

We study economic growth and inflation at different levels of government and external debt. Our analysis is based on new data on forty-four countries spanning about two hundred years. The dataset incorporates over 3,700 annual observations covering a wide range of political systems, institutions, exchange rate arrangements, and historic circumstances. Our main findings are: First, the relationship between government debt and real GDP growth is weak for debt/GDP ratios below a threshold of 90 percent of GDP. Above 90 percent, median growth rates fall by one percent, and average growth falls considerably more. We find that the threshold for public debt is similar in advanced and emerging economies. Second, emerging markets face lower thresholds for external debt (public and private)—which is usually denominated in a foreign currency. When external debt reaches 60 percent of GDP, annual growth declines by about two percent; for higher levels, growth rates are roughly cut in half. Third, there is no apparent contemporaneous link between inflation and public debt levels for the advanced countries as a group (some countries, such as the United States, have experienced higher inflation when debt/GDP is high). The story is entirely different for emerging markets, where inflation rises sharply as debt increases.

Debt:GDP ratio
90%+ → −0.1% growth



Paul Ryan's 2013 House budget resolution

Austerity and Excel

Thomas Herndon

Over time, another problem emerged: Other researchers, using seemingly comparable data on debt and growth, couldn't replicate the Reinhart-Rogoff results. They typically found some correlation between high debt and slow growth — but nothing that looked like a tipping point at 90 percent or, indeed, any particular level of debt.

Finally, Ms. Reinhart and Mr. Rogoff allowed researchers at the University of Massachusetts to look at their original spreadsheet — and the mystery of the irreproducible results was solved. First, they omitted some data; second, they used unusual and highly questionable statistical procedures; and finally, yes, they made an Excel coding error. Correct these oddities and errors, and you get what other researchers have found: some correlation between high debt and slow growth, with no indication of which is causing which, but no sign at all of that 90 percent "threshold."

From Paul Krugman, "The Excel Depression"

Austerity and Excel

Table 1. Real GDP Growth as the Level of Government Debt Varies:
Selected Advanced Economies, 1790-2009
(annual percent change)

		Central (Federal) government debt/ GDP			
Country	Period	Below 30 percent	30 to 60 percent	60 to 90 percent	90 percent and above
Australia	1902-2009	3.1	4.1	2.3	4.6
Austria	1880-2009	4.3	3.0	2.3	n.a.
Belgium	1835-2009	3.0	2.6	2.1	3.3
Canada	1925-2009	2.0	4.5	3.0	2.2
Denmark	1880-2009	3.1	1.7	2.4	n.a.
Finland	1913-2009	3.2	3.0	4.3	1.9
France	1880-2009	4.9	2.7	2.8	2.3
Germany	1880-2009	3.6	0.9	n.a.	n.a.
Greece	1884-2009	4.0	***0.3***	***4.8***	2.5
Ireland	1949-2009	4.4	4.5	4.0	2.4
Italy	1880-2009	***5.4***	***4.9***	1.9	0.7
Japan	1885-2009	4.9	3.7	3.9	0.7
Netherlands	1880-2009	4.0	2.8	2.4	2.0
New Zealand	1932-2009	2.5	2.9	3.9	**3.6**
Norway	1880-2009	2.9	4.4	n.a.	n.a.
Portugal	1851-2009	4.8	2.5	1.4	n.a.
Spain	1850-2009	***1.6***	3.3	***1.3***	2.2
Sweden	1880-2009	2.9	2.9	2.7	n.a.
United Kingdom	1830-2009	2.5	2.2	2.1	1.8
United States	1790-2009	4.0	3.4	3.3	***-1.8***
Average		**3.7**	**3.0**	**3.4**	**1.7**
Median		**3.9**	**3.1**	**2.8**	**1.9**
Number of observations = **2,317**		866	654	445	352

Debt:GDP ratio = 90%+ → 2.2% growth (!!)

Genes and Excel

Septin 2

Membrane-Associated Ring Finger (C3HC4) 1

2310009E13

	A	B
1	**Actual value**	**What Excel turns it into**
2	SEPT2	2-Sep
3	MARCH1	1-Mar
4	2310009E13	2.31E+19

20% of genetics papers between 2005–2015 (!!!)

General guidelines

Don't touch the raw data

If you do, explain what you did!

Use self-documenting, reproducible code

R Markdown!

Use open formats

Use .csv, not .xlsx

R Markdown in real life

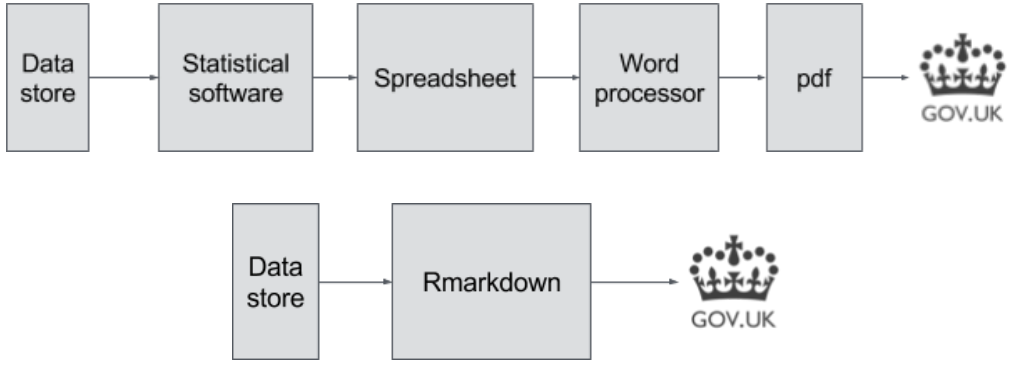
3.1.2 Data Visualization

We use ggplot2 as our main package to create ad-hoc exploratory graphics as well as polished-looking customized visualizations. When combined with tools to clean and transform data, ggplot2 allows analysts to quickly translate insights into high quality, compelling visualizations. In addition to the static graphics of `ggplot2`, we often make interactive visualizations or dashboards using R packages such as `plotly` (Sievert et al. 2017), `leaflet` (Cheng et al. 2017), `dygraphs` (Vanderkam et al. 2017), `DiagrammeR` (Sveidqvist et al. 2017), and `shiny` (Chang et al. 2017).

3.1.3 Reproducible Research

At Airbnb, all R analyses are documented in `rmarkdown`, where code and visualizations are combined within a single written report. Posts are carefully reviewed by experts in the content area and techniques used, both in terms of methodologies and code style, before publishing and sharing with the business partners. The peer review process is

Airbnb, ggplot, and rmarkdown



The UK's reproducible analysis pipeline

Program theories

Elements of a program

Inputs

Things that go into an activity; money, people, time, etc.

Outputs

Tangible goods and services produced by activities; you have control over these

Activities

Actions that convert inputs to outputs; things that the program does

Outcomes

What happens when the target population uses the outputs; you don't have control over these

Inputs → Activities → Outputs → Outcomes

Program theory

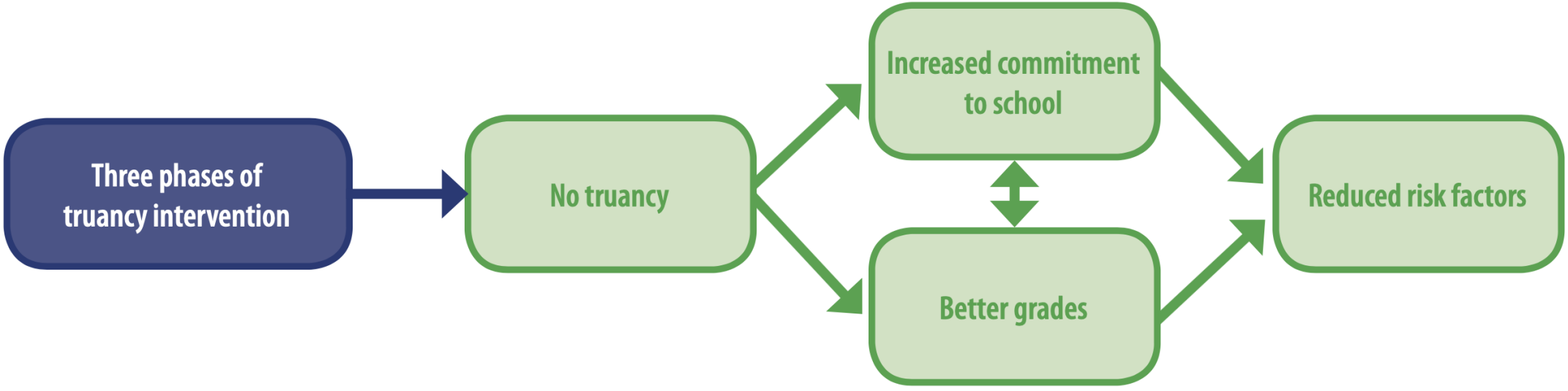
How and why an intervention causes change

A sequence of events that connects inputs to activities to outputs to outcomes

Why you think inputs → activities → outputs → outcomes

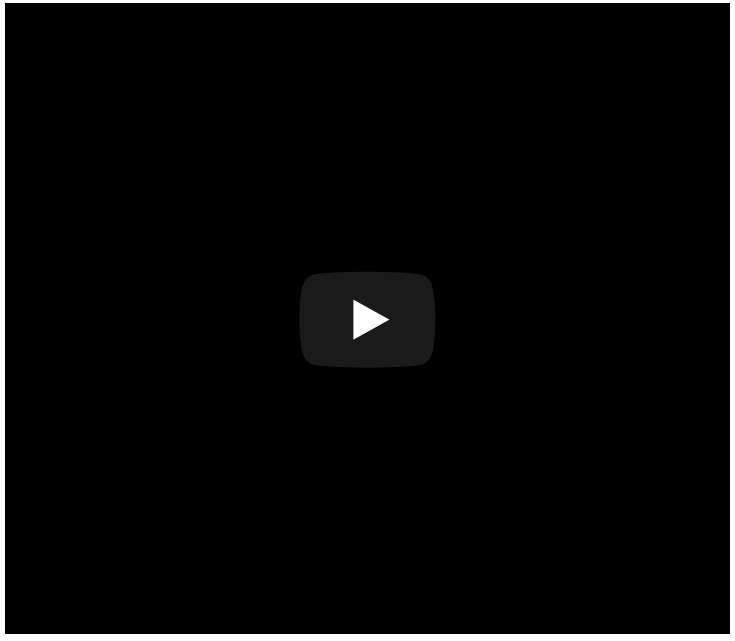
Impact theory

Causes (activities) linked to effects (outcomes)



One Laptop Per Child (OLPC)

OLPC

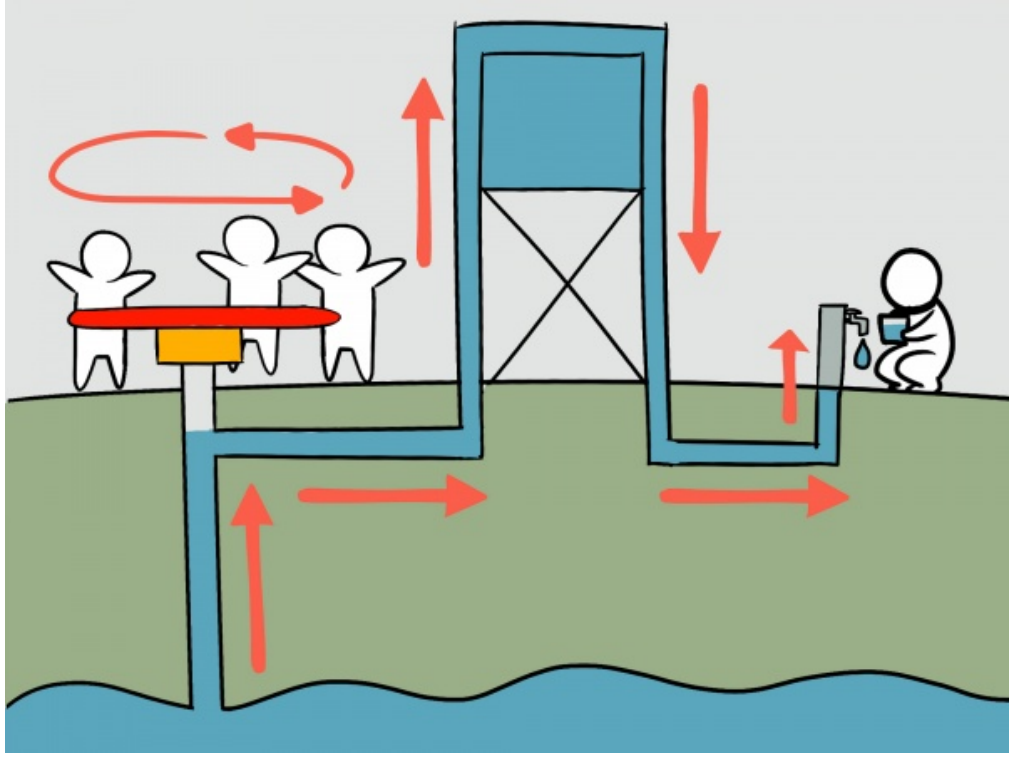


OLPC may have undercut even the XO-1's strong points by overselling them. "The utopianism set unrealistic expectations around what the laptops should be able to accomplish," says Morgan Ames, a Berkeley researcher who's currently writing a book about OLPC. That included Negroponte's laptop-tossing demonstrations. "When you're talking about a laptop that kids are using surrounded by concrete floors and cobblestone streets — there was a ton of breakage that really blindsided projects, because they expected these laptops to be a lot more indestructible."

> **"THE UTOPIANISM SET UNREALISTIC EXPECTATIONS AROUND WHAT THE LAPTOPS SHOULD BE ABLE TO ACCOMPLISH."**

Adi Robertson, "OLPC's $100 laptop was going to change the world—then it all went wrong"

PlayPumps



Why theorize?

Implicit theory

What program designers think or assume is going to happen, and why

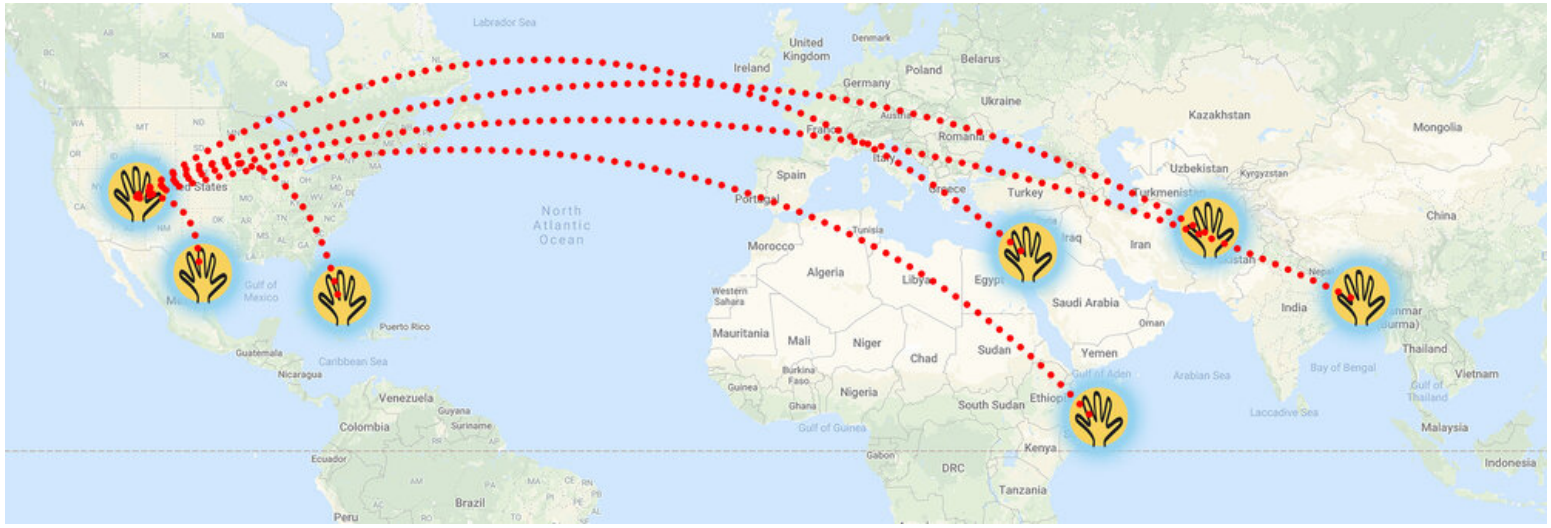
Assumed

Articulated theory

What program designers officially claim and predict, and why

Written down

Should all social programs be rooted in explicit articulated theory?


Labrador Sea
United Kingdom
Ireland
Denmark
Poland
Belarus
Germany
Ukraine
Kazakhstan
Mongolia
Romania
Spain
Portugal
Turkey
Uzbekistan
Kyrgyzstan
China
North Atlantic Ocean
Morocco
Algeria
Tunisia
Libya
Egypt
Iraq
Iran
Saudi Arabia
India
Western Sahara
Mauritania
Mali
Niger
Chad
Sudan
Yemen
Oman
Thailand
Vietnam
Gulf of Mexico
Puerto Rico
Guatemala
Caribbean Sea
Nicaragua
Venezuela
Guyana
Suriname
Colombia
Ecuador
Peru
Brazil
Guinea
Burkina Faso
Ghana
Nigeria
Gulf of Guinea
South Sudan
Ethiopia
Kenya
Gabon
DRC
Tanzania
Arabian Sea
Gulf of Aden
Bay of Bengal
Laccadive Sea
Malaysia
Indonesia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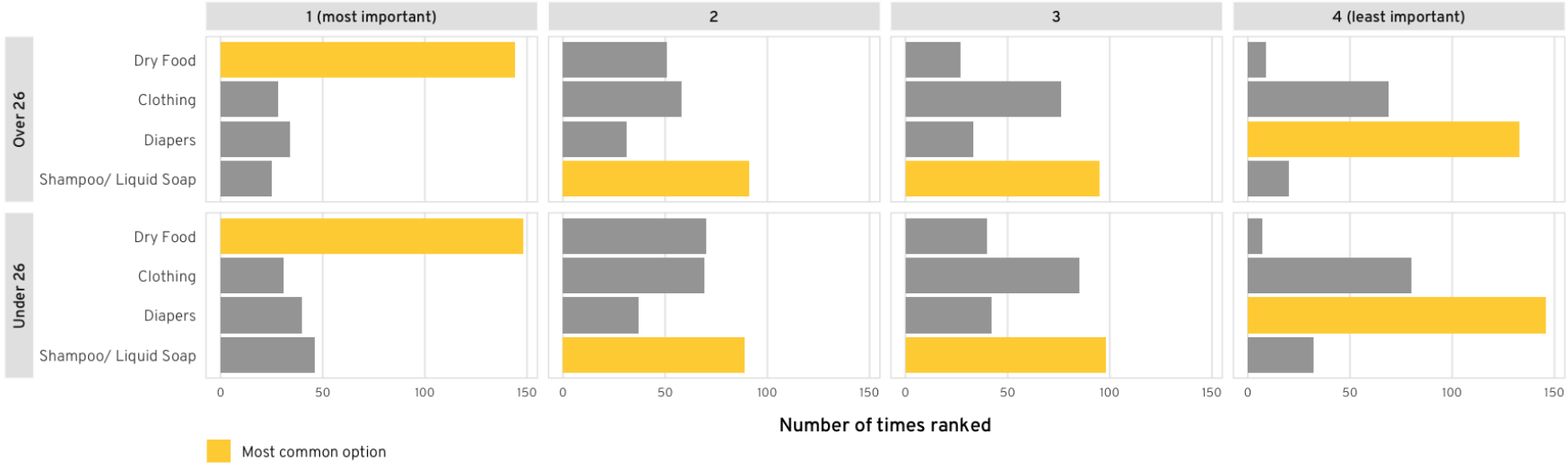
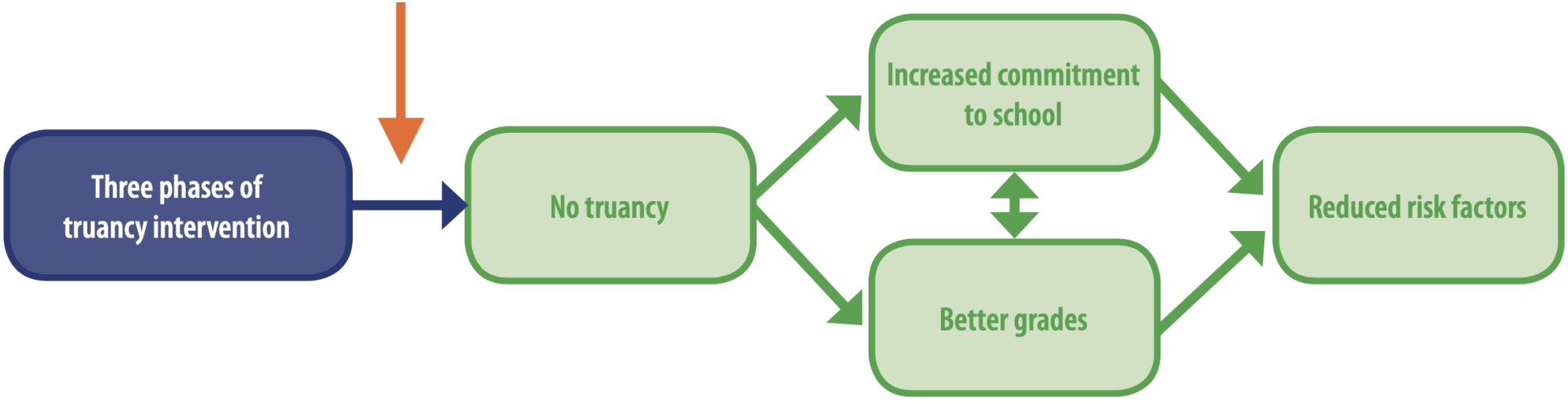
Distribution preferences by age



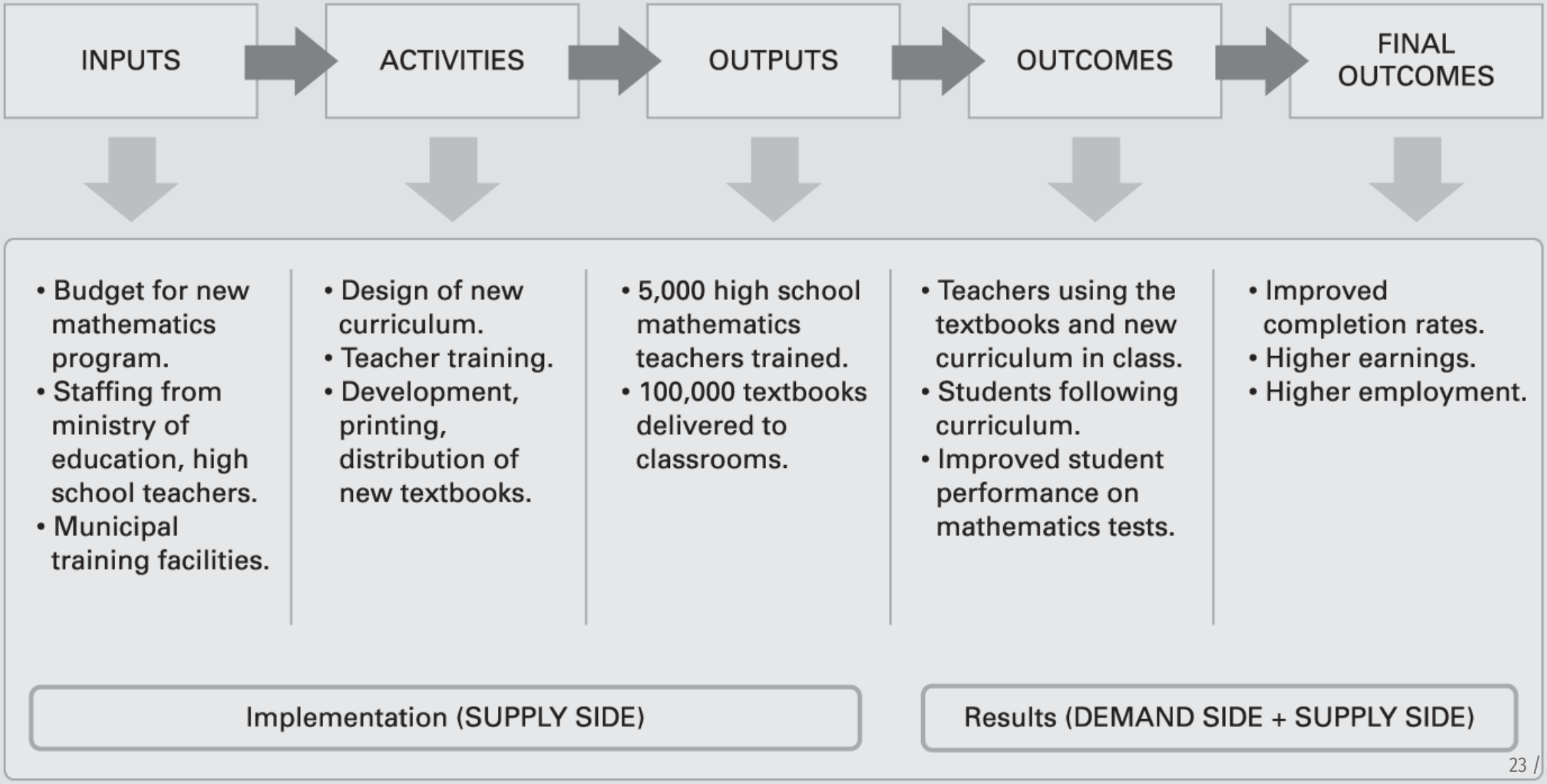
Impact theory

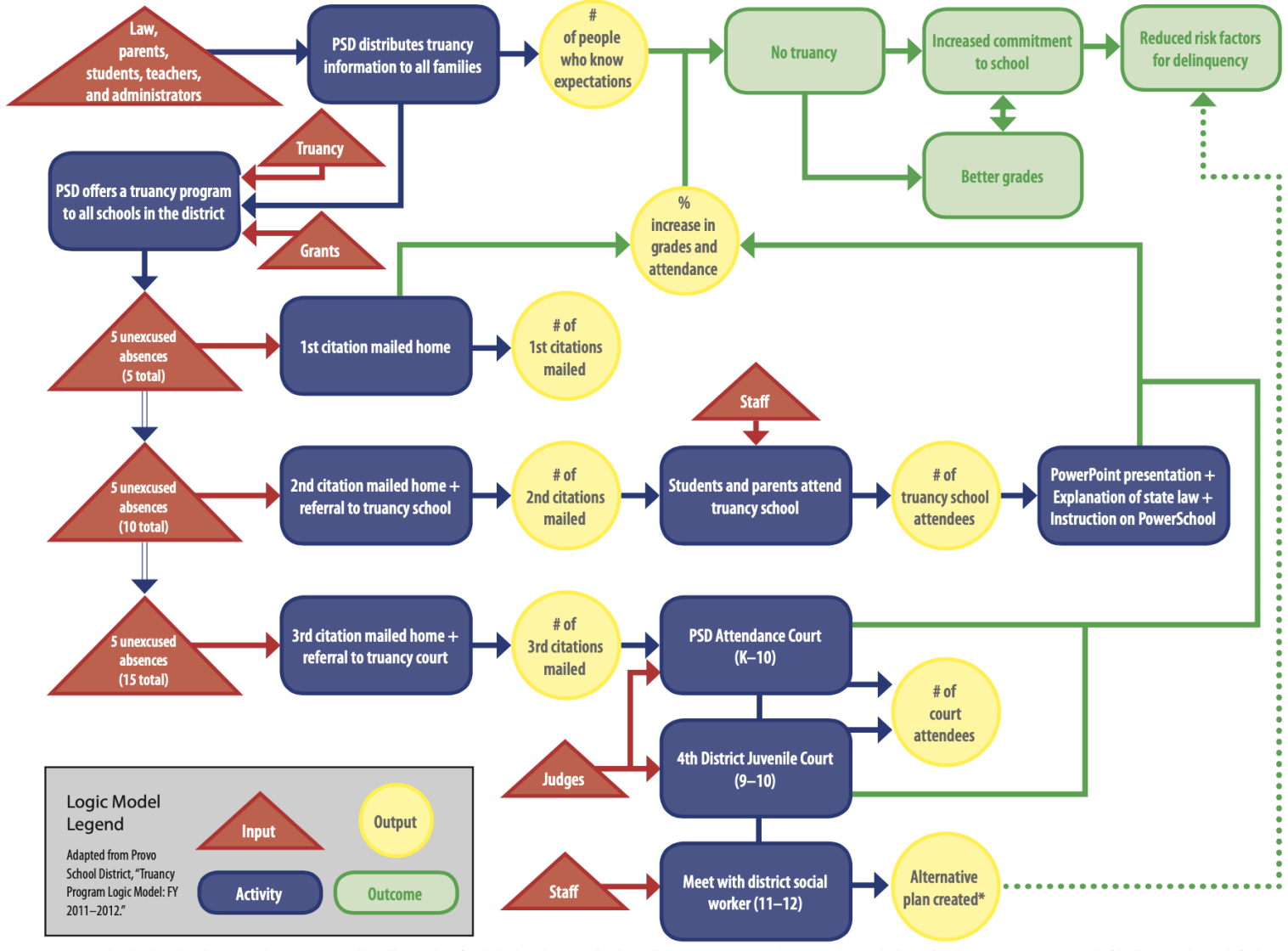
Ensure that the theory linking activities to the outcomes is sound!



Logic models & results chains

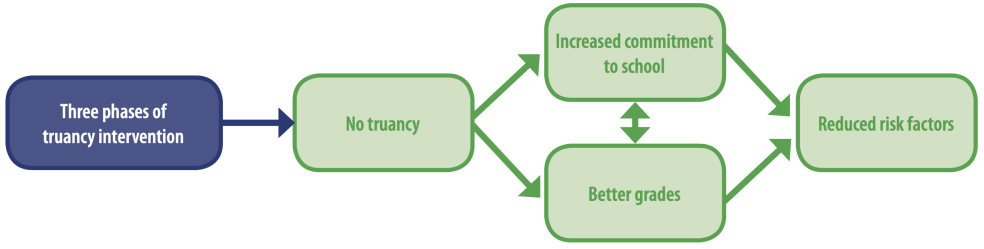
Figure B2.3.1 A Results Chain for the High School Mathematics Curriculum Reform

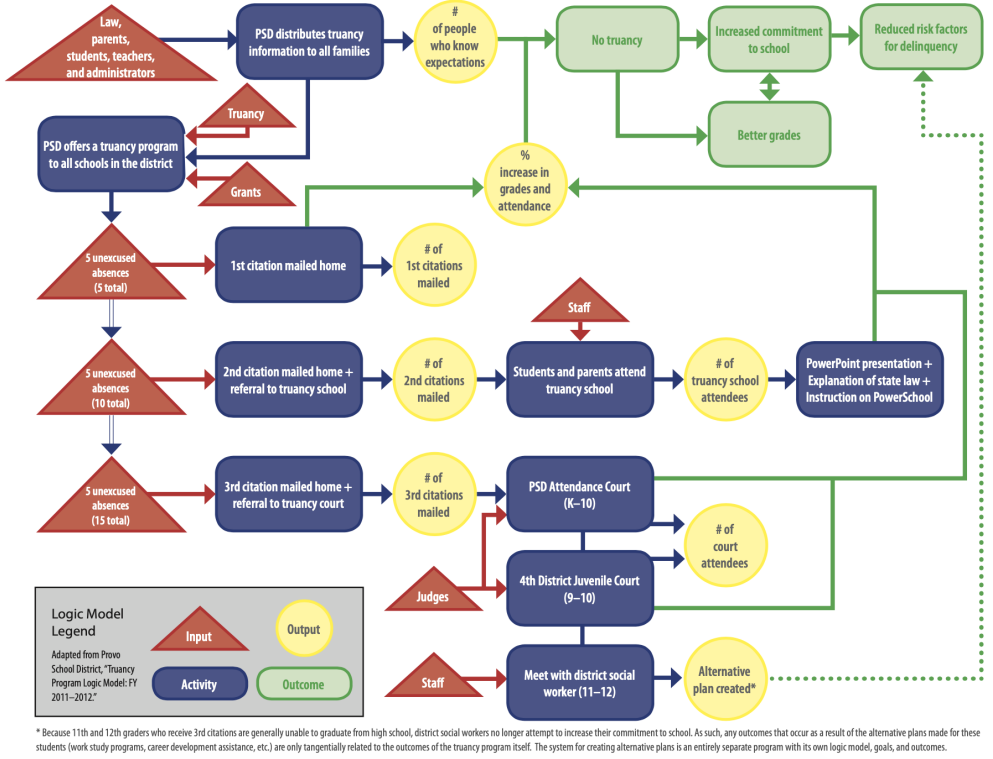




* Because 11th and 12th graders who receive 3rd citations are generally unable to graduate from high school, district social workers no longer attempt to increase their commitment to school. As such, any outcomes that occur as a result of the alternative plans made for these students (work study programs, career development assistance, etc.) are only tangentially related to the outcomes of the truancy program itself. The system for creating alternative plans is an entirely separate program with its own logic model, goals, and outcomes.

Impact theory vs. logic model





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