

Empirical Work on Economic Growth And Financial Development

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Empirical Analysis of Growth and Financial Development

- Empirical analyses generally similar to other analyses of economic growth
- General form $g_y = \beta y_{-1} + \gamma x + \delta z + \varepsilon$
 - Where g_y is the growth rate of real income
 - y_{-1} is the initial level of log real income
 - Convergence – a whole question by itself
 - x is the set of variables being examined
 - e.g. stock turnover as measure of importance of stock market
 - z is a set of “control” variables
 - e.g. secondary school enrollment relative to number of people in age group that normally attends secondary school

Data for Empirical Analyses of Economic Growth

- Most popular, and generally best, data are from Penn World Tables
 - <http://pwt.econ.upenn.edu/>
- Data on GDP and components
 - 1950 to 2000 or later to 2000
 - Essentially covers the world
 - In “international dollars”
 - Value of consumption basket in U.S. dollars but using average relative prices around the world
 - Intended to reflect purchasing power parity prices
 - Otherwise, anyone having a maid would be really rich, even if maids happen to be relatively cheap in a country

Other Data

- Sometimes people use GDP and related measures in domestic real terms
 - On one level, this doesn't matter if it's a one-commodity world, which the theoretical analyses assume
 - May affect results if prices differ a lot across countries adjusted for exchange rate and relative prices change
 - Why use real GDP? Data readily available from *World Development Indicators* and *International Financial Statistics*
- New data from Baier, Dwyer and Tamura (2005) discussed earlier
 - In “international dollars”
 - Cover much longer period
 - Have physical and human capital
 - Work underway to extend data further back

Some of the Players

- Levine and co-authors – finance
- Bekaert and Harvey – financial liberalization
- LaPorta *et al.* – financial and legal institutions
- Rousseau and Sylla – financial history
- Co-authors of above people
- Others who I don't mean to slight (including friends of mine)
- It is an enormous literature
 - Levine's (2004) selective survey is 110+ pages
 - What are we to do?
 - We can't spend the rest of our lives talking about it
 - I haven't read it all and I don't expect you to read it all either
 - By the way, not easy to publish in either – Rousseau and Harvey

A Few General Issues

- Regression of growth rate of income on lagged level
- Convergence? $\ln y - \ln y_{-1} = \beta \ln y_{-1} + \dots$
 - Lower income level countries have higher growth rate
- Same as $\ln y = (1 + \beta) \ln y_{-1} + \dots$
- $\beta < 0$ implies that this is a stable difference equation
 - Converges to steady-state income level of income
 - Constant is suppressed because I always tend to do that, but it is there
 - Mean level of income?
 - Cross-country regressions
 - Explaining cross-country differences in income levels?
 - What if no dummy variables for countries?

Exogeneity

- In statistical terms, as I use the terms here, this is a matter of whether $E\epsilon_x=0$ and $E\epsilon_z=0$
 - Important for consistent estimates
- This is tough to resolve
 - Looking at growth
 - What is exogenous relative to growth of real income?
 - Regressions are reduced forms anyway
 - Do not characterize the behavior of any particular agent
 - Characterize response of economic growth to something happening – x
 - Instruments?

What variables are exogenous?

- Geography
 - Measured, e.g., by
 - Latitude
 - Incidence of malaria
 - If it's such an awful place, why did anyone go there?
 - Nobody lives in Antarctica or at the North Pole
 - People migrating from the northern U.S. to the southern U.S. now that air conditioning is relatively cheap
 - Houston
- Legal code
 - Can be changed
- Legal origin from colonial ruler
 - Not random sampling
- Pushing variables to those which are immutable, but they need not be statistically exogenous

Another Way of Thinking About Exogeneity

- An exogenous variable is one that is causal
 - If you start up the system in roughly the same initial state, you get roughly the same sequence of states
 - If you vary something (a variable) in the initial state, then the sequence of states changes in a predictable way
 - We can say that such a variable is *causal*
- I can't imagine how one is going to find that with regressions such as these

Abandon Hope All Ye Who Enter Here?

- What does this imply?
 - Uninformative regressions?
 - “Everything is related to everything.”
- Look for developments that are largely due to external developments
 - Developments that are driven largely by domestic developments are problematic
 - Capital market liberalization
 - Sometimes yes, sometimes no
 - Turnover of stock – trading volume divided by market capitalization

Opening of Stock Exchanges

- Why would opening a stock exchange increase growth?
 - Better allocation of existing capital
 - Less reliance on assets such as cash, jewelry
 - Stocks can support capital investment – purchases of new plant and equipment and structures
- Why would someone open a stock exchange?
 - Expect that there will be a desire by people in the country to trade stock
 - Presupposes substantial legal development
 - Has not always existed
 - Does not exist everywhere

Is Creation of A Stock Exchange Associated With Higher Growth?

- Growth of
 - Output
 - Physical capital
 - Human capital
 - Total factor productivity
- Time period
 - One period
 - About 10 years
 - Two periods
 - About 20 years

Table 1
 Stock market opening dates for countries with output and capital data one period before and after opening

Country	Open date
Australia ^a	1871
Brazil ^{a,b}	1890
Belgium ^{a,b}	1901
Venezuela ^a	1947
South Korea ^{a,b}	1948
Taiwan ^{a,b}	1960
El Salvador ^a	1964
Jamaica ^a	1968
Tunisia ^a	1969
Iran ^{a,b}	1971
Singapore ^a	1973
Thailand ^{a,b}	1975
Costa Rica ^{a,b}	1976
Ivory Coast ^a	1976
Portugal ^{a,b}	1976
Switzerland ^{a,b}	1976
Indonesia ^{a,b}	1977
Jordan ^a	1978
Togo	1981
Trinidad	1981
Namibia	1985
Guatemala	1987
Bolivia	1989
Botswana	1989
Ghana	1989
Mauritius	1989
Yugoslavia	1989
China	1990
Honduras	1990
Hungary	1990
Panama	1990
Romania	1990

^a Data are available for the country for one period before and two periods after the opening of the stock market.

^b Data are available for the country for two periods before and after the opening of the stock market.

Permanent or Temporary Increase in Growth of Output?

- Permanent increase in growth of physical capital
 - Diminishing returns implies higher growth of output temporary
 - No diminishing returns if increase in growth of human capital
 - Essentially an Ak model
- Permanent increase in growth of TFP
 - Suppose TFP reflects continuing increases in knowledge
 - Stock exchange associated with increase in human capital
 - Growth of TFP increases if TFP growth increases with level of human capital (Nelson and Phelps 1966)
 - Stock exchange improves allocation of capital, not measure in real value of capital

Organizing A Stock Exchange Often Endogenous

- Examples
 - New York Stock Exchange in 1792
 - Warsaw Stock Exchange in 1991
- Endogenous in theories
 - Greenwood and Jovanovic (1990)

Increase in Growth Relative to What?

- After opening of exchange compared to before
- Relative to rest of world
 - After stock exchange created
 - Change in growth
 - Also did relative to rest of countries in region

Simple Algebra of Estimation

- Growth rate

$$y_{i,t} = \mu_i + \varepsilon_{i,t}$$

- If no effect

$$E(y_{i,t} - \mu_i) = 0$$

- If effect

$$E(z_{i,t} - \mu_i) \neq 0$$

Opening of Exchanges

- Data one period before and after
 - 32 countries
 - Australia is first in 1871
 - Romania is the last in 1990
- Data two periods before and after
 - 10 countries
 - Brazil is first in 1890
 - Indonesia is last in 1977

Table 2.
Estimated Stock Exchanges' Effects
For Two Periods Before and After Opening

	Change in Country's Growth	Country's Growth After Exchange Relative to the Rest of the World	Change in Country's Growth Relative to the Rest of the World
Mean Difference and Fraction of Countries with Higher Growth ^a			
Output	0.28 (0.82)	1.04 (0.43)	1.33 (0.55)
	0.44 (0.17)	0.67 (0.16)	0.78 (0.14)
Physical Capital	0.11 (1.06)	1.04 (0.81)	0.73 (1.21)
	0.44 (0.17)	0.56 (0.17)	0.56 (0.17)
Human Capital	0.80 (0.23)	0.14 (0.11)	0.35 (0.16)
	0.89 (0.10)	0.56 (0.17)	0.78 (0.14)
TFP	-0.29 (0.63)	0.60 (0.37)	0.86 (0.36)
	0.33 (0.16)	0.89 (0.10)	0.78 (0.14)

^a The standard deviations of the mean differences and the fractions are in parentheses.

Table 3.
Estimated Stock Exchanges' Effects
For One Period Before and Two Periods After Opening

	Change in Country's Growth	Country's Growth After Central Bank Relative to the Rest of the World	Change in Country's Growth Relative to the Rest of the World
Mean Difference and Fraction of Countries with Higher Growth ^a			
Output	-1.11 (0.75)	0.58 (0.51)	0.28 (0.67)
	0.47 (0.12)	0.59 (0.12)	0.53 (0.12)
Physical Capital	-1.65 (0.96)	0.31 (0.61)	-0.98 (0.99)
	0.35 (0.12)	0.47 (0.12)	0.41 (0.12)
Human Capital	-0.39 (0.56)	-0.04 (0.16)	-0.75 (0.55)
	0.53 (0.12)	0.47 (0.12)	0.53 (0.12)
TFP	-0.30 (0.64)	0.50 (0.37)	1.11 (0.62)
	0.41 (0.12)	0.59 (0.12)	0.65 (0.12)

^a The standard deviations of the mean differences and the fractions are in parentheses.

Table 4.
Estimated Stock Exchanges' Effects
For One Period Before and After Opening

	Change in Country's Growth	Country's Growth After Exchange Relative to the Rest of the World	Change in Country's Growth Relative to the Rest of the World
Mean Difference and Fraction of Countries with Higher Growth ^a			
Output	-0.76 (0.81)	1.14 (0.62)	0.27 (0.76)
	0.48 (0.09)	0.68 (0.08)	0.58 (0.09)
Physical Capital	-1.13 (0.90)	0.55 (0.59)	-0.63 (0.87)
	0.42 (0.09)	0.48 (0.09)	0.52 (0.09)
Human Capital	-0.37 (0.34)	0.15 (0.17)	-0.36 (0.34)
	0.39 (0.09)	0.42 (0.09)	0.45 (0.09)
TFP	-0.14 (0.75)	0.86 (0.58)	0.72 (0.73)
	0.52 (0.09)	0.68 (0.08)	0.65 (0.09)

^a The standard deviations of the mean differences and the fractions are in parentheses.

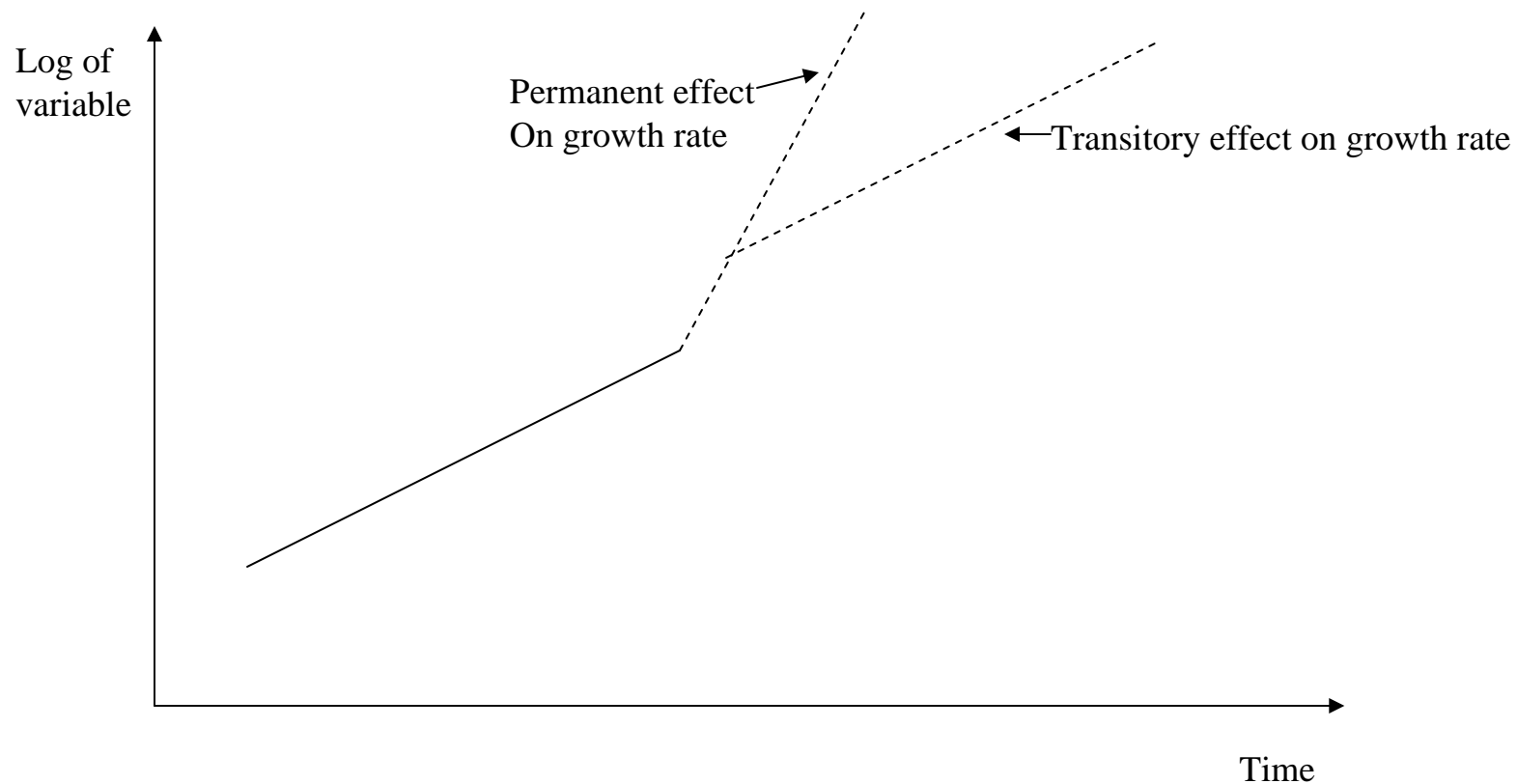
Summary of Results

- Countries with stock exchanges opening grow faster
 - Faster after
 - Faster before
 - Somewhat faster after than before
- Increase in TFP is primary source
 - Consistent with improved allocation of capital

Alternative Strategy

- Bekaert, Harvey and Lundblad (2005)
 - Looking at effect of allowing foreigners to buy stocks on local exchange
 - How sensitive are the results?
 - “fragile”
 - Run regressions with many combinations of variables
 - Run regressions with different estimators
 - No matter how they do it, they find that growth is higher for several years after liberalization
 - Some evidence that the effect diminishes over time
 - Question of level versus growth

Permanent versus Transitory Effect on Growth



No Strategy is Perfect

- Contrast is not meant to say one is better than the other
- One will be more appropriate than another depending on the circumstances

What Circumstances?

- Time period
 - Common time period in liberalization piece
 - 1980 to 1997
 - Substantially different time periods in stock market piece
 - Less commonality would have been better
 - Common international factors more of an issue in liberalization study

Another Difference

- Policy change versus private development
- Policy change
 - More likely to be overwhelmed by other things
 - Possibly more exogenous relative to growth of economy