SIMON KUZNETS MEMORIAL LECTURES
2000
LECTURE #1
Arnold C. Harberger - UCLA

INTRODUCTION

- These Lectures are something of a potpourri.
- The common thread is the growth process.
- What we have learned about it.
- How we can learn more about it.
- How we measure it.
- And the conceptual framework from which to view it.
- The soup will be salted by some gripes and grousings from this ancient mariner, mostly about the methods employed by some authors in their studies of economic growth.

- Be forewarned. The presentation will not be very orderly.
- Different strands of ideas will weave in and out as the presentation proceeds.
- The lectures are demarcated not by conceptual or substantive results, but by areas of work.
- Today: Working with national aggregate data.
- Tomorrow: Working with data on industries and firms.
- Friday: Tasks and challenges for future work.

- One of the threads that we will be following is the Two Deflator Method.
- For now, we will see how it is used with national aggregate data.
- The Traditional Method is often presented using an aggregate production function.

$$(1) \quad Y = A_t \Phi(K,L)$$

$$(2) \quad \frac{dY}{dt} = \Phi \frac{dA_t}{dt} + \Phi_K \frac{dK}{dt} + \Phi_L \frac{dL}{dt}$$

Dividing by Y, with a homogeneous of degree one production function, we get.

$$(3) \quad g_Y = g_A + s_K g_K + s_L g_L$$

- Perpetual Inventory Approach:

  Traditional Method Capital Stock

$$(4) \quad K_t = (1-\delta)K_{t-1} + \frac{I_t}{P_{It}}$$

  2-Deflator Capital Stock

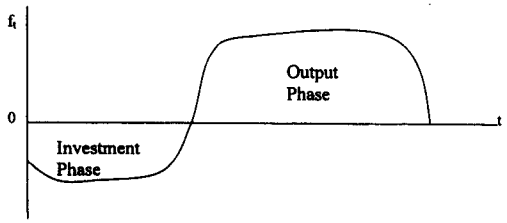
$$(5) \quad K^*_t = (1-\delta)K^*_{t-1} + \frac{I^*_t}{P^*_t}$$

- Basic differences – P_I is the investment deflator and P* is the GDP deflator. Thus, for the 2-Deflator Method, K* and Y are expressed in the same units.
- Why do we like that?

  Because we can attribute to increments of capital an increment of product equal to $(\rho + \delta)\,\Delta K^*$.

- Focusing on the rate of return opens our eyes to many aspects of the growth process and of growth analysis that we did not see clearly using the Traditional Method.
- 2-Deflator Method is based on capital theory – pure and applied.
- Applied Capital Theory / Project Evaluation

  The Project Profile



One would never deflate investment phase flow by a different deflator than the output phase.

- Standard practice is to use the GDP deflator or the CPI in *ex post* cost-benefit analysis.
- We prefer the GDP deflator because it leaves Y the same, at the national level, for the Traditional Method and the 2-Deflator Method.
- So capital, for us, is measured in GDP baskets, instead of investment goods baskets.
- Capital's contribution to ΔY is $(\rho + \delta)_{t-1}\Delta K^*_t$.
- Capital's contribution to $\frac{\Delta Y}{Y}$ is

$$(6) \qquad \frac{(\rho+\delta)K^*}{Y}\frac{\Delta K^*}{K^*} = s_K g_K .$$

- So the GDP deflator is the first deflator of the 2-Deflator Method. It is used to convert all monetary flows to real terms.
- The second deflator is w*, the real wage of a standard worker. This is a good way to correct for changes in the quality of labor.
- Analogy with residential construction in the national accounts.
- Total residential construction outlays are divided by the price of a standard house. Thus a mansion may work out to be 15 standard units and an upscale suburban house to be 5 standard units.

- So, for us, a successful surgeon may represent 20 labor units, a registered nurse 5, a medical technician 2, and maybe the medical orderly just one standard unit.
- The definition of L* is then

$$(7) \qquad L^* = \sum \frac{w_i L_i}{w^*} = \frac{\text{total labor earnings}}{w^*}$$

- The contribution of labor to ΔY is $w^*\Delta L^*$.
- Its contribution to $\frac{\Delta Y}{Y}$ is

$$(8) \qquad \frac{w^*L^*}{Y}\frac{\Delta L^*}{L^*} = s_L g_L .$$

- This labor contribution is an exact measure of $\Sigma w_i \Delta L_i$ if the "multiples" (w_i / w^*) representing the relative skill premia of different classes and types of workers remain the same, or even if their changes average to zero, i.e. if $\Sigma_i L_i \Delta\left(\frac{w_i}{w^*}\right) = 0$.
- It is possible to break this labor contribution into
  1) A part $w^* \Delta N$ due to "raw labor" (i.e. what labor would have contributed if all the increments of labor were of standard quality).
  2) A part $w^*(\Delta L^* - \Delta N)$ due to the increment of human capital being used.

- The human capital contribution can in turn be broken into a maintenance component $\frac{L^*}{N}\Delta N$, endowing new workers with the previous average human capital, and the rest (due to improved average quality of the labor force).

- Where does w* come from?

  Best answer: where does the "standard house" come from for residential construction accounts.
- We have experimented with:

  -average wage of textile or apparel workers.

  -median wage from a broader class of low-end manufacturing industries.
- Here, we use 2/3 of 1 per capita GDP.

  Why?

  -Because it is easy to get.
  -Because it is easy to explain.
  -Because if the 2-Deflator Method works reasonably well using w* = 2/3 (GDP / POP) that is a very good sign for the method. It should work even better with a more refined definition of w*.

- Enough of conceptual matters (for now).

Now, we will compare the 2-Deflator Method with the Traditional Method for 23 countries.

- These were countries for which U.N. National Accounts gave "compensation to workers". Where these accounts also gave "income of unincorporated enterprises", half of which was assigned to labor and half to owners of capital.
- Otherwise the following formula was used:

$$s_L = \frac{\text{"comp. to workers"} + 0.3(Y - \text{"IndirectTaxes"} - \text{"comp. to workers"})}{Y - \text{"IndirectTaxes"}}$$

Kuznets Lecture I - ④

- First, we compare graphs of

  K and K* (capital stock time series)

  L and L* (labor force time series)

  for the 23 countries.

- Then, we plot against each other

  -the two capital contributions to growth (Traditional and 2-Deflator)

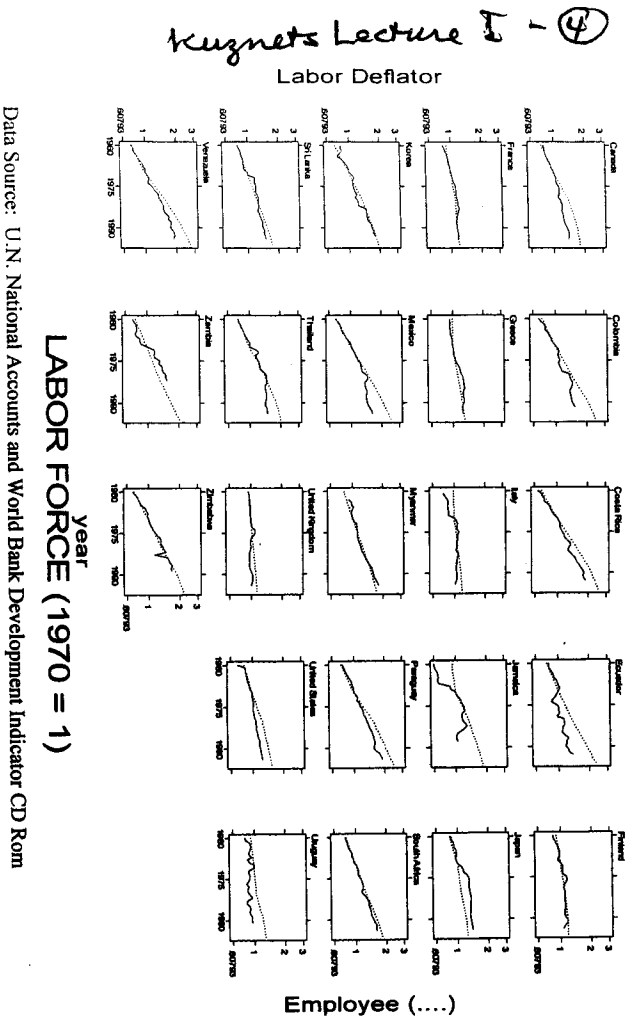
  -the two labor contributions to growth (Traditional and 2-Deflator)

- This is done for growth measured:

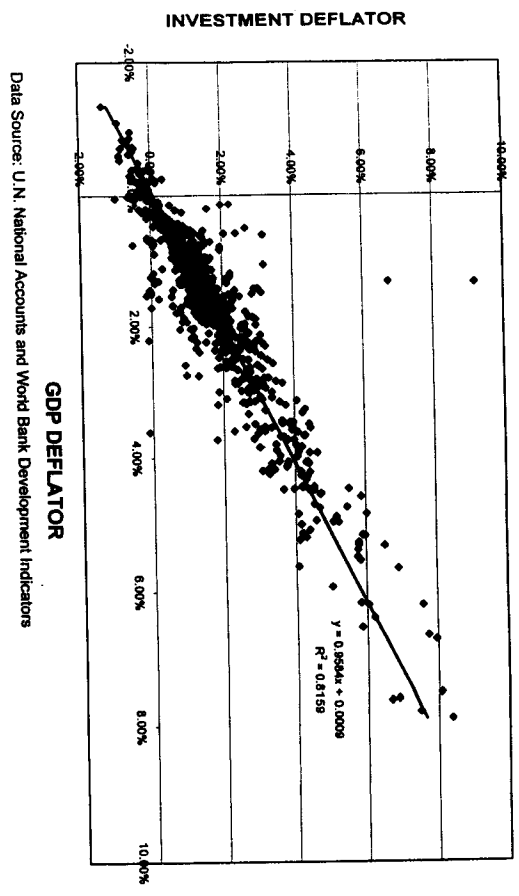
  a) in annual steps

  b) in non-overlapping 5-year steps

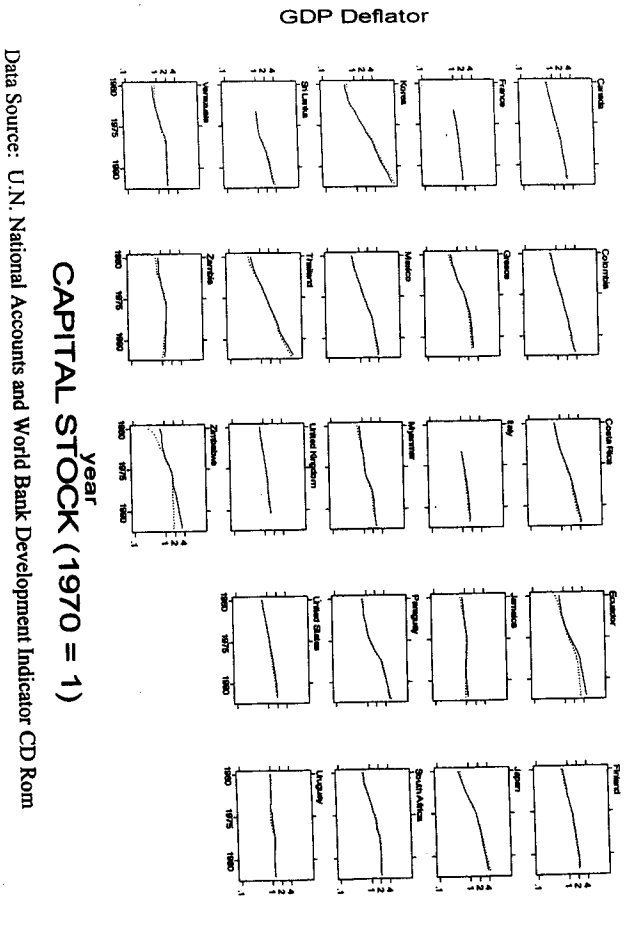
- Then, f.y.i., we plot our raw labor contribution against the Traditional labor contribution.



Data Source: U.N. National Accounts and World Bank Development Indicator CD Rom



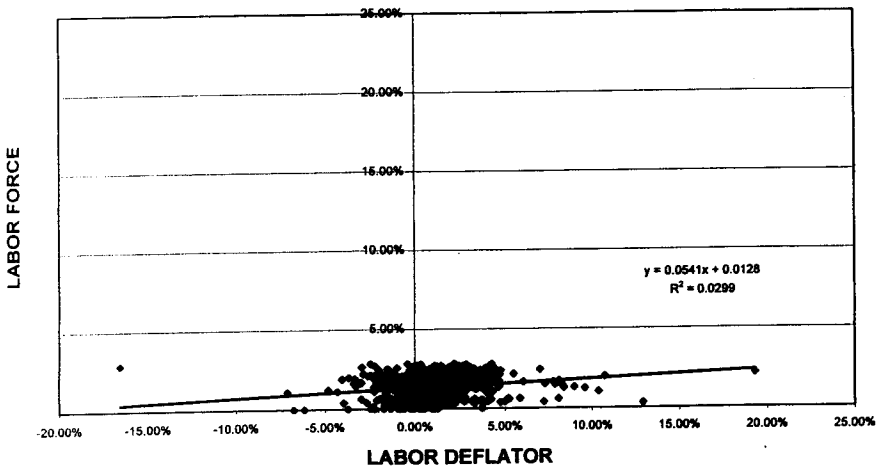
Data Source: U.N. National Accounts and World Bank Development Indicators



Data Source: U.N. National Accounts and World Bank Development Indicator CD Rom

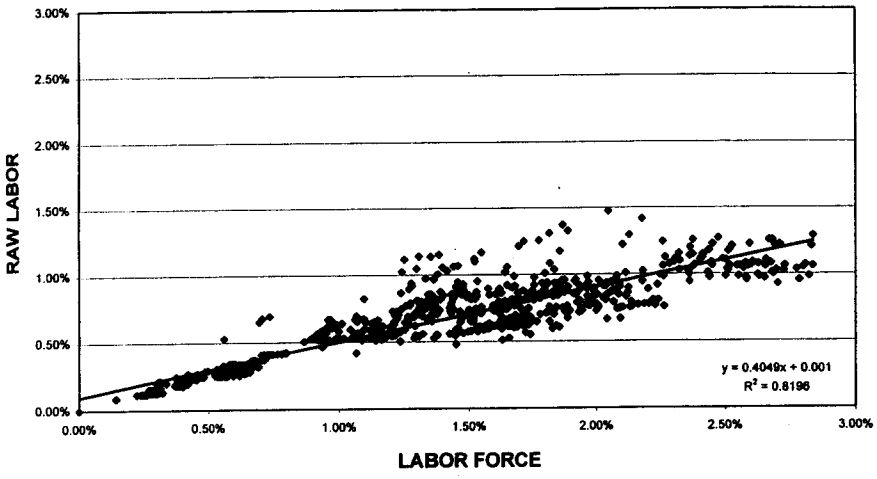
Kuznets Lecture I - ②

LABOR CONTRIBUTION (Annual)



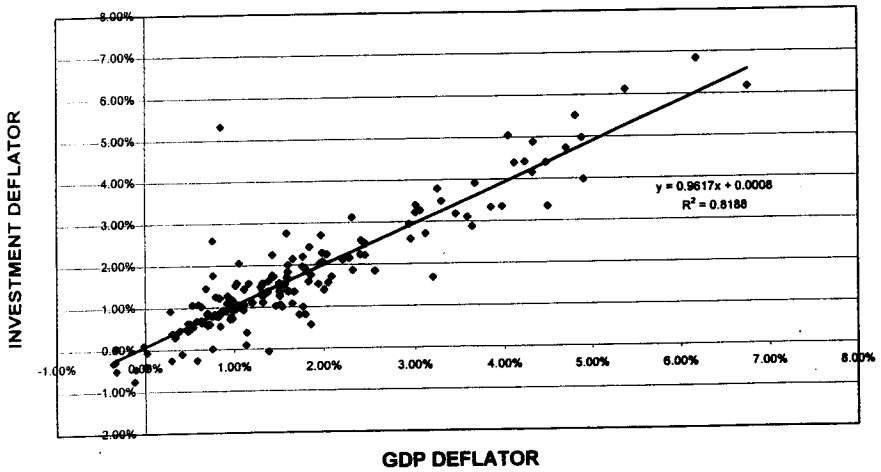
Data Source: U.N. National Accounts and World Bank Development Indicators

RAW LABOR CONTRIBUTION (Annual)



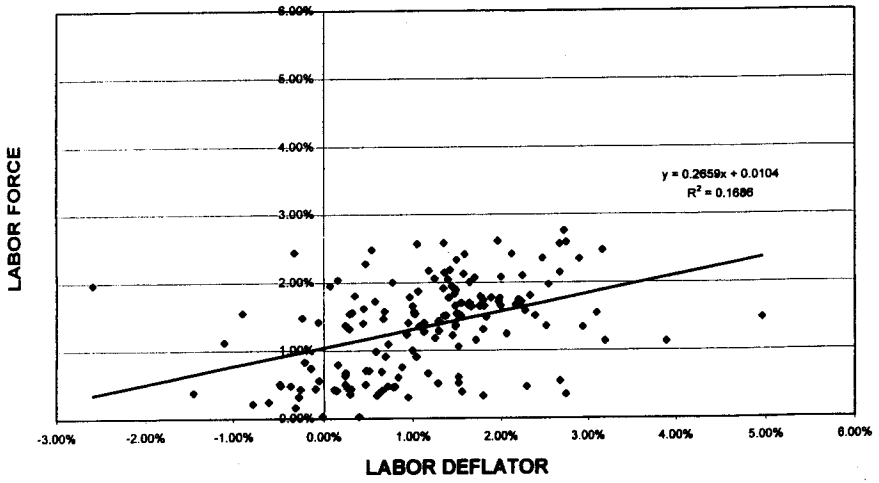
Data Source: U.N. National Accounts and World Bank Development Indicators

CAPITAL CONTRIBUTION (5 Year)

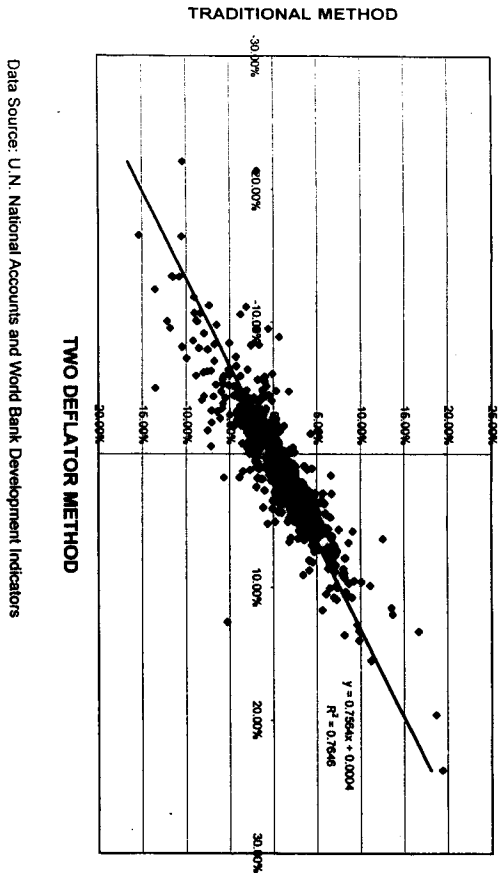


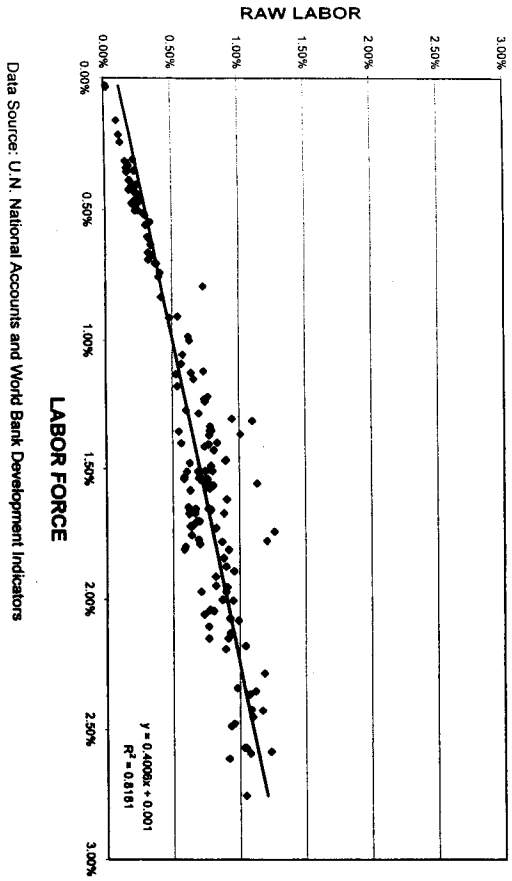
Data Source: U.N. National Accounts and World Bank Development Indicators

LABOR CONTRIBUTION (5 Year)



Data Source: U.N. National Accounts and World Bank Development Indicators

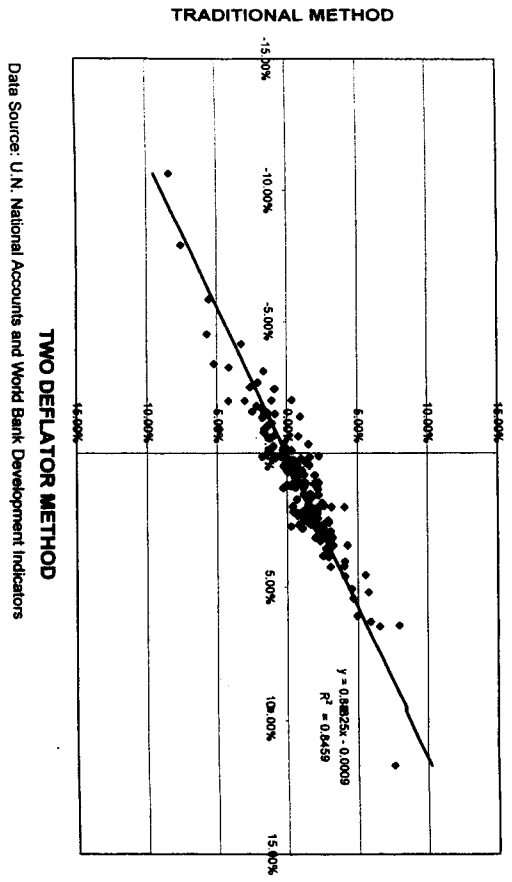




- Finally, we plot a scatter of the TFP contribution to the changes in output, measured by the two methods.

  In annual steps, $R^2 = .77$

  In 5 year steps, $R^2 = .85$



- Now to some substantive stories.

One easy and familiar story concerns accounting for the differences between high-growth and low-growth episodes. For this purpose, averages are taken of the top set (20 of 144) of growth experiences and a bottom set (also 20 of 144). Then differences are taken between the averages of the two sets.

- In this case the stories told by the two methods are virtually identical.

COMPARISON OF HIGH AND LOW GROWTH PERIODS (TOP AND BOTTOM 20)

RANK	COUNTRY	YEAR	LABOR SHARE	NET RATE OF RETURN	GDP GROWTH	2-DEFLATOR METHOD: LABOR CONTRIB. (LABOR DEFLATOR)	2-DEFLATOR METHOD: CAPITAL CONTRIB. (GDP DEFLATOR)	2-DEFLATOR METHOD: REAL COST REDUCTION (TWO DEFLATOR)
1	Ecuador	1970-74	62.74%	15.88%	11.43%	-2.59%	2.32%	11.70%
2	Japan	1965-69	56.89%	10.89%	10.64%	0.58%	3.58%	6.48%
3	Japan	1960-64	56.01%	9.78%	10.64%	1.00%	3.20%	6.44%
4	Zimbabwe	1970-74	67.17%	12.41%	10.40%	1.64%	2.46%	6.29%
5	Korea	1970-74	50.98%	23.66%	10.21%	1.02%	5.39%	3.81%
6	Korea	1985-89	60.32%	11.76%	9.87%	1.12%	3.67%	5.08%
7	Costa Rica	1965-69	63.36%	12.16%	9.43%	2.68%	1.57%	5.19%
8	Korea	1975-79	50.63%	21.54%	9.29%	0.44%	6.18%	2.67%
9	Thailand	1990-94	46.00%	15.25%	9.13%	0.16%	6.75%	2.22%
10	Korea	1965-69	48.46%	27.29%	8.89%	2.39%	4.49%	2.01%
11	Paraguay	1975-79	55.41%	21.04%	8.81%	1.59%	4.48%	2.75%
12	Thailand	1985-89	49.10%	14.90%	8.74%	0.28%	3.85%	4.60%
13	Thailand	1965-69	51.45%	21.16%	8.51%	1.80%	4.04%	2.67%
14	Thailand	1975-79	51.81%	17.39%	8.12%	1.80%	4.32%	2.01%
15	Ecuador	1975-79	55.88%	19.68%	7.61%	1.55%	4.91%	1.16%
16	Mexico	1960-64	51.81%	18.69%	7.53%	1.64%	1.86%	4.02%
17	Greece	1960-64	48.51%	20.28%	7.38%	-0.02%	1.97%	5.43%
18	Paraguay	1970-74	56.04%	20.10%	7.30%	1.49%	1.96%	3.85%
19	Venezuela	1960-64	58.14%	8.16%	7.27%	1.97%	0.76%	4.54%
20	Greece	1965-69	49.67%	20.85%	7.07%	0.39%	3.25%	3.42%
Average of High Growth Periods			54.52%	17.14%	8.91%	1.06%	3.56%	4.32%

Data Source: U.N. National Accounts and World Bank Development Indicators

COMPARISON OF HIGH AND LOW GROWTH PERIODS (TOP AND BOTTOM 20)

RANK	COUNTRY	YEAR	GDP GROWTH	TRADITIONAL METHOD: LABOR CONTRIB. (LABOR FORCE)	TRADITIONAL METHOD: CAPITAL CONTRIB. (INVESTMENT DEFLATOR)	TRADITIONAL METHOD: REAL COST REDUCTION (TRADTIONAL METHOD)
1	Ecuador	1970-74	11.43%	1.97%	1.86%	7.60%
2	Japan	1965-69	10.64%	0.99%	3.10%	6.56%
3	Japan	1960-64	10.64%	1.00%	1.67%	7.97%
4	Zimbabwe	1970-74	10.40%	2.01%	2.49%	5.90%
5	Korea	1970-74	10.21%	1.56%	6.12%	2.53%
6	Korea	1985-89	9.87%	1.41%	3.91%	4.56%
7	Costa Rica	1965-69	9.43%	2.15%	1.54%	5.75%
8	Korea	1975-79	9.29%	1.62%	6.83%	0.84%
9	Thailand	1990-94	9.13%	0.79%	6.17%	2.17%
10	Korea	1965-69	8.89%	1.51%	3.35%	4.04%
11	Paraguay	1975-79	8.81%	2.42%	4.39%	2.00%
12	Thailand	1985-89	8.74%	1.32%	3.34%	4.08%
13	Thailand	1965-69	8.51%	1.31%	5.05%	2.16%
14	Thailand	1975-79	8.12%	1.74%	4.15%	2.23%
15	Ecuador	1975-79	7.61%	1.70%	3.98%	1.93%
16	Mexico	1960-64	7.53%	1.70%	1.76%	4.07%
17	Greece	1960-64	7.38%	0.04%	2.71%	4.64%
18	Paraguay	1970-74	7.30%	2.34%	2.03%	2.93%
19	Venezuela	1960-64	7.27%	1.72%	0.01%	5.54%
20	Greece	1965-69	7.07%	0.03%	3.78%	3.25%
Average of High Growth Periods			8.91%	1.47%	3.41%	4.84%

Data Source: U.N. National Accounts and World Bank Development Indicators

Lugnetts Lecture I - (8)

COMPARISON OF HIGH AND LOW GROWTH PERIODS (TOP AND BOTTOM 20)

				TRADITIONAL METHOD		
RANK	COUNTRY	YEAR	GDP GROWTH	LABOR CONTRIB. (LABOR FORCE)	CAPITAL CONTRIB. (INVESTMENT DEFLATOR)	REAL COST REDUCTION (TRADTIONAL METHOD)
125	France	1990-94	1.28%	0.50%	0.68%	0.10%
126	Mexico	1985-89	1.24%	1.81%	1.09%	-1.66%
127	South Africa	1975-79	1.11%	1.66%	1.62%	-2.17%
128	Uruguay	1970-74	1.10%	0.36%	-0.26%	1.00%
129	Canada	1990-94	0.81%	0.91%	1.26%	-1.36%
130	United Kingdom	1980-84	0.78%	0.43%	0.32%	0.02%
131	South Africa	1985-89	0.74%	1.79%	0.29%	-1.34%
132	Uruguay	1980-84	0.72%	0.47%	-0.11%	0.36%
133	Italy	1990-94	0.70%	0.32%	0.63%	-0.25%
134	Greece	1990-94	0.46%	0.51%	0.79%	-0.84%
135	Zambia	1985-89	0.32%	1.66%	-0.26%	-1.08%
136	South Africa	1990-94	0.09%	1.51%	-0.06%	-1.36%
137	Costa Rica	1980-84	-0.19%	2.57%	1.40%	-4.16%
138	Jamaica	1980-84	-0.42%	1.41%	-0.51%	-1.33%
139	Myanmar	1985-89	-1.08%	1.24%	0.94%	-3.25%
140	Finland	1990-94	-1.16%	0.16%	0.45%	-1.77%
141	Zimbabwe	1975-79	-1.86%	1.97%	1.73%	-5.56%
142	Jamaica	1975-79	-2.20%	1.95%	0.04%	-4.20%
143	Venezuela	1980-84	-2.52%	2.15%	1.03%	-5.70%
144	Uruguay	1980-84	-2.91%	0.83%	1.46%	-5.20%
Average of Low Growth Periods			-0.15%	1.21%	0.63%	-1.99%
Average of High Growth Periods			8.91%	1.47%	3.41%	4.04%
Average of Low Growth Periods			-0.15%	1.21%	0.63%	-1.99%
Differences in Averages			9.06%	0.25%	2.79%	6.02%

Data Source: U.N. National Accounts and World Bank Development Indicators

COMPARISON OF HIGH AND LOW GROWTH PERIODS (TOP AND BOTTOM 20)

						2-DEFLATOR METHOD		
RANK	COUNTRY	YEAR	LABOR SHARE	NET RATE OF RETURN	GDP GROWTH	LABOR CONTRIB. (LABOR DEFLATOR)	CAPITAL CONTRIB. (GDP DEIFLATOR)	REAL COST REDUCTION (TWO DEFLATOR)
125	France	1990-94	67.92%	4.18%	1.28%	0.46%	0.58%	0.24%
126	Mexico	1985-89	50.36%	13.47%	1.24%	0.35%	1.65%	-0.76%
127	South Africa	1975-79	71.54%	3.87%	1.11%	1.48%	1.39%	-1.75%
128	Uruguay	1970-74	67.02%	4.55%	1.10%	0.29%	0.58%	0.22%
129	Canada	1990-94	67.65%	5.28%	0.81%	1.04%	0.79%	-1.02%
130	United Kingdom	1980-84	71.68%	3.94%	0.78%	-0.26%	0.34%	0.70%
131	South Africa	1985-89	70.67%	3.01%	0.74%	0.97%	0.34%	-0.57%
132	Uruguay	1980-84	67.11%	3.81%	0.72%	2.30%	0.41%	-1.99%
133	Italy	1990-94	64.56%	5.23%	0.70%	-0.28%	0.48%	0.50%
134	Greece	1990-94	53.92%	12.02%	0.46%	-0.49%	0.76%	0.19%
135	Zambia	1985-89	65.44%	2.79%	0.32%	2.00%	0.30%	-1.97%
136	South Africa	1990-94	72.41%	2.57%	0.09%	1.54%	0.02%	-1.47%
137	Costa Rica	1980-84	65.46%	6.94%	-0.19%	1.05%	2.00%	-3.25%
138	Jamaica	1980-84	62.41%	2.18%	-0.42%	-0.06%	-0.32%	-0.04%
139	Myanmar	1985-89	60.43%	14.57%	-1.08%	2.07%	0.99%	-4.13%
140	Finland	1990-94	68.63%	2.93%	-1.16%	-0.32%	0.48%	-1.33%
141	Zimbabwe	1975-79	70.15%	6.94%	-1.86%	2.54%	1.44%	-5.85%
142	Jamaica	1975-79	64.97%	1.72%	-2.20%	0.07%	-0.32%	-1.95%
143	Venezuela	1980-84	55.86%	5.44%	-2.52%	1.35%	0.63%	-4.51%
144	Uruguay	1980-84	60.41%	6.26%	-2.91%	-0.21%	0.68%	-3.38%
Average of Low Growth Periods			64.94%	5.58%	-0.15%	0.79%	0.66%	-1.61%
Average of High Growth Periods			54.52%	17.14%	8.91%	1.05%	3.55%	4.32%
Average of Low Growth Periods			64.94%	5.58%	-0.15%	0.79%	0.66%	-1.61%
Differences in Averages			-10.42%	11.57%	9.06%	0.25%	2.89%	5.92%

Data Source: U.N. National Accounts and World Bank Development Indicators

SUMMARY OF 20 HIGH AND 20 LOW GROWTH PERIODS

	GDP GROWTH	LABOR CONTRIB.	CAPITAL CONTRIB.	REAL COST REDUCTION
Average of 20 High Growth Periods				
2-Deflator Method	8.91%	1.05%	3.55%	4.32%
Traditional Method	8.91%	1.47%	3.41%	4.04%
Average of 20 Low Growth Periods				
2-Deflator Method	-0.15%	0.79%	0.66%	-1.61%
Traditional Method	-0.15%	1.21%	0.63%	-1.99%
Differences in Averages				
2-Deflator Method	9.06%	0.25%	2.89%	5.92%
Traditional Method	9.06%	0.25%	2.79%	6.02%

Data Source: U.N. National Accounts and World Bank Development Indicators

- It is, of course possible that these stories would mainly reflect "country effects", with a few countries accounting for most of the high-growth episodes, and a different few countries for most of the low-growth episodes.
- To guard against this possibility, we made another set of tables. In this case the "high-growth" observations were the single highest 5-year GDP growth period for each country. The "low-growth" observations were similarly composed of each country's lowest-growth quinquennium.

COMPARISON OF HIGH AND LOW GROWTH PERIODS

(HIGH AND LOW FOR EACH COUNTRY)

				TRADITIONAL METHOD		
RANK	COUNTRY	YEAR	GDP GROWTH	LABOR CONTRIB. (LABOR FORCE)	CAPITAL CONTRIB. (INVESTMENT DEFLATOR)	REAL COST REDUCTION (TRADITIONAL METHOD)
36	Canada	1965-69	5.72%	1.65%	1.57%	2.49%
22	Colombia	1970-74	6.99%	2.06%	2.12%	2.81%
7	Costa Rica	1965-69	9.43%	2.15%	1.54%	5.75%
1	Ecuador	1970-74	11.43%	1.97%	1.86%	7.60%
30	Finland	1970-74	6.44%	0.61%	1.58%	4.25%
52	France	1970-74	4.68%	0.66%	1.10%	2.92%
17	Greece	1960-64	7.38%	0.04%	2.71%	4.64%
57	Italy	1970-74	4.48%	0.48%	0.92%	3.09%
47	Jamaica	1970-74	5.04%	1.54%	1.22%	2.27%
2	Japan	1965-69	10.64%	0.99%	3.10%	6.56%
5	Korea	1970-74	10.21%	1.56%	6.12%	2.53%
16	Mexico	1960-64	7.53%	1.70%	1.76%	4.07%
32	Myanmar	1980-84	6.24%	1.22%	2.87%	2.15%
11	Paraguay	1975-79	8.81%	2.42%	4.39%	2.00%
31	South Africa	1960-64	6.41%	1.53%	0.84%	4.03%
35	Sri Lanka	1990-94	5.76%	1.27%	1.27%	3.21%
9	Thailand	1990-94	9.13%	0.79%	6.17%	2.17%
62	United Kingdom	1970-74	4.34%	0.39%	0.82%	3.13%
59	United States	1960-64	4.39%	1.13%	1.00%	2.26%
70	Uruguay	1975-79	4.14%	0.22%	0.87%	3.05%
19	Venezuela	1960-64	7.27%	1.72%	0.01%	5.54%
45	Zambia	1975-79	5.19%	1.47%	2.76%	0.96%
4	Zimbabwe	1970-74	10.40%	2.01%	2.49%	5.90%
Average of High Growth Periods			7.05%	1.29%	2.13%	3.63%

Data Source: U.N. National Accounts and World Bank Devlopment Indicators

COMPARISON OF HIGH AND LOW GROWTH PERIODS

(HIGH AND LOW FOR EACH COUNTRY)

						2-DEFLATOR METHOD		
RANK	COUNTRY	YEAR	LABOR SHARE	NET RATE OF RETURN	GDP GROWTH	LABOR CONTRIB. (LABOR DEFLATOR)	CAPITAL CONTRIB. (GDP DEFLATOR)	REAL COST REDUCTION (TWO DEFLATOR)
36	Canada	1965-69	62.73%	8.87%	5.72%	1.81%	2.05%	1.86%
22	Colombia	1970-74	60.34%	16.05%	6.99%	1.24%	2.21%	3.54%
7	Costa Rica	1965-69	63.36%	12.16%	9.43%	2.68%	1.57%	5.19%
1	Ecuador	1970-74	62.74%	15.88%	11.43%	-2.59%	2.32%	11.70%
30	Finland	1970-74	68.17%	4.87%	6.44%	1.52%	1.51%	3.41%
52	France	1970-74	68.06%	3.60%	4.68%	1.17%	1.01%	2.50%
17	Greece	1960-64	48.51%	20.28%	7.38%	-0.02%	1.97%	5.43%
57	Italy	1970-74	67.56%	4.03%	4.48%	0.72%	0.87%	2.90%
47	Jamaica	1970-74	62.79%	2.89%	5.04%	3.10%	0.84%	1.10%
2	Japan	1965-69	56.89%	10.89%	10.64%	0.58%	3.58%	6.48%
5	Korea	1970-74	50.96%	23.66%	10.21%	1.02%	5.39%	3.81%
16	Mexico	1960-64	51.81%	18.69%	7.53%	1.64%	1.86%	4.02%
32	Myanmar	1980-84	59.27%	18.37%	6.24%	1.44%	3.64%	1.15%
11	Paraguay	1975-79	55.41%	21.04%	8.81%	1.59%	4.48%	2.75%
31	South Africa	1960-64	70.01%	5.39%	6.41%	1.51%	0.70%	4.20%
35	Sri Lanka	1990-94	66.01%	7.02%	5.76%	1.12%	1.51%	3.13%
9	Thailand	1990-94	46.00%	15.25%	9.13%	0.16%	6.75%	2.22%
62	United Kingdom	1970-74	74.07%	4.18%	4.34%	1.55%	0.79%	2.00%
59	United States	1960-64	66.38%	8.27%	4.39%	3.20%	1.08%	0.11%
70	Uruguay	1975-79	61.71%	6.52%	4.14%	-0.79%	0.70%	4.23%
19	Venezuela	1960-64	58.14%	8.16%	7.27%	1.97%	0.76%	4.54%
45	Zambia	1975-79	59.42%	5.74%	5.19%	4.96%	1.59%	-1.36%
4	Zimbabwe	1970-74	67.17%	12.41%	10.40%	1.64%	2.46%	6.29%
Average of High Growth Periods			61.20%	11.06%	7.05%	1.38%	2.16%	3.53%

Data Source: U.N. National Accounts and World Bank Devlopment Indicators

Krugman Lecture I - (10)

COMPARISON OF HIGH AND LOW GROWTH PERIODS

(HIGH AND LOW FOR EACH COUNTRY)

						2-DEFLATOR METHOD		
RANK	COUNTRY	YEAR	LABOR SHARE	NET RATE OF RETURN	GDP GROWTH	LABOR CONTRIB. (LABOR DEFLATOR)	CAPITAL CONTRIB. (GDP DEFLATOR)	REAL COST REDUCTION (TWO DEFLATOR)
129	Canada	1990-94	67.65%	5.28%	0.81%	1.04%	0.79%	-1.02%
105	Colombia	1980-84	65.93%	11.19%	2.49%	3.17%	1.99%	-2.67%
137	Costa Rica	1980-84	65.46%	6.94%	-0.19%	1.05%	2.00%	-3.25%
124	Ecuador	1985-89	52.90%	12.90%	1.30%	1.06%	1.77%	-1.53%
140	Finland	1990-94	68.63%	2.93%	-1.16%	-0.32%	0.48%	-1.33%
125	France	1990-94	67.92%	4.18%	1.28%	0.46%	0.58%	0.24%
134	Greece	1990-94	53.92%	12.02%	0.46%	-0.49%	0.76%	0.19%
133	Italy	1990-94	64.59%	5.23%	0.70%	-0.28%	0.48%	0.50%
142	Jamaica	1975-79	64.97%	1.72%	-2.20%	0.07%	-0.32%	-1.95%
107	Japan	1990-94	65.35%	4.61%	2.19%	0.78%	1.60%	-0.19%
42	Korea	1980-84	55.39%	13.27%	5.42%	2.94%	4.88%	-2.41%
126	Mexico	1985-89	50.36%	13.47%	1.24%	0.35%	1.65%	-0.76%
139	Myanmar	1985-89	60.43%	14.57%	-1.08%	2.07%	0.99%	-4.13%
100	Paraguay	1990-94	51.01%	13.46%	2.70%	1.84%	1.98%	-1.11%
136	South Africa	1990-94	72.41%	2.57%	0.09%	1.54%	0.02%	-1.47%
96	Sri Lanka	1980-84	65.35%	8.85%	2.96%	-0.24%	3.06%	0.14%
43	Thailand	1980-84	53.22%	14.29%	5.39%	0.32%	3.97%	1.10%
130	United Kingdom	1980-84	71.88%	3.94%	0.78%	-0.26%	0.34%	0.70%
118	United States	1980-84	67.35%	6.85%	1.59%	0.72%	0.97%	-0.10%
144	Uruguay	1980-84	60.41%	6.26%	-2.91%	-0.21%	0.68%	-3.38%
143	Venezuela	1980-84	55.86%	5.44%	-2.52%	1.35%	0.63%	-4.51%
135	Zambia	1985-89	65.44%	2.79%	0.32%	2.00%	0.30%	-1.97%
141	Zimbabwe	1975-79	70.15%	6.94%	-1.86%	2.54%	1.44%	-5.85%
Average of Low Growth Periods			62.46%	7.81%	0.77%	0.93%	1.35%	-1.51%
Average of High Growth Periods			61.29%	11.05%	7.05%	1.36%	2.16%	3.53%
Average of Low Growth Periods			62.46%	7.81%	0.77%	0.93%	1.35%	-1.51%
Differences in Averages			-1.26%	3.24%	6.27%	0.42%	0.81%	5.04%

Data Source: U.N. National Accounts and World Bank Devlopment Indicators

COMPARISON OF HIGH AND LOW GROWTH PERIODS

(HIGH AND LOW FOR EACH COUNTRY)

				TRADITIONAL METHOD		
RANK	COUNTRY	YEAR	GDP GROWTH	LABOR CONTRIB. (LABOR FORCE)	CAPITAL CONTRIB. (INVESTMENT DEFLATOR)	REAL COST REDUCTION (TRADITIONAL METHOD)
129	Canada	1990-94	0.81%	0.91%	1.26%	-1.36%
105	Colombia	1980-84	2.49%	2.48%	2.07%	-2.06%
137	Costa Rica	1980-84	-0.19%	2.57%	1.40%	-4.16%
124	Ecuador	1985-89	1.30%	1.87%	1.01%	-1.58%
140	Finland	1990-94	-1.16%	0.16%	0.45%	-1.77%
125	France	1990-94	1.28%	0.50%	0.68%	0.10%
134	Greece	1990-94	0.46%	0.51%	0.79%	-0.84%
133	Italy	1990-94	0.70%	0.32%	0.63%	-0.25%
142	Jamaica	1975-79	-2.20%	1.95%	0.04%	-4.20%
107	Japan	1990-94	2.19%	0.46%	1.84%	-0.11%
42	Korea	1980-84	5.42%	1.34%	4.98%	-0.90%
126	Mexico	1985-89	1.24%	1.81%	1.09%	-1.66%
139	Myanmar	1985-89	-1.08%	1.24%	0.94%	-3.25%
100	Paraguay	1990-94	2.70%	1.49%	2.29%	-1.07%
136	South Africa	1990-94	0.09%	1.51%	-0.06%	-1.36%
96	Sri Lanka	1980-84	2.96%	1.48%	3.27%	-1.79%
43	Thailand	1980-84	5.39%	1.56%	3.34%	0.49%
130	United Kingdom	1980-84	0.78%	0.43%	0.32%	0.02%
118	United States	1980-84	1.59%	1.09%	0.77%	-0.27%
144	Uruguay	1980-84	-2.91%	0.83%	1.46%	-5.20%
143	Venezuela	1980-84	-2.52%	2.15%	1.03%	-5.70%
135	Zambia	1985-89	0.32%	1.66%	-0.26%	-1.08%
141	Zimbabwe	1975-79	-1.86%	1.97%	1.73%	-5.56%
Average of Low Growth Periods			0.77%	1.32%	1.35%	-1.89%
Average of High Growth Periods			7.05%	1.29%	2.13%	3.63%
Average of Low Growth Periods			0.77%	1.32%	1.35%	-1.89%
Differences in Averages			6.27%	-0.03%	0.78%	5.52%

Data Source: U.N. National Accounts and World Bank Devlopment Indicators

SUMMARY OF COUNTRY BY COUNTRY HIGH AND LOW GROWTH PERIODS

	GDP GROWTH	LABOR CONTRIB.	CAPITAL CONTRIB.	REAL COST REDUCTION
Average of 20 High Growth Periods				
2-Deflator Method	7.05%	1.36%	2.16%	3.53%
Traditional Method	7.05%	1.29%	2.13%	3.63%
Average of 20 Low Growth Periods				
2-Deflator Method	0.77%	0.93%	1.35%	-1.51%
Traditional Method	0.77%	1.32%	1.35%	-1.89%
Differences in Averages				
2-Deflator Method	6.27%	0.42%	0.81%	5.04%
Traditional Method	6.27%	-0.03%	0.78%	5.52%

Data Source: U.N. National Accounts and World Bank Development Indicators

Kuznets lecture I - (11)

- One important footnote, however:

  The capital contribution consists of $(\rho+\delta)\frac{\Delta K^*}{Y}$ in the 2-Deflator Method. So we can isolate the average rates of return (ρ) for the high-growth (17.14%) and the low-growth (5.58%) episodes. Clearly this is an enormous difference, which lets us see inside of the growth process in a way the Traditional Method does not. When high and low growth periods are taken country by country, the average rates of return (ρ) are 11.05% for the high-growth and 7.81% for the low-growth periods.

- The preceding results were substantive, but did not entail predictions.
- Now, we turn to ΔTFP as a predictor of future events.
- This is our first glimpse of what I think of as "my story" of the growth process.
- It is a syndrome in which real cost reduction plays the leading role, stimulating
  - -higher rates of return
  - -higher rates of investment
  - -higher output growth
- This syndrome pervades the data we have dealt with, and you will see it again tomorrow.

- Our procedure is to correlate future values with base period values. The base period value is the average over the year in which the real cost reduction takes place (is measured).
- Thus, we look at

$$\rho_{t+1} - \frac{\rho_t + \rho_{t-1}}{2}, \quad \rho_{t+2} - \frac{\rho_t + \rho_{t-1}}{2}, \quad \rho_{t+3} - \frac{\rho_t + \rho_{t-1}}{2}, \ldots$$

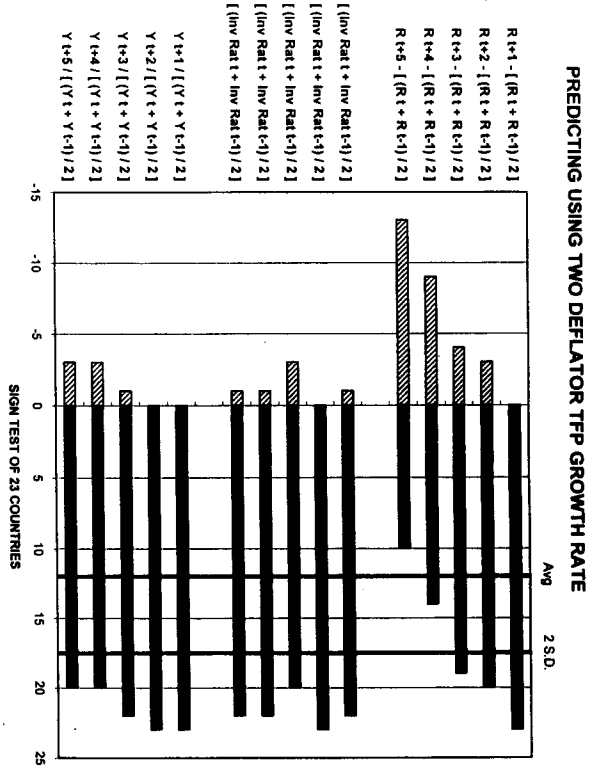
Similarly,

$$\left(\frac{\Delta K^*}{K^*}\right)_{t+j} - \frac{\left(\frac{\Delta K^*}{K^*}\right)_t + \left(\frac{\Delta K^*}{K^*}\right)_{t-1}}{2}$$

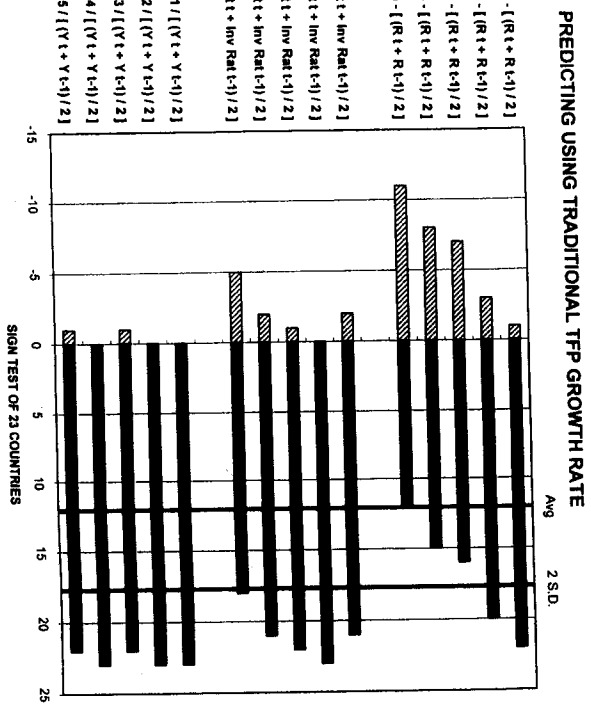
and

$$\frac{Y_{t+j}}{\left(\frac{(Y_t + Y_{t-1})}{2}\right)}$$

Data Source: U.N. National Accounts and World Bank Development Indicators



Data Source: U.N. National Accounts and World Bank Development Indicators



- Conclusion:
  1. The syndrome is real.
  2. The syndrome is revealed equally well using the Traditional Method and the 2-Deflator Method.

- Now, to some of my gripes.
- First and foremost is the recent fascination of our profession with cross-country and panel regressions.
- What serious inferences can we draw from comparing:

  Bangladesh with Belgium?

  Senegal with Switzerland?

  Nepal with New Zealand?

  Cameroon with Canada?
- Are they part of the same population in any relevant statistical sense?
- If these regressions reveal something, what lessons can we draw?

- To illustrate, I take as my text R. J. Barro's Determinants of Economic Growth: A Cross-Country Empirical Study. In doing so, I recognize that Barro ranks among the most thoughtful and careful users of cross-country data.
- First of all, the variables explaining the per capita growth rate are:

  X1. Log per Capita Real GDP
  X2. Male Secondary and Higher Schooling
  X3. Log Life Expectancy
  X4. Interaction (X1*X2)
  X5. Log Fertility rate
  X6. Government Consumption / GDP
  X7. Rule of Law
  X8. Terms of Trade
  X9. Democracy Index
  X10. Democracy Index squared
  X11. Inflation Rate

- Not much help here for the Finance Minister or the economic team in India or Uruguay. Most of the variables (X1, X2, X3, X4, X5, X7, and probably X9 and X10) are typically the fruits of a long period of economic development. The terms of trade are also beyond any small country's (and most big countries') control. So we are left with the inflation rate and government consumption as amenable to prompt policy action, and male secondary schooling as a long-term policy goal.

- Barro's most important education variable is male "secondary and higher schooling". Once this variable is in, both male primary schooling and female secondary schooling are insignificant. Barro does mention that male primary is a necessary predecessor of male secondary and higher education, and that female education in general has a strong effect via fertility.
- But let us simply pursue Barro's positive results – a coefficient that says that every extra year of male secondary and higher schooling tends to augment a country's growth rate by 1.2 percentage point per annum.
- When I first saw this result, I practically fell off my chair. How could it be true?

IMPLIED CONTRIBUTION TO GDP GROWTH OF MALE SECONDARY AND HIGHER SCHOOLING

Country	Average Years of Male Secondary and Higher Schooling (1985)	Implied Contributions to Annual GDP Growth Rate
India	1.20	1.44%
Argentina	1.22	1.46%
Spain	1.91	2.29%
Israel	2.19	2.63%
United Kingdom	2.29	2.75%
Hong Kong	3.30	3.96%
Canada	3.87	4.64%
United States	4.89	5.87%
Barro's coefficient on male secondary or higher education = 1.2% per year		

Data Source: Barro-Lee Data Set - Educational Attainment Data 1960-1985 International Comparisons of Educational Attainment from website: http://www.worldbank.org/growth/ddbarlee.htm

- Careful reading of Barro reduced the shock somewhat. His variable measures total years of secondary and higher education among males 25 years or older, divided by the population of such males. It is not, for example, just adding one year to the average level achieved by the current cohorts.
- But still, it is an enormous effect. Israel's reward for an extra year, thus measured, is a growth rate 1.2 percentage higher per year than Argentina's. Canada's reward is a growth rate 2.4 percentage point per year higher than Spain's. And the U.S.'s reward is a growth rate over three points per year higher than that of the U.K.

- These figures do not incorporate Barro's interaction term (male secondary and higher education x per capita real GDP), mainly because I do not see the mechanism by which this works, and because I believe that many alternative variables interacting with per capita GDP would probably yield similar results, with interpretations that would not be connected with education.
- But just to satisfy skeptics, we can note that Barro's interaction term has an estimated impact on the growth rate of less than one percentage point per annum for the great bulk of his sample of countries.

- How should we try to analyze the effect of education on the growth rate? Well, in the first place, by assigning to each category its corresponding wage or earnings level. This is how we have for more than half a century estimated social (gross of tax and counting government costs) and private (net of tax and not counting government costs) rates of return to education. This, too, is the approach employed by Griliches, Jorgenson and many followers in the empirical analysis of growth.
- The expression $\sum_i w_i \Delta L_i$ captures it all, provided we have good enough data and sufficient detail. Obviously, this expression can be positive in sign and important in magnitude even when $\sum_i \Delta L_i = 0$.

This emphasizes that it fully captures any direct effects on growth of an upgrading of the labor force. By direct effects, I mean those that are reflected in the market earnings (gross of taxes and fringe benefits) of the various categories of labor.

- As was already shown, the 2-Deflator Method seeks to do the same kind of job that Jorgenson does, by expressing each worker's contribution in standard units. Suppose, then, a very extreme case, in which from quality improvement via education alone the labor force was increasing at 2 percent per year. This would double the effective labor force in some 36 years. Over that span, the contribution of quality of education to

the growth rate would be labor's share of GDP times 2 percent – say 1 to 1 1/3 percentage point per year. After that, there would be no contribution to growth, if the total number of workers and their distribution by quality both remain the same.

- This scenario could plausibly add 4 years of secondary and higher education to a country's initial average level. It could bring a country from, say, Argentina level to that of the U.S. Our scenario would add around 1 point to the annual growth rate during the process and zero afterward. Barro's regression would end in a steady state with something like 4 percentage point of extra annual growth forever, with the

education contribution building up to this over the 36 year period.

- You may feel that I have been unfair because I have not mentioned externalities. I believe there are real externalities to education, some of which probably have an impact on the growth rate. But the way to proceed is to try to identify these externalities and measure them. To do this one should not throw away the imputation of the direct effects of education. Rather, we should use it and build on it. Make an imputation of direct effect using $\sum_i w_i \Delta L_i$ and $\sum_j (\rho_j + \delta)\Delta K_j$, and then test to see how different variables representing possible sources of externalities succeed in

accounting for the as yet unexplained residual, R and R*.

- If the externality works in a geographical area, what is the area -- the village or the town, the country, the state or the province, etc.? Maybe the education externality works across a metropolitan area or across an industry within a nation. These are things that we can investigate empirically, so long as we can measure the growth residual across sufficiently disaggregated units. There is plenty of serious work to be done here, for those who are willing to pay the price.

- Inflation is an area where Barro's treatment gives me less of a problem. Though Barro uses a single inflation variable in his regressions explaining growth, he goes beyond this in the text. In particular, he presents scatters showing that the relationship between the rates of inflation and the rates of growth is strongly negative and significant for annual inflation rates above 20 percent, and much less negative and not significant for rates below for rates below 20 percent. He also notes the important association between higher average rates of inflation and higher variability of these same rates.
- I like this degree of subtlety in discussing the relationship between inflation and growth.

- My own summary on this subject emphasizes the confusion about relative prices that seems to be the inevitable counterpart of high inflation rates.
- I like to note that, quite contrary to the feeling that once prevailed, that inflation was the painless way and that we always had to pay a huge price for disinflation, the evidence on high inflation episodes is quite to the contrary.
- Obviously, we are not here "measuring" the effect of inflation on growth. Without doubt the episodes of high inflation were not sought by policymakers, but came as a result of their inability to control the situation.
- Typically this inability was mirrored in poor policy management in many different directions

such as futile efforts at price control, devaluation crises, multiple exchange rates, enormous tariffs, widespread import prohibitions. In almost every case black markets flourished, often dominating activity in many sectors. Negative interest rates were common, at least in "official" arenas.

- We really have no case with which to establish how a textbook "pure" inflation would affect the growth rate.
- What we can say is that the high inflation syndrome has in fact entailed worse growth experiences on the upside, and better on the downside, in nearly every case.

- What can we learn looking at within-country evidence? I have for many years used a classification system in which inflation episodes were broken down in to cases of
  - Acute inflation
  - Chronic inflation / devaluation crisis
  - Stable exchange rate
- Here we see a clear pattern
  - A very strong negative relation for the acute inflation cases
  - A reasonably strong negative relation for he middle group
  - Essentially no relation for the stable exchange rate group

- This is what we should expect. In Central America in the 50's, 60's and 70's (up to about 1978), the inflation was essentially the world inflation (in $). High growth was a year of good coffee prices. Low growth was an earthquake or a coffee bust.
- What does the one have to do with the other?
- This is why the relation between inflation and growth is so inconclusive for the stable-exchange-rate countries.

- Good rules to follow in growth analysis are
  - look at all the evidence you can find
  - try to understand what you see
  - try to state clearly what conclusions you draw (without shame but also without exaggeration)
  - try to reach a level of understanding that encompasses some element of texture of what you see.
- I think our story of inflation and growth meets these conditions.

- My other complaint concerns, in a sense, two topics in one: a) more on cross-country and panel-type regression analysis, and b) analyzing growth by fitting production functions. The context is in an article by Larry Lau and J. I. Kim which in turn was brought to my attention by Paul Krugman in his blockbuster article in Foreign Affairs. In that paper Krugman asserted that the performance of the East Asian Tigers represented no miracle at all. Their growth was simply due to more labor and more capital. Of real cost reduction (TFP improvements), they had experienced little or none.

- Krugman's support for these assertions came from just two sources -- a paper by Alwyn Young, and the one by Lau and Kim. I was puzzled from the beginning when I read the Lau-Kim paper, because they went at the measurement of growth by fitting a common production function to panel data from nine countries. My obvious question was why would anybody ever do a thing like that? Why would countries differ only in the constant term of a common production function and in its rate of shift over time?

- This led me to experiment with measuring a Cobb-Douglas production function (the form fitted by K·L) with time series data for a number of countries. I was absolutely stunned by the results. The estimates that emerged made practically no sense at all. Instead of elaborating, let me show you the results.

FITTING COBB-DOUGLAS PRODUCTION FUNCTIONS
(LOG Y = C + B_L LOG L + B_K LOG K)

COUNTRY	PERIOD	B_L	B_K	ADJ. R^2	$B_L + B_K$
Canada	1960-1994	0.122	0.872	0.987	0.994
		0.339	0.133		
Colombia	1960-1992	0.341	0.731	0.987	1.072
		0.154	0.076		
Costa Rica	1960-1993	1.390	0.031	0.964	1.421
		0.286	0.154		
Ecuador	1960-1993	-0.667	0.949	0.955	0.282
		0.319	0.070		
Finland	1960-1994	0.578	0.824	0.973	1.402
		0.220	0.054		
France	1970-1994	-0.550	1.306	0.991	0.755
		0.134	0.041		
Greece	1960-1994	-1.493	1.105	0.983	-0.388
		0.322	0.073		
Italy	1970-1994	-0.068	1.103	0.980	1.014
		0.257	0.033		
Jamaica	1960-1988	-0.147	1.716	0.809	1.569
		0.112	0.321		
Japan	1960-1994	-0.326	0.944	0.981	0.619
		0.358	0.091		
Korea	1960-1993	0.380	0.733	0.991	1.113
		0.292	0.075		
Mexico	1960-1994	1.696	0.121	0.995	1.817
		0.107	0.043		
Myanmar	1963-1994	-0.356	1.068	0.945	0.712
		0.284	0.150		
Paraguay	1960-1994	1.269	0.330	0.977	1.599
		0.259	0.100		
South Africa	1960-1994	-0.328	0.925	0.957	0.598
		0.230	0.121		
Sri Lanka	1970-1994	0.932	0.520	0.976	1.451
		0.204	0.055		
Thailand	1960-1994	0.146	0.816	0.995	0.962
		0.102	0.027		
United Kingdom	1960-1991	0.316	0.937	0.970	1.253
		0.196	0.031		
United States	1960-1994	0.513	0.693	0.989	1.206
		0.164	0.065		
Uruguay	1960-1994	0.403	1.151	0.706	1.554
		0.274	0.135		
Venezuela	1960-1994	0.470	0.357	0.896	0.826
		0.204	0.167		
Zambia	1960-1990	0.549	0.098	0.846	0.647
		0.282	0.370		
Zimbabwe	1960-1989	0.335	0.689	0.904	1.024
		0.320	0.205		

Data Source: U.N. National Accounts and World Bank Devlopment Indicators

FITTING COBB-DOUGLAS PRODUCTION FUNCTIONS
(LOG Y = C + B_L LOG L + B_K LOG K + A_T TIME)

COUNTRY	PERIOD	B_L	B_K	TIME	ADJ. R^2	$B_L + B_K$
Canada	1960-1994	0.162	1.362	-0.022	0.990	1.524
		0.292	0.180	0.006		
Colombia	1960-1992	0.335	0.382	0.017	0.987	0.718
		0.154	0.396	0.019		
Costa Rica	1960-1993	2.311	0.635	-0.063	0.968	2.946
		0.503	0.314	0.029		
Ecuador	1960-1993	-0.978	0.601	0.027	0.959	-0.377
		0.344	0.189	0.014		
Finland	1960-1994	0.526	0.922	-0.003	0.972	1.448
		0.306	0.395	0.012		
France	1970-1994	-1.389	2.468	-0.020	0.994	1.079
		0.301	0.387	0.006		
Greece	1960-1994	-1.528	1.283	-0.009	0.985	-0.246
		0.302	0.102	0.004		
Italy	1970-1994	-0.348	1.639	-0.013	0.983	1.291
		0.271	0.260	0.006		
Jamaica	1960-1988	-0.130	1.696	0.000	0.801	1.565
		0.158	0.354	0.002		
Japan	1960-1994	-2.494	2.399	-0.059	0.994	-0.095
		0.326	0.180	0.007		
Korea	1960-1993	-0.075	0.025	0.081	0.996	-0.051
		0.201	0.118	0.012		
Mexico	1960-1994	1.699	0.096	0.001	0.994	1.794
		0.109	0.120	0.006		
Myanmar	1963-1994	-1.208	0.651	0.035	0.974	-0.557
		0.247	0.127	0.006		
Paraguay	1960-1994	1.357	0.342	-0.003	0.977	1.699
		0.618	0.125	0.019		
South Africa	1960-1994	-0.001	0.935	-0.007	0.956	0.934
		0.617	0.123	0.013		
Sri Lanka	1970-1994	-0.282	-0.246	0.055	0.996	-0.528
		0.140	0.075	0.005		
Thailand	1960-1994	-0.023	0.258	0.050	0.997	0.235
		0.102	0.166	0.015		
United Kingdom	1960-1991	0.719	0.029	0.022	0.979	0.748
		0.196	0.247	0.006		
United States	1960-1994	0.507	0.593	0.003	0.989	1.101
		0.166	0.183	0.006		
Uruguay	1960-1994	0.061	0.391	0.010	0.784	0.452
		0.255	0.252	0.003		
Venezuela	1960-1994	0.456	0.358	0.000	0.892	0.814
		0.602	0.178	0.015		
Zambia	1960-1990	0.378	-0.104	0.013	0.849	0.274
		0.315	0.405	0.011		
Zimbabwe	1960-1989	-0.055	0.209	0.034	0.910	0.155
		0.393	0.356	0.021		

FITTING COBB-DOUGLAS PRODUCTION FUNCTIONS
(dLOG Y = C + B_L dLOG L + B_K dLOG K)

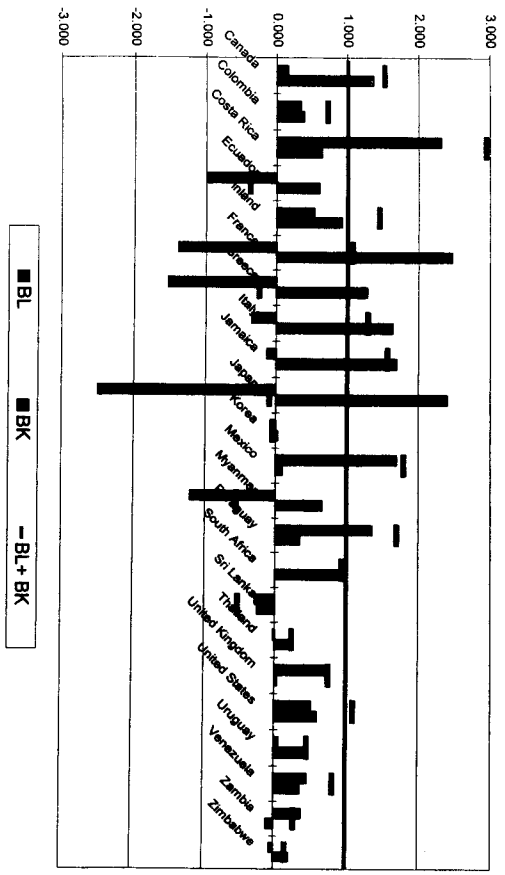
COUNTRY	PERIOD	B_L	B_K	CONST.	ADJ. R^2	$B_L + B_K$
Canada	1960-1994	-0.797	0.922	0.014	0.189	0.125
		0.280	0.370	0.014		
Colombia	1960-1992	0.010	0.162	0.036	0.009	0.172
		0.089	0.356	0.017		
Costa Rica	1960-1993	0.744	-0.036	0.024	0.178	0.708
		0.271	0.457	0.029		
Ecuador	1960-1993	-0.277	0.528	0.022	0.135	0.251
		0.160	0.272	0.017		
Finland	1960-1994	-0.122	0.194	0.026	0.006	0.072
		0.289	0.547	0.018		
France	1970-1994	-0.910	1.766	-0.006	0.280	0.856
		0.306	0.546	0.010		
Greece	1960-1994	-0.221	0.533	0.018	0.078	0.312
		0.385	0.245	0.012		
Italy	1970-1994	-0.436	0.529	0.013	0.111	0.093
		0.198	0.557	0.013		
Jamaica	1960-1988	-0.075	0.811	0.007	0.046	0.736
		0.189	0.743	0.012		
Japan	1960-1994	-1.434	1.830	-0.035	0.699	0.396
		0.209	0.210	0.012		
Korea	1960-1993	-0.165	-0.165	0.098	0.050	-0.330
		0.175	0.219	0.021		
Mexico	1960-1994	0.622	0.118	0.026	0.178	0.740
		0.221	0.289	0.016		
Myanmar	1963-1994	-0.980	0.641	0.032	0.182	-0.339
		0.393	0.287	0.014		
Paraguay	1960-1994	-0.211	0.320	0.036	0.036	0.109
		0.306	0.197	0.015		
South Africa	1960-1994	-0.470	0.365	0.028	0.018	-0.105
		0.349	0.269	0.011		
Sri Lanka	1970-1994	-0.217	-0.172	0.051	0.006	-0.389
		0.155	0.204	0.011		
Thailand	1960-1994	-0.251	0.134	0.067	0.123	-0.117
		0.102	0.166	0.014		
United Kingdom	1960-1991	0.085	-0.499	0.035	0.028	-0.414
		0.230	0.559	0.014		
United States	1960-1994	-0.047	-0.100	0.033	0.006	-0.146
		0.138	0.434	0.014		
Uruguay	1960-1994	0.158	-0.008	0.011	0.034	0.150
		0.159	0.365	0.009		
Venezuela	1960-1994	0.542	-0.122	0.017	0.046	0.420
		0.287	0.308	0.014		
Zambia	1960-1990	-0.030	-0.321	0.029	0.021	-0.351
		0.240	0.517	0.019		
Zimbabwe	1960-1989	-0.064	-0.066	0.046	0.008	-0.130
		0.152	0.435	0.022		

FITTING COBB-DOUGLAS PRODUCTION FUNCTIONS
(LOG Y = C_j + B_L LOG L + B_K LOG K + A_T TIME)

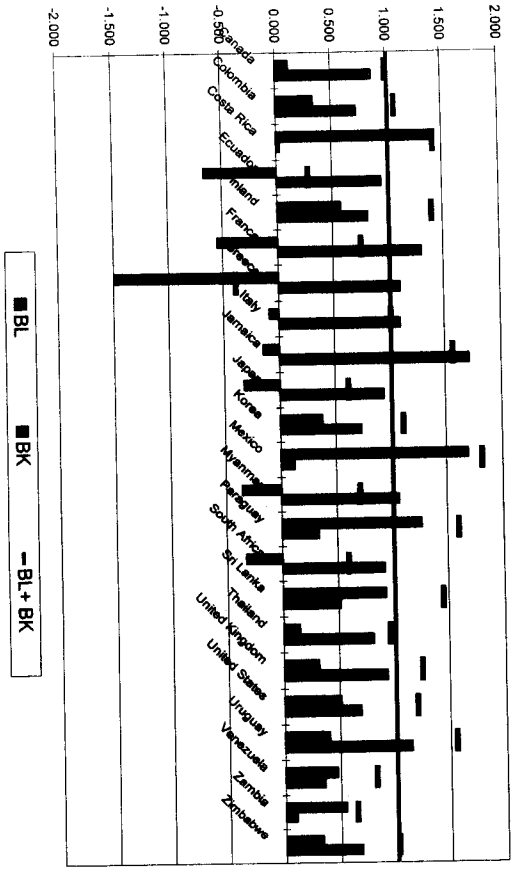
	B_L	B_K	TIME	ADJ. R^2	$B_L + B_K$
ALL	**-0.086**	**0.766**	**0.004**	**0.993**	**0.680**
COUNTRIES	0.031	0.015	0.001		
DEVELOPED	**0.066**	**0.802**	**0.003**	**0.997**	**0.868**
COUNTRIES	0.083	0.038	0.001		
Fixed Effect Regressions					

FITTING COBB-DOUGLAS PRODUCTION FUNCTIONS
(LOG Y = C_j + B_L LOG L + B_K LOG K)

	B_L	B_K	ADJ. R^2	$B_L + B_K$
ALL	**0.054**	**0.815**	**0.994**	**0.869**
COUNTRIES	0.029	0.012		
DEVLOPED	**0.035**	**0.882**	**0.998**	**0.917**
COUNTRIES	0.085	0.026		
Fixed Effect Regressions				



FITTING COBB-DOUGLAS PRODUCTION FUNCTIONS
(LOG Y = C + B_L LOG L + B_K LOG K + A_T TIME)



FITTING COBB-DOUGLAS PRODUCTION FUNCTIONS
(LOG Y = C + B_L LOG L + B_K LOG K)

Kuznets Lecture I (10)

$B_K + B_L$

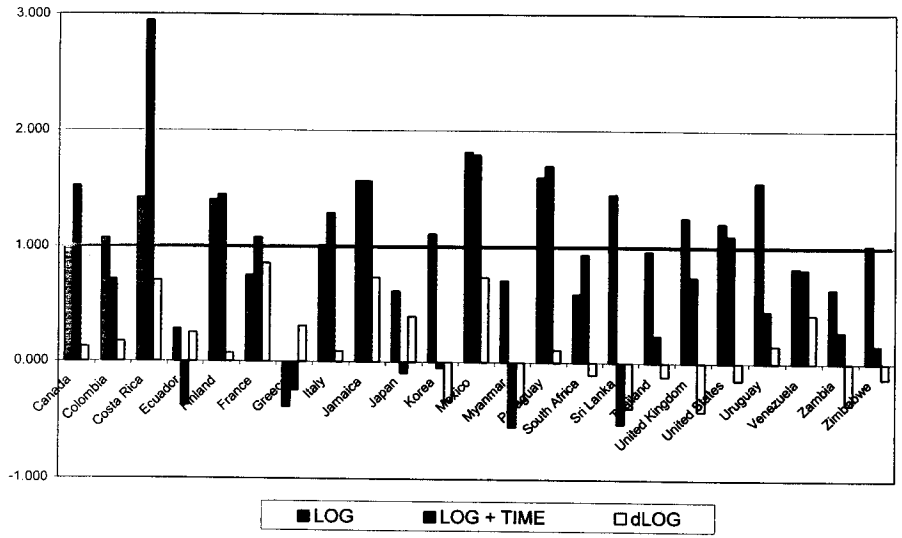


Chart6 regress.xls 3/8/00

TIME TREND VERSUS GDP GROWTH RATE
(Log Y = C + B_L Log L + B_K Log K + A_T Time)

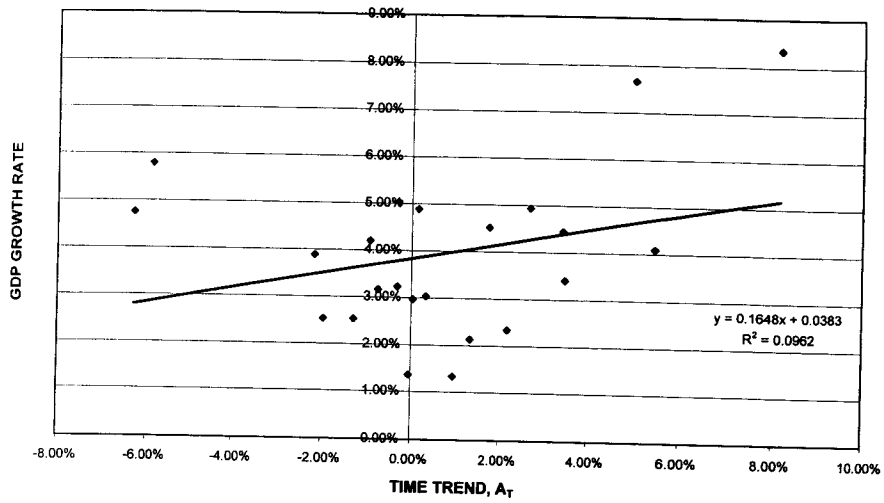
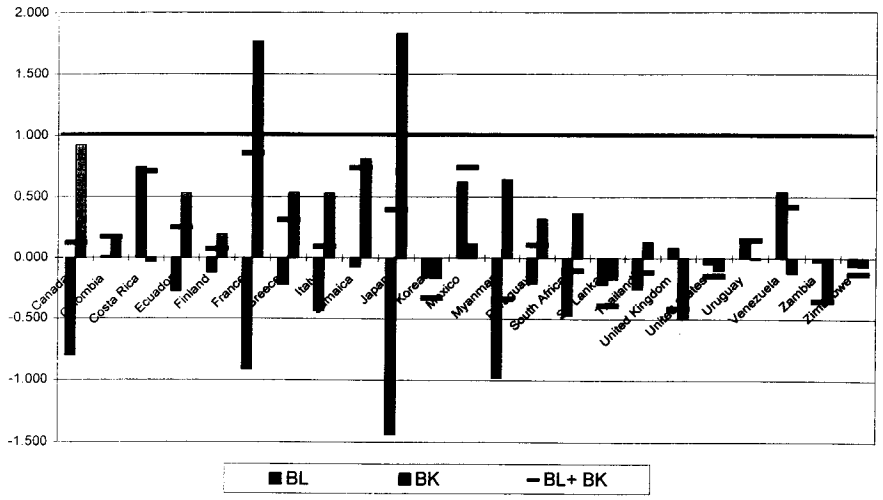


Chart1 regress.xls 3/18/00

FITTING COBB-DOUGLAS PRODUCTION FUNCTIONS
(dLOG Y = C + B_L dLOG L + B_K dLOG K)



TIME TREND, A
(Log Y = C + B_L Log L + B_K Log K + A_T Time)

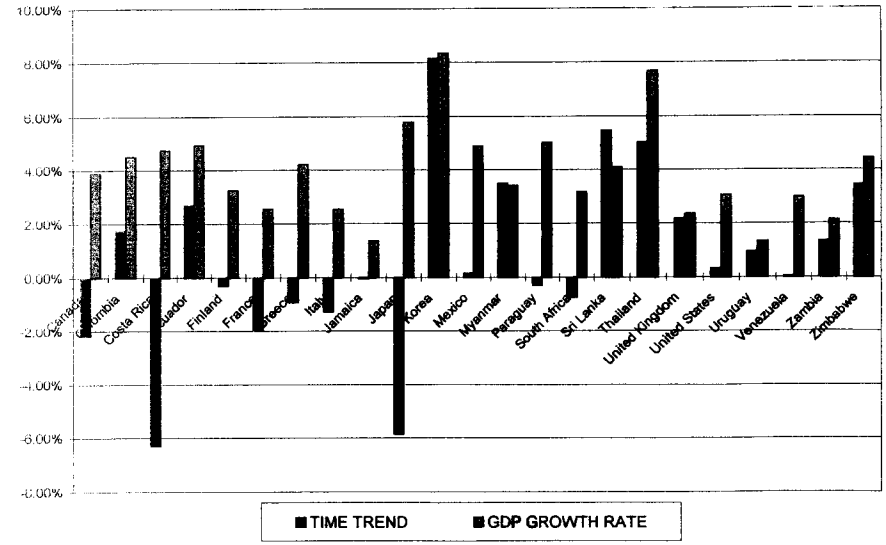
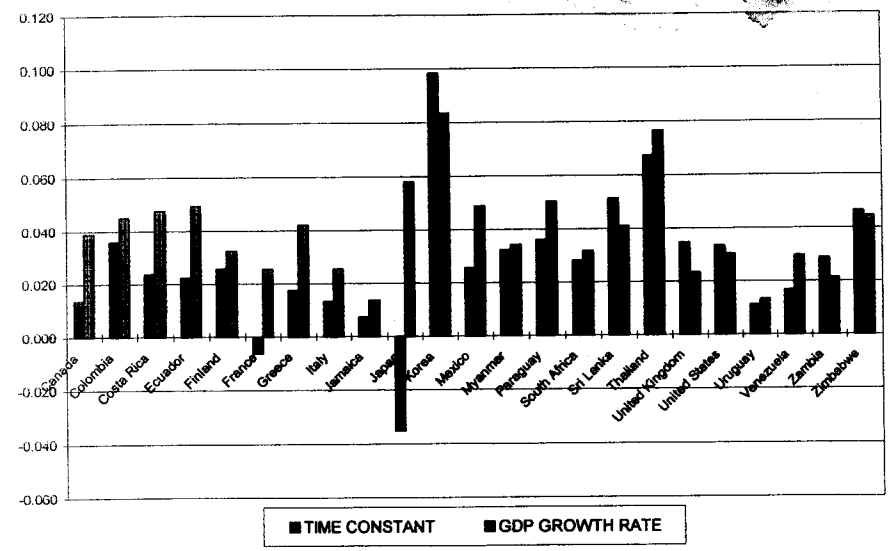


Chart3 3/13/00

Ingmars Lecture I - (21)



regress Chart7 3/13/00

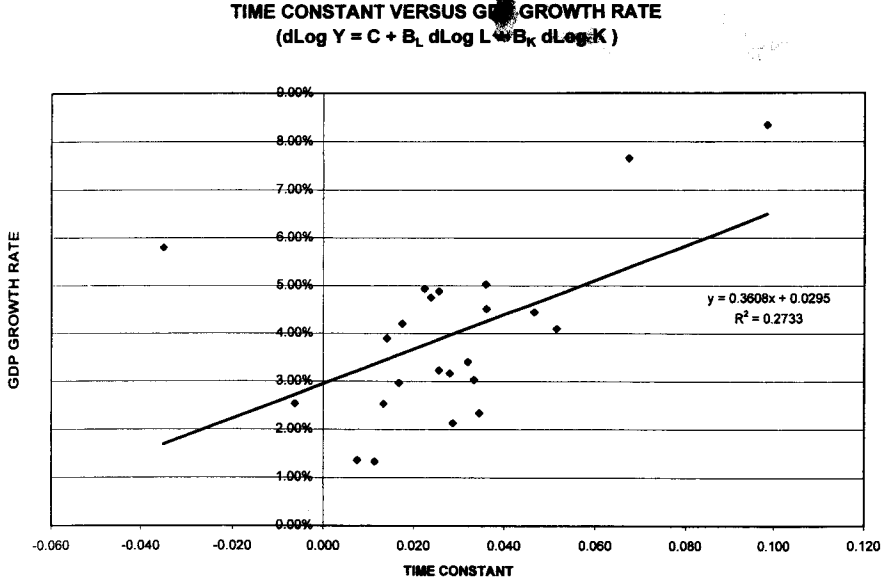


Chart4 regress.xls 3/18/00