Trade and Growth: models and empirical evidence convergence….

Darryl McLeod, Overview Lecture 7
Economic Growth & Development
Econ 6470 Spring 2015

Is Trade an engine or handmaiden of Growth?

- Evidence of correlation or indirect effects, see Sachs and Warner, Frankel and Romer, 1999, Dollar and Kraay, Edwards
- Rodriguez and Rodrik, 2000, challenge the existing evidence and replicate all regressions, especially those of Sachs & Warner….
- Warner, 2003 and others reply, a consensus of sorts emerges, Rodrik outlines this in a series of papers: EPZs plus weak RER best of both worlds

Gravity model of Trade: Frankel and Romer

G+1 0

0 Reviews
Write review

The Gravity Model in International Trade: Advances and Applications

edited by Peter A. G. van Bergeijk, Steven Brakm

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These early contributions started the first wave of applications in the early 1960s (see for critical discussions of this early literature, Taplin 1967, and Leamer and Stern 1970, chapter 6). Although the model itself can be applied to many phenomena, most applications involved bilateral trade flows and in our discussion we will thus concentrate on trade. The basic form of the gravity equation is as follows:

$$T_{ij} = \frac{GDP_i^{\alpha} GDP_j^{\beta}}{D_{ij}^{\theta}}, \qquad (1.1)$$

where: T_{ij} indicates bilateral trade between country i, and j; GDP_i indicates the economic size of i, measured by GDP; and D_{ij} indicates the bilateral distance between the two countries. The parameters α, β, and θ are often estimated in a log-linear reformulation of the model. This equation explains bilateral trade using economic size and distance: the larger the two trading partners, the larger the trade flows; the larger the distance between the two countries, the smaller bilateral trade. Usually the model explains 70–80 per cent of the variance in bilateral trade flows.

What was missing during the early days of the gravity equation, despite its popularity, was a convincing micro-economic foundation. Tinbergen (1962 p. 263) actually introduced his trade flow equation

Gravity model of Trade: Frankel and Romer, 1999

$$F_{grav} \propto \frac{m_1 * m_2}{d^2}$$

where F_{grav} represents the force of gravity between two objects

$\propto$ means "proportional to"

m_1 represents the mass of object 1

m_2 represents the mass of object 2

d represents the distance separating the objects' centers

The UNIVERSAL Gravitation Equation

But Newton's law of universal gravitation extends gravity beyond earth. Newton's law of universal gravitation is about the universality of gravity. Newton's place in the *Gravity Hall of Fame* is not due to his discovery of gravity, but rather due to his discovery that gravitation is universal. **ALL** objects attract each other with a force of gravitational attraction. Gravity is universal. This force of gravitational attraction is directly dependent upon the masses of both objects and inversely proportional to the square of the distance that separates their centers. Newton's conclusion about the magnitude of gravitational forces is summarized symbolically as

Trade & Growth Readings:

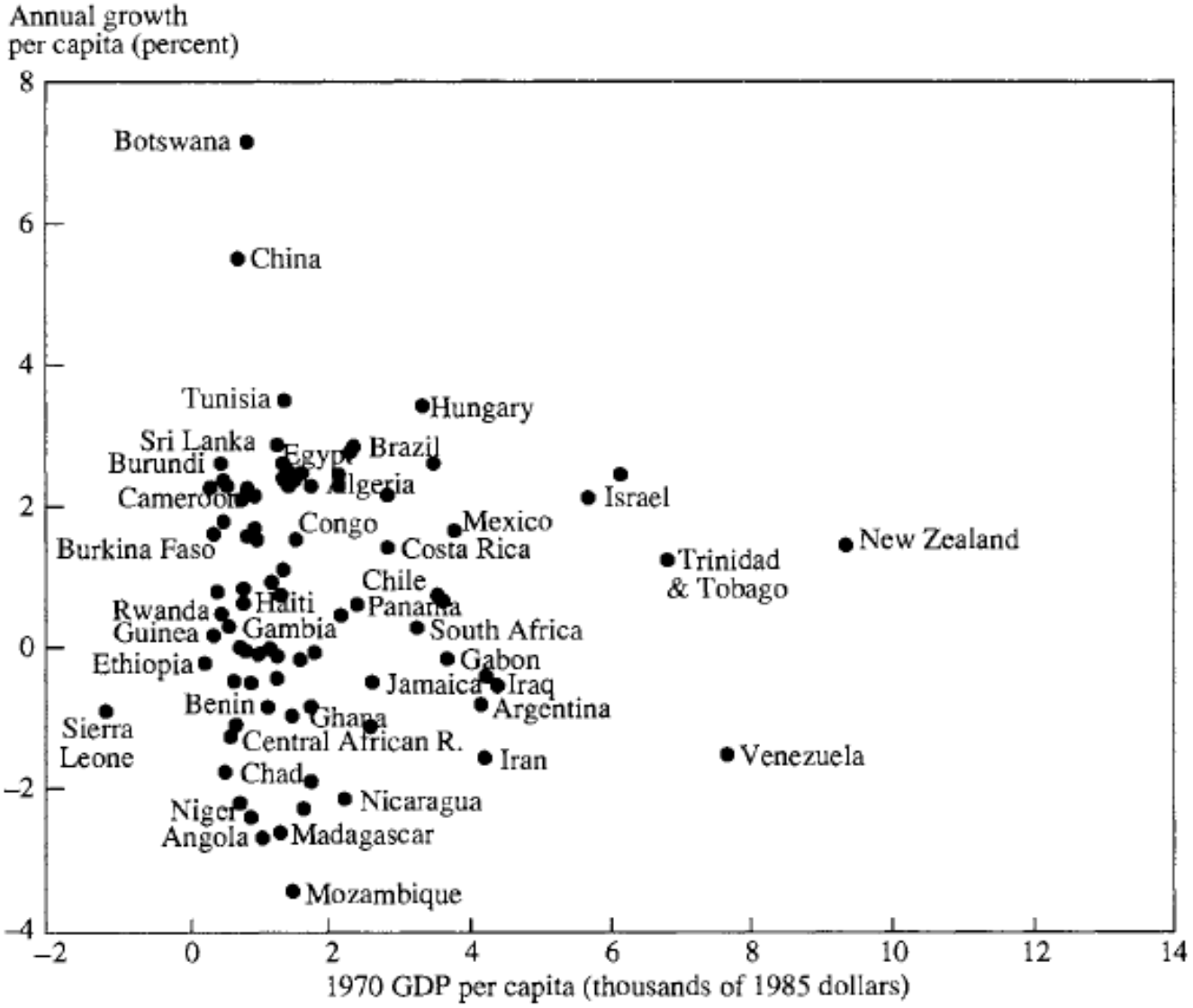
- Levine and Renelt (1992)
- and Sala-i-Martin (1997, I just ran 2 million…)
- Rodriguez and Rodrik (2000). Warner (2003)
- Wacziarg and welch (2008)
- Dollar and Kraay (2004)
- Estevadeordal and Taylor, 2008.
- Rodriguez and Rodrik (2000)
- McLeod and Meliva 2012

The Sachs Warner Index very robust take on by Skeptics R&R 2000

1. it had average tariff rates higher than 40% (TAR);
2. its nontariff barriers covered on average more than 40% of imports (NTB);
3. it had a socialist economic system (SOC);
4. it had a state monopoly of major exports (MON);
5. its black-market premium exceeded 20% during either the decade of the 1970s or the decade of the 1980s (BMP).[16]

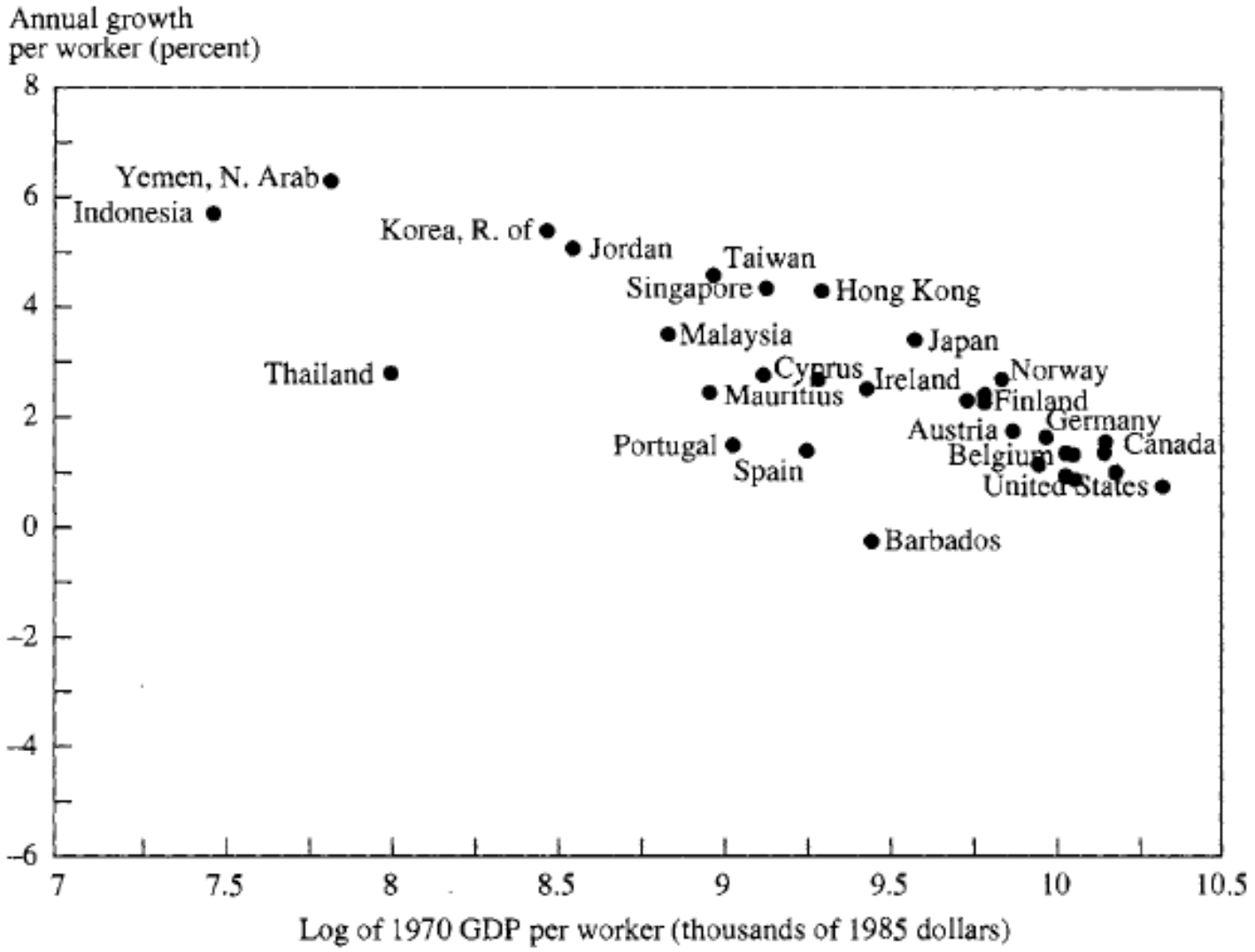
Convergence rare unless conditional on something….

Figure 5. Growth and Initial Income, Closed Economies, 1970–89



Source: Authors' calculations using version 5.5 of the data in Summers and Heston (1991) and World Bank (1994d).

Figure 6. Growth Per Worker and Initial GDP Per Worker, Open Economies, 1970–85



Source: Authors' calculations using versions 5 and 5.5 of the data in Summers and Heston (1991).

Convergence across countries rare conditional on something… Sachs-Warner "openess"

Consensus growth strategies: post East Asian miracle with or w/o best institutions

Early Washington Consensus

- Trade liberalization
- Open capital account??
- Macroeconomic stability
- Privatization

Sachs-Warner Index:

- Tariffs < 10%, quotas <40%
- BMP < 20%
- Non-socialist government
- No export monopoly

Post EA miracle consensus

- Weak RER
- Macro stability
- Exports and FDI
- EPZ + SOEs best (China)

Africa w/poverty traps:

- **Levers for growth**
- **Macro stability, weak RER**
- **Aid OK, resource rents?**
- **Aid can break poverty trap**
- **Debt relief?**

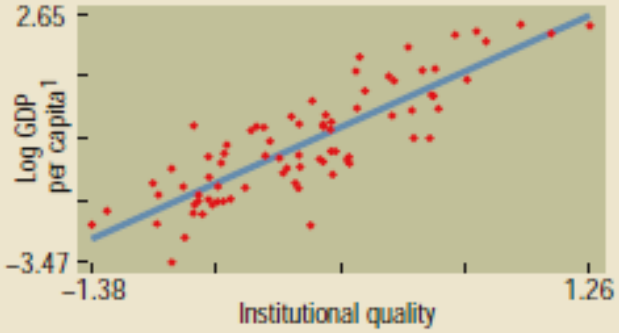
Rodrik and Subramanian (2003)

Chart 2

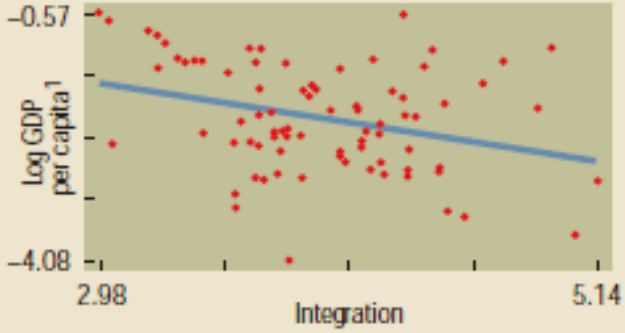
Institutional quality scores high

Institutional quality can boost income significantly, while global integration and geography, on their own, do not.

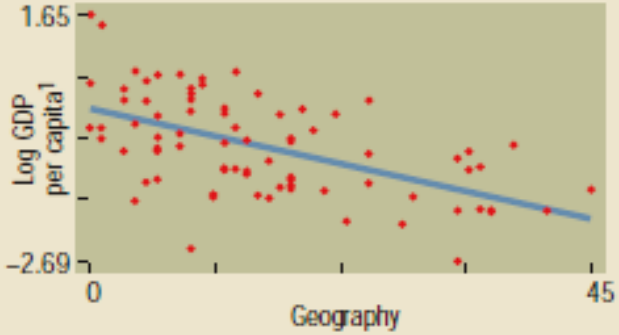
As institutional quality rises, so does income ...



but increases in integration may not help



... nor does a more benign geographic location.



Source: Authors

Note: The graphs capture the causal impact of each of the determinants on income, after controlling for the impact of the others. The indicators of integration and geography used are the ratio of trade to GDP and distance from the equator, respectively. For further details, see Rodrik, Subramanian, and Trebbi (2002).

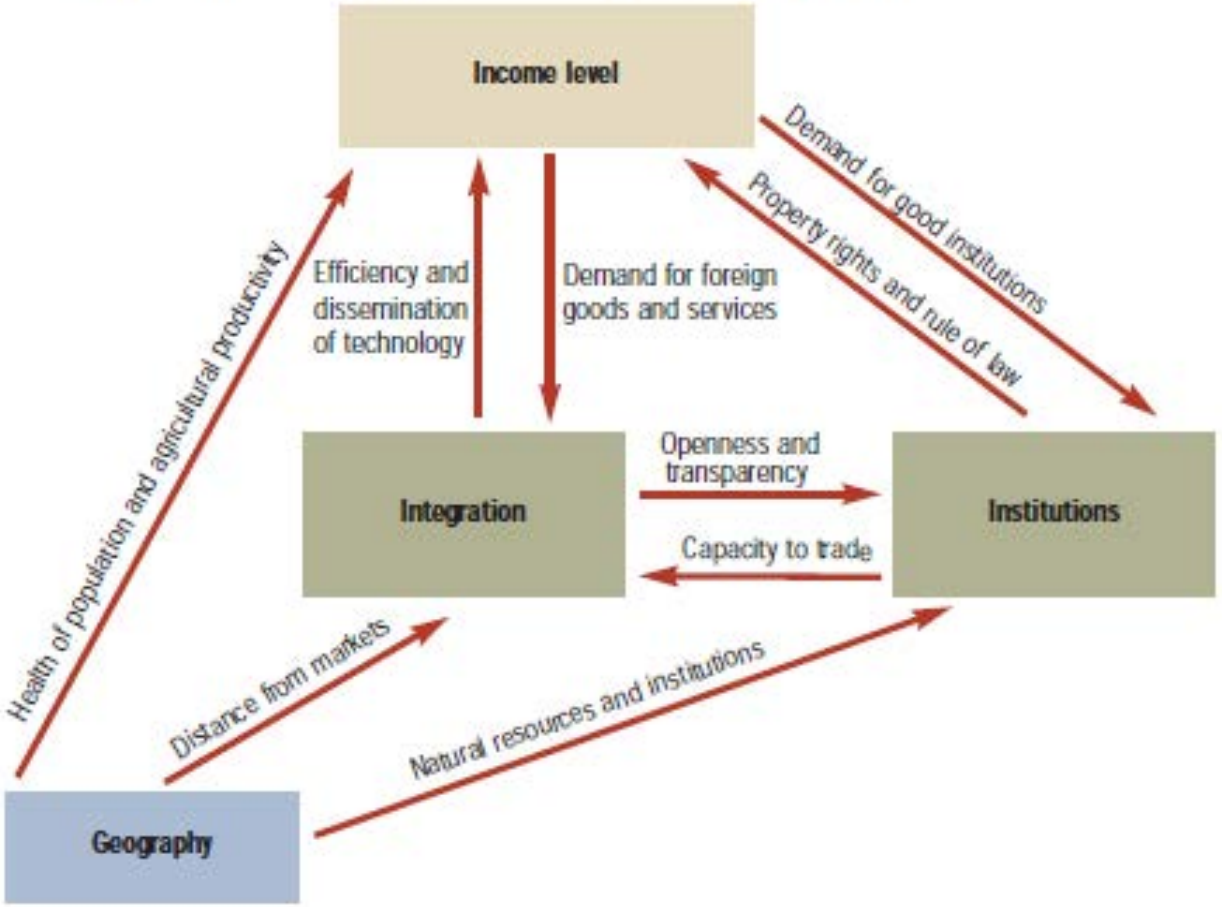
[1]Expressed in terms of purchasing power parity, 1995.

Rodrik and Subramanian (2003) F&D

Chart 1

The "deep determinants" of income

Development and its determinants are related in multiple and complex ways, making the task of determining and quantifying causality difficult.

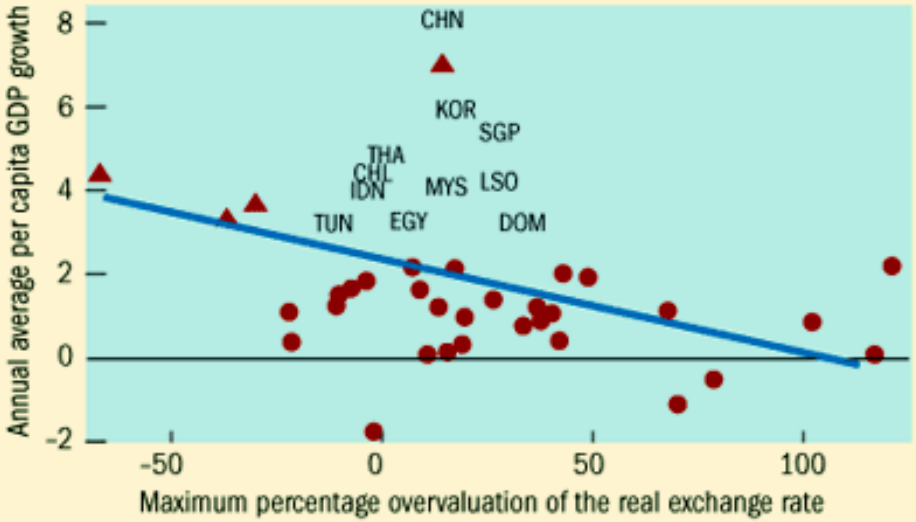


Competitive RER

Chart 2

Getting the currency right

The sustained growers avoided prolonged bouts of currency overvaluation.

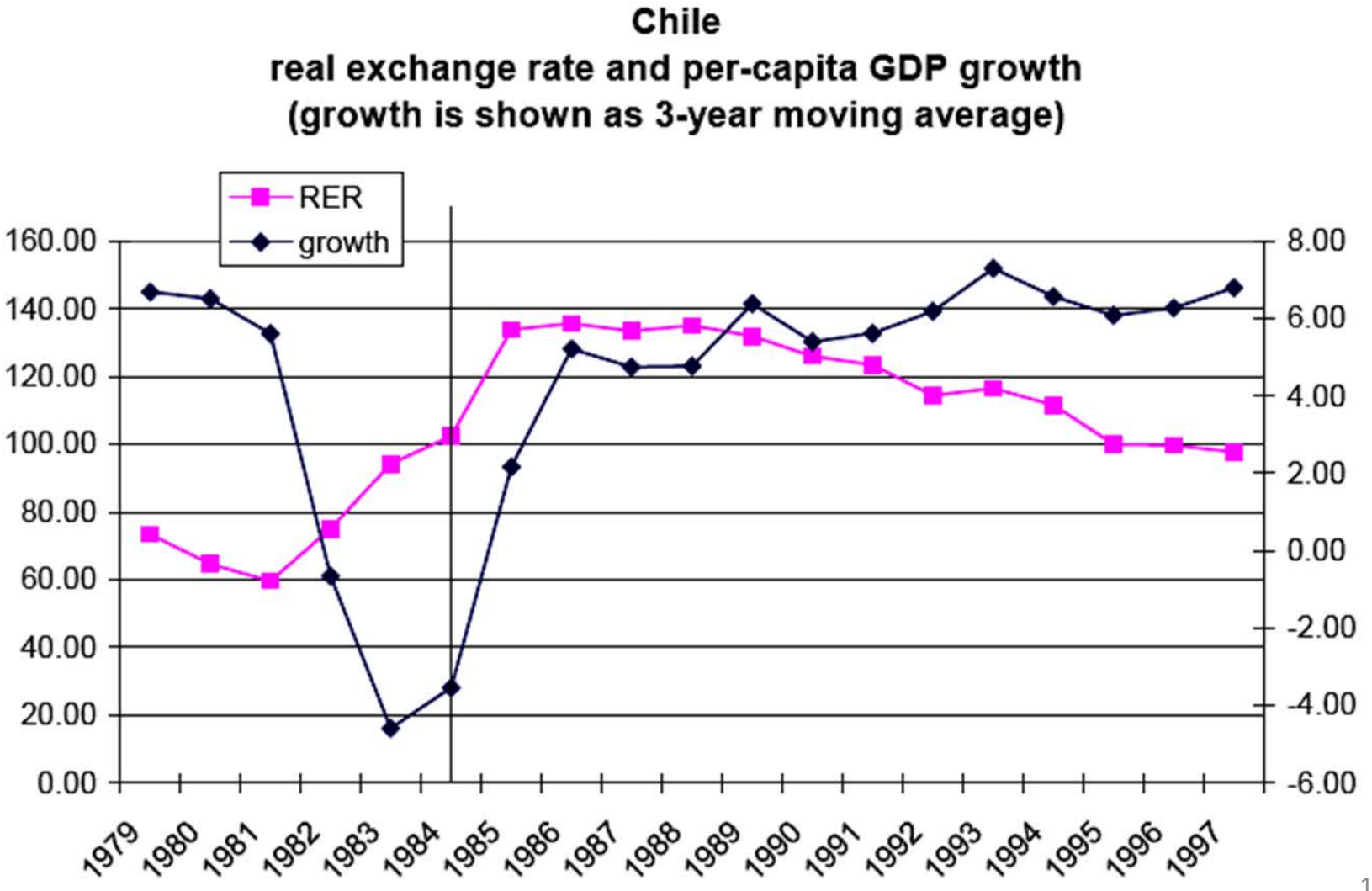


CHL = Chile
CHN = China
DOM = Dominican Republic
EGY = Egypt
IDN = Indonesia
KOR = Korea
LSO = Lesotho
MYS = Malaysia
SGP = Singapore
THA = Thailand
TUN = Tunisia

Sources: World Bank, World Development Indicators database, and IMF staff estimates.

Note: Overvaluation is measured as the residual from a regression of the real exchange rate against per capita income, measured in terms of purchasing power parity.

Slide from Rodrik, Growth Strategies(Uganda too)

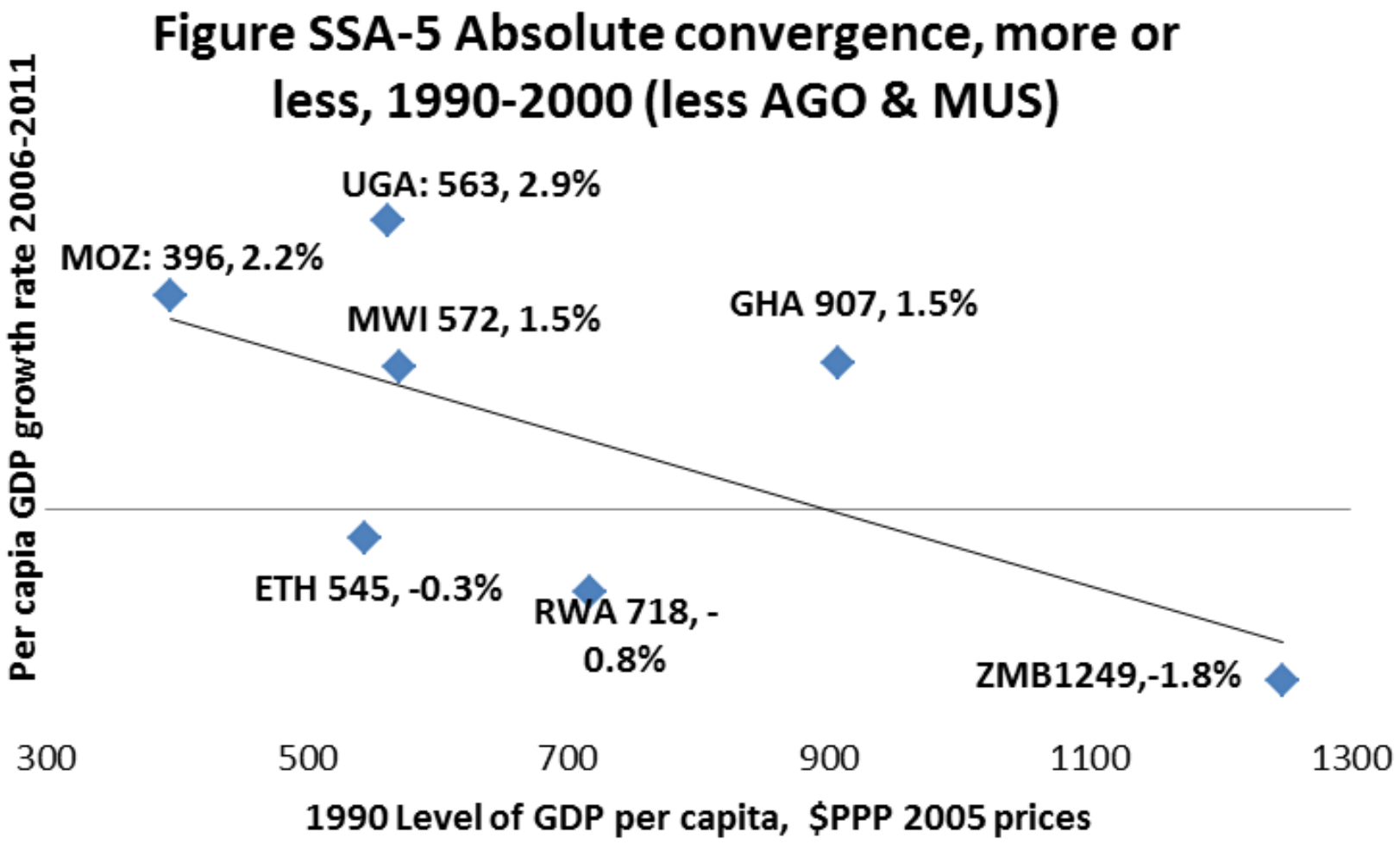


East/west African Miracles

Table SSA-2 Per capita Income & growth rates, 2000 to 2011

Country	ISO	1990	2000	2006	2011	2006-2011	2000-2011	1990-2000
Ghana	GHA	907	1067	1255	1652	5.7%	4.1%	1.5%
Mozambique	MOZ	396	501	694	861	4.4%	5.1%	2.2%
Rwanda	RWA	718	654	889	1132	5.0%	5.1%	-0.8%
Uganda	UGA	563	774	977	1188	4.0%	4.0%	2.9%
Zambia	ZMB	1249	1028	1200	1431	3.6%	3.1%	-1.8%
Ethiopia	ETH	545	527	689	979	7.3%	5.8%	-0.3%
Malawi	MWI	572	670	640	789	4.3%	1.5%	1.5%
Angola	AGO	3093	2476	3926	5227	5.9%	7.0%	-2.0%
Mauritius	MUS	6104	9154	10479	12733	4.0%	3.0%	3.8%
Mean log Dev*		0.378	0.297	0.274	0.266	*(not including AGO or MUS)		

East/west African Miracles



East Asian miracle dotted line (from Justin Lin's 2012 Quest for Prosperity p.275)

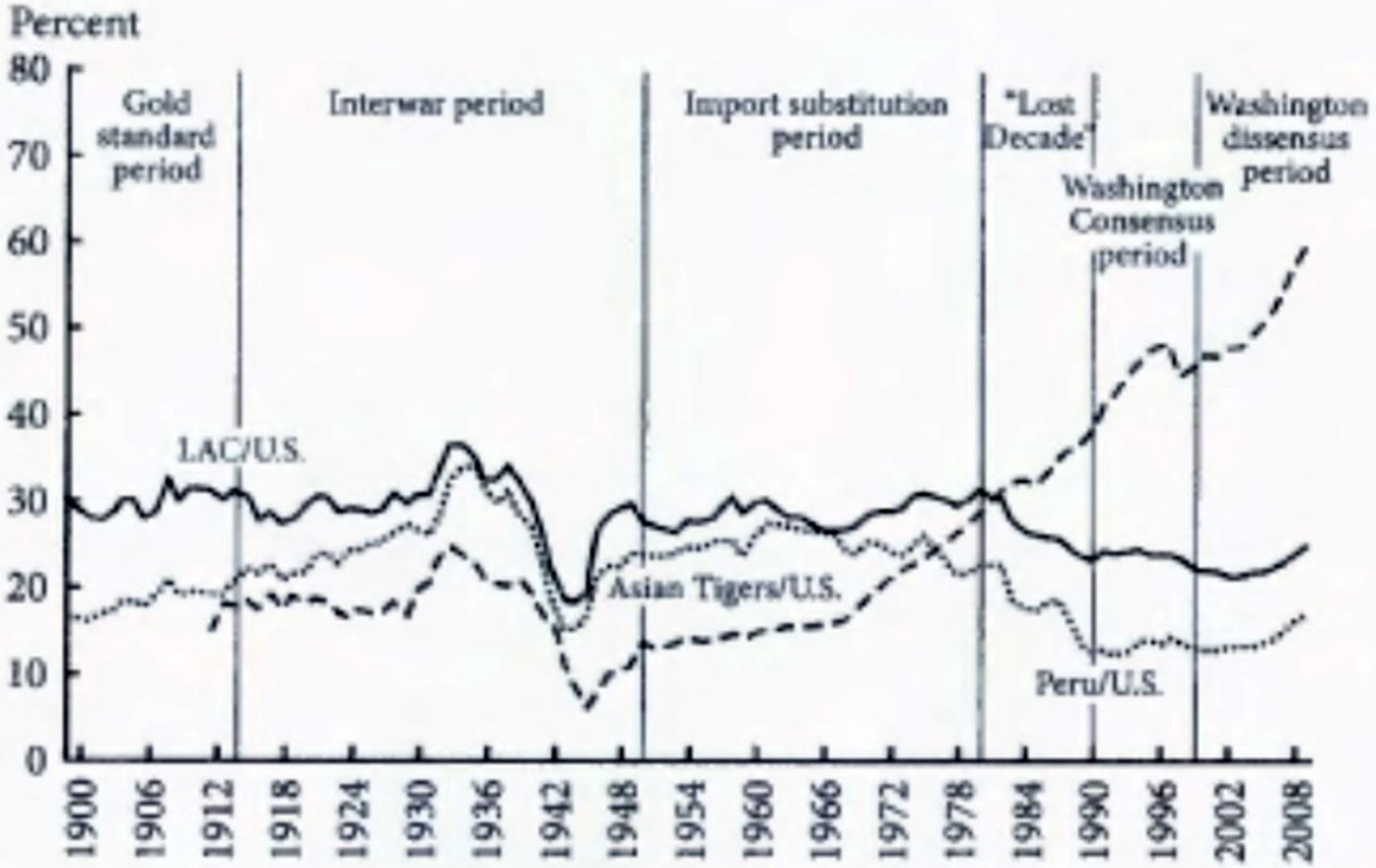


Figure 9.1 GDP per capita of selected regions relative to the United States, 1900–2008

Source: Maddison (n.d.).

Note: LAC: Latin American countries. Asian Tigers: an average of Hong Kong SAR, China; Taiwan, China; the Republic of Korea; Singapore; and South Korea.

McLeod and Meliva, 2012

Labor is the only mobile factor of production. The total labor supply is assumed to be constant and set to one, $L = 1$. Assuming identical diminishing returns technologies $(0 < \alpha < 1)$, and defining l_t as the share of the labor force in manufacturing, traded and non-traded goods productions functions are

$$Q_t^T = A_t l_t^{\alpha}, \qquad (2)$$

$$Q_t^N = B(1 - l_t)^{\alpha}. \qquad (3)$$

The key difference between the two sectors is the productivity level, B, in the non-traded goods sector is assumed to be constant, whereas traded goods sector productivity, A_t, is subject to "learning by doing" in the tradition of Kenneth Arrow. Traded goods sector productivity increases with the level of output, Q_t^T, but is not affected by changes in non-traded output, Q_t^N.

McLeod and Meliva, 2012 follow

Learning by doing is external to the individual firm but internal to the sector as a whole, so that manufacturing productivity evolves over time according to

$$\dot{A}_t = \delta Q_t^T , \qquad (4)$$

in which $\delta > 0$ is the exogenous rate of learning by doing.

Competition and the mobility of labor between the two sectors equalize the marginal products of labor in the two sectors:

$$B(1-l_t)^{\alpha-1} = q_t A_t l_t^{\alpha-1}, \qquad (5)$$

in which q_t is the real exchange rate defined in Equation (1). The real exchange rate affects the allocation of labor between the two sectors: a weaker RER (a higher q_t) raises the marginal product of labor in the traded goods sector, increasing real wages in that sector until movement of labor out of the non-traded

McLeod and Meliva, 2012

Substituting (2) into (4) yields the growth rate of productivity in the traded goods sector as a function of the share of labor employed in that sector and the learning-by-doing externality:

$$\frac{\dot{A}_t}{A_t} = \delta l_t^{\alpha}. \qquad (6)$$

Equation (5) implicitly defines l_t as a function of q_t, and differentiation $\left(\frac{\partial l_t}{\partial q_t} > 0\right)$ shows that an increase in the domestic relative price of the traded good leads to an increase in the share of labor employed in the traded goods sector, which then raises productivity via Equation (6). Total output, Y_t, in foreign prices is

$$Y_t = B(1 - l_t)^{\alpha} + A_t l_t^{\alpha}. \qquad (7)$$

McLeod and Meliva, 2012

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McLeod and Meliva, 2012

The time derivative of Equation (7) and Equations (2), (4) and (5) yields the instantaneous rate of growth of output:

$$\frac{\dot{Y}_t}{Y_t} = \left[\lambda_t + \frac{\alpha(\lambda_t - l_t)}{1-\alpha}\right]\delta l_t^{\alpha}, \qquad (8)$$

in which $\frac{Q_t^T}{Y_t} = \lambda_t$ represents the manufacturing share of output in foreign prices.

Since learning by doing in the traded goods sector is the only source of productivity growth over the longer term, overall (economy-wide) productivity growth depends only on the share of labor, l_t, in that sector. This implies a steady state overall TFP growth of

$$\hat{TFP}_t = \delta\, l_t^{1+\alpha}. \qquad (9)$$

McLeod and Meliva, 2012

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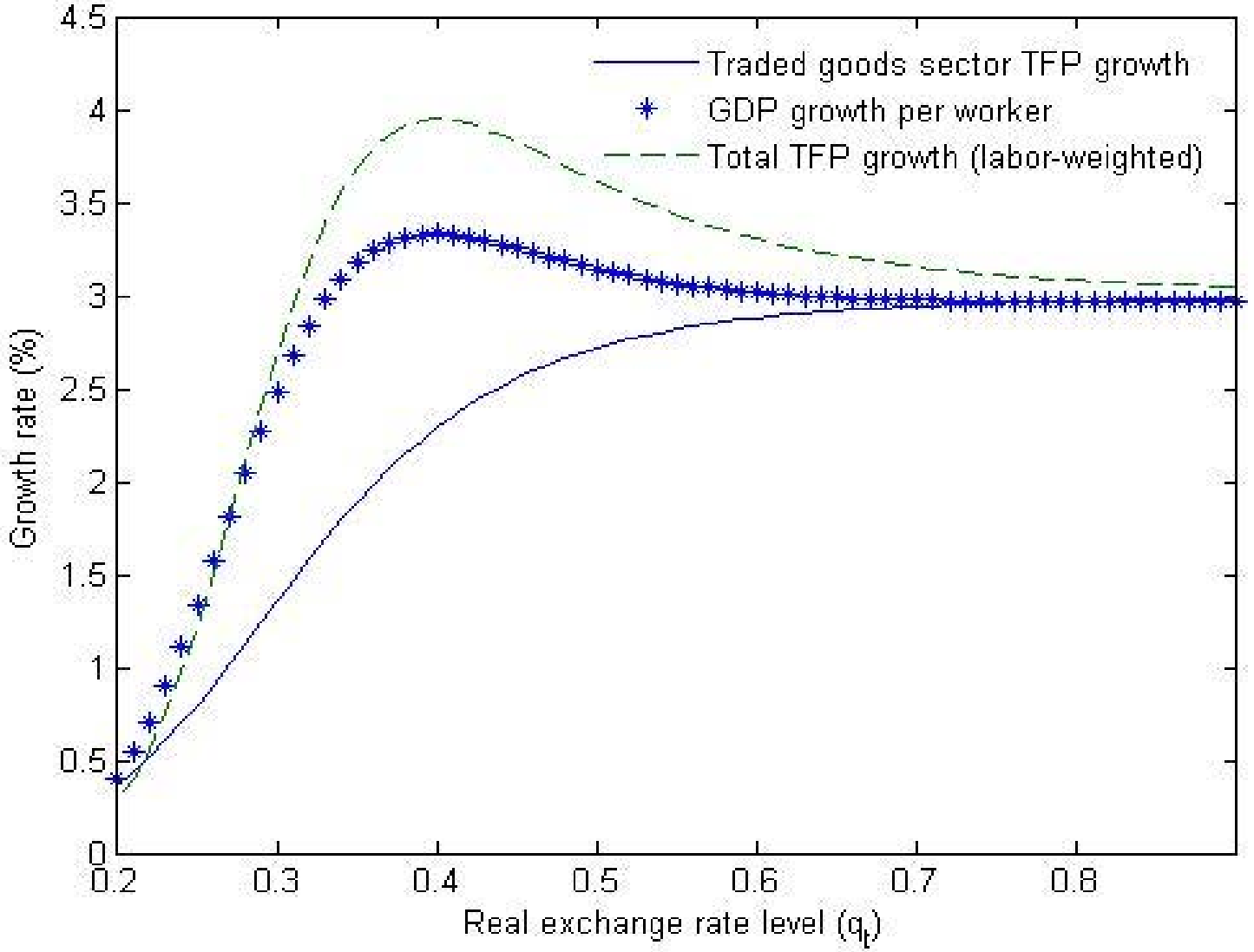
McLeod and Meliva, 2012

However, during the transition changing the RER changes the labor share l_t, so overall productivity growth also depends on the rate at which l_t changes over time (i.e. how fast changes in the RER, q_t, move labor out of the non-traded goods sector with fixed productivity level B into the dynamic traded goods sector). The instantaneous rate of growth of overall TFP is given by

$$\frac{\dot{TFP}_t}{TFP_t} = \frac{(A_t - B)\dot{l}_t + l_t\dot{A}_t}{l_t A_t + (1-l_t)B}, \qquad (10)$$

where $TFP_t = l_t A_t + (1-l_t)B$.

Growth surges & miracles



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