1. INTRODUCTION

- Economic growth is a fundamental branch of (macro)economics.
- It focuses on the long-run trend performance of GDP growth (as opposed to business cycles).
- The literature is vast, intuitively quite simple, but mathematically demanding.

For inspiration

- “Is there some action a government of India could take that would lead the Indian economy to grow like Indonesia’s or Egypt’s? If so, what, exactly? If not, what is it about the “nature of India” that makes it so? The consequences for human welfare involved in questions like this are staggering: once one starts to think about them, it is hard to think about anything else”.
2. SOME FACTS

Figure 4.1. World economic history in one picture. Incomes rose sharply in many countries after 1800 but declined in others.

Figure 4.2. Cross-country convergence.

Table 4.3

|------|---------|---------|-----------|-----------
| Urban | 1.5     | 1.2     | 1.1       | 1.2       |
| Rural | 2.2     | 2.4     | 2.5       | 2.4       |


Figure 4.4

SOME FACTS

- Some facts (there are many):
  - Differences in the level of income, and differences in the rate of income growth among countries.
  - Growth is a recent phenomenon.
  - “Club convergence”.
  - Poverty reduction.
  - Inequality reduction.

3. FIVE MODELS

FIVE MODELS

- There are many frameworks to analyze economic growth. The “correct” model depends on the issue one wants to focus on.
- This course will be focused on the five main models.

3.1: HARROD-DOMAR

HARROD-DOMAR

- This pertains to the “first wave” in modern economic growth (Harrod 1939, Domar 1946).
- It is a Keynesian inspired growth model.
  - “Domar was writing in the aftermath of the Great Depression that made many people running the machines lose jobs. Domar and many other economists expected a repeat of the Depression after World War II unless the government did something to avoid it. Domar took high unemployment as a given, so there were always people available to run any additional machines that you built.” (Easterly, 2001)

HARROD-DOMAR

- According to Easterly (2001), even though it is ignored on a theoretical basis nowadays, it is still used on a practical basis:
  - “The Harrod-Domar growth model supposedly died long ago. But for over 40 years, economists working on developing countries have applied (and still today apply) the Harrod-Domar model to calculate short-run investment requirements for a target growth rate. They then calculate a “Financing Gap” between the required investment and available resources, and often fill the “Financing Gap” with foreign aid.”
The main prediction of the Harrod-Domar model is that "GDP growth is proportional to the ratio of investment over GDP".

Since output $Y_t$ was assumed to be proportional to the stock of capital $K$:

$$Y_t = aK_{t-1}$$

Then

$$Y_t - Y_{t-1} = \alpha(K_{t-1} - K_{t-2}) = \alpha d_{t-1}$$

And the main prediction is given by:

$$\frac{Y_t - Y_{t-1}}{Y_{t-1}} = \alpha \frac{I_{t-1}}{Y_{t-1}}$$

"The problem of balancing aggregate demand and supply was Domar’s concern. Investment in building new machines had a dual character -- it added to desired purchases of goods (demand) and it also added capacity (supply). These two effects would not necessarily be equal, Domar argued, and so the economy would spiral off into either chronic overproduction or chronic underproduction. This was the Harrod-Domar model."

---

As we will show below, the Harrod-Domar model can also be seen as a special case of the AK model.

The empirical evidence is at odds with the main predictions of the model.

This is the “second wave” in modern economic growth.

Today it is the most important benchmark model.

It has become known as the Solow-Swan model (1956).
NEOCLASSICAL GROWTH

- In the simplest model, increasing savings increases growth (temporarily), but it cannot last indefinitely.
- In the long run, growth rate is determined by the growth rate of technological progress, which is taken to be EXOGENOUS (independent of economic forces). This exogeneity is an important limitation of the model.
- Underlying principle: diminishing returns or declining marginal product.

NEOCLASSICAL GROWTH

Objective: explaining the evolution of output per worker \( L (Y/L) \).

Four elements of the model:
1. Standard (Cobb-Douglas) production function, with constant returns to scale. Diminishing marginal product is a key element of the model.
2. Savings \( S \) is a fraction of output.
3. Savings = Investment \( I \).
4. Solow-Swan equation: increase in capital depends on investment minus depreciation \( \delta K \).

Then, in intensive terms (dividing by the units of effective workers \( E \times L \)),

\[
(\delta + n + g)(K/EL)
\]

Where \( n \) is population growth and \( g \) is the rate of technological progress \( E \).

NEOCLASSICAL GROWTH

\[
k_{t+1} - k_t = sy_t - (\delta + n + g)k_t
\]

is known as the Solow-Swan equation

- Capital stock per worker increases with the difference between gross savings of the economy and the term \((\delta + n + g)k\).
- When savings increases investment increases, and capital stock raises.
- \((\delta + n + g)k\): the higher the depreciation rate \( \delta \) and so on, the lower the increase of capital stock per worker.
**NEOCLASSICAL GROWTH**

- In a balanced equilibrium:
  \[ \dot{k}_{i+1} = \dot{k}_i \Rightarrow s\dot{y}_i = (\delta + n + g)k_i \]
- So that the stock of capital per effective worker and capital-output ratio reach a steady state:
  \[ \frac{K}{Y} = \frac{s}{\delta + n + g} \]

- This implies that:
  - Long run growth is only determined by the growth rate of technological change. However, the growth rate of the level of technology is exogenously given.
  - In the simplest case where there is no growth in technological progress, for instance, an increase in savings can increase the rate of growth transitorily, but not permanently. However, the level of output increases permanently.

**NEOCLASSICAL GROWTH**

- For a Cobb-Douglas production function:
  \[ \frac{Y}{L} = \left( \frac{K}{L} \right)^\alpha E^{1-\alpha} \]
- The level of output per worker is given by
  \[ \frac{K}{Y} = \frac{s}{\delta + n + g} \]

**NEOCLASSICAL GROWTH**

- Are poor countries likely to catch up with rich ones? This has become known as conditional convergence:
  - If countries have the same characteristics (technology, ...), the answer is YES for the neoclassical growth model, since they will converge on the same steady state.
  - There is a vast literature on this issue, when compared to the AK model (more on this below).
NEOCLASSICAL GROWTH
• Additionally, the neoclassical growth model offers a growth accounting framework to quantify the contribution of inputs to output growth (Solow, 1957). More on this will be shown below in Sections 4 and 5.

NEOCLASSICAL GROWTH
• This model can be easily extended to incorporate an endogenous savings rate *a la Cass-Koopmans-Ramsey*. This is the benchmark model in advanced and PhD macroeconomics courses today.

3.3: AK GROWTH
• In the neoclassical growth model the rate of technological change was exogenously given. However, that was clearly unsatisfactory.
• Now it is endogenously derived.
• The AK growth model pertains to the third wave (“first family” of models; since there are others) in modern economic growth.

AK GROWTH
• Technological change is surely NOT exogenous. Instead, it depends on economic decisions (it is endogenous, therefore):
  – Industrial innovations made by profit-seeking firms, depending on:
    • The funding of science,
    • The accumulation of human capital, and
    • Others.

AK GROWTH
• Incorporating endogenous technology into growth theory forces us to deal with the difficult phenomenon of increasing returns to scale: people must be given an incentive to improve technology.
  – With constant returns to scale inputs are paid their marginal products. Then there is nothing to pay for the resources used in improving technology.
  – Endogenous theory cannot be based on the usual theory of competitive equilibrium.
AK GROWTH

• Arrow (1962) proposed a solution: technological progress is supposed to be an unintended consequence of producing new capital goods; “learning by doing” (e.g., airframe manufacturing, shipbuilding, ...). Knowledge creation is a side product of investment. A firm that increases its physical capital learns simultaneously how to produce more efficiently.

• Learning by doing was assumed to be purely external to the firms responsible for it. That is, if technological progress depends on the aggregate production function of capital and firms are all very small, they all can be assumed to take the rate of technological progress as being given independently of capital goods:
  – Learning by doing works through each firm’s net investment.
  – Each firms knowledge is a public good that any other firm can access at zero cost. In other words, once discovered, a piece of knowledge spills over instantly across the whole economy.

AK GROWTH

• The AK model assumes that when people accumulate capital, learning by doing generate technological progress that tends to raise the marginal product of capital, thus offsetting diminishing marginal product. Then:

\[ Y = AK \]

AK and HARROD-DOMAR

• An early precursor of the AK model was that of Harrod-Domar. If the production function has fixed technological coefficients (Leontiev):

\[ Y = F(K, L) = \min\{AK, BL\} \]

• Due to the non-substitutability of inputs, the there will be probably surplus capital or labor.

AK and HARROD-DOMAR

• When capital is the limiting factor (surplus labor takes place) in Harrod-Domar’s model, then the production function is “linear-in-K”:

\[ Y = AK \]
AK and HARROD-DOMAR

- Then the Solow-Swan equation becomes
  \[ K_{t+1} - K_t = sAK_t - \delta K_t \]
- The growth rate of capital will be:
  \[ \frac{K_{t+1} - K_t}{K_t} = sA - \delta \]

AK and HARROD-DOMAR

- The growth rate of capital:
  \[ \frac{K_{t+1} - K_t}{K_t} = sA - \delta \]
- Since output is linear in \( K \), then the rate of growth of output will also be \( g \) (the growth rate of output per worker will be \( g-n \)), and the growth rate is increasing in the savings rate \( s \).

MODERN AK GROWTH

- The modern AK growth encompasses:
  - Solow: perfect competition, substitutability of factors, and full employment.
  - Harrod-Domar: long run growth rate depends on the savings rate.

MODERN AK GROWTH

- “Learning by doing” model (Frankel 1962): individual firms contribute to the accumulation of technological knowledge when they accumulate capital (spillover effects):
  \[
  \frac{y_j}{\bar{Y}} = \frac{\bar{\eta} k_j^{\alpha} L_j^{1-\alpha}}{\bar{\sigma} A_0 \left( \sum_{j=1}^{N} k_j \right)^\eta}
  \]
  \( \eta \) reflects the extent of the knowledge externalities generated among firms (if \( \eta = 0 \) there are not extern.)

MODERN AK GROWTH

- The result implies that aggregating output, capital, and labor across firms, then in equilibrium aggregate output is given by:
  \( Y = AK^{\alpha+\eta} \)
- Thus
  \[
  \frac{K_{t+1} - K_t}{K_t} = sAK_t^{\alpha+\eta} - \delta
  \]

MODERN AK GROWTH

- Depending on the impact of diminishing returns and the spillover effect:
  - Diminishing returns are stronger (\( \alpha + \eta < 1 \)): Solow-Swan results.
  - Both impacts compensate (\( \alpha + \eta = 1 \)): AK model results.
  - Spillover results are stronger (\( \alpha + \eta > 1 \)): explosive growth.
- Intertemporal utility maximization can be easily incorporated to the model.
MODERN AK GROWTH

- There is a vast literature on the empirical debate between between neoclassical and AK growth models:
  - Persistent positive growth rates of per capita GDP in most countries worldwide. This fact can be explained by the AK growth model, but not by the neoclassical model.
  - Cross-country or cross-regional convergence, either absolute (irrespective of their characteristics) or conditional (given similar characteristics). This runs in favor of the neoclassical model. *Clubs convergence.*

3.4: PRODUCT VARIETY

- This is the third wave (“second family”) in modern economic growth: innovation-based growth models related to product variety (Romer, 1990).
  - Innovation causes productivity growth by creating new, but not necessarily improved, varieties of products. Growth is induced and sustained by increased specialization.

PRODUCT VARIETY

- For each new product there is a sunk cost of product innovation that must be incurred just once, when the product is first introduced, and never again. The sunk costs can be taken as costs of research, an activity that add to the stock of technological knowledge.

PRODUCT VARIETY

- Technological knowledge consists of a list of blueprints, each of them describing how to produce a different product, and every innovation adds one more blueprint to the list (basic innovation, as if a new industry is opened up). Identifying the state of the technology with the number of varieties should be seen as a metaphor.
PRODUCT VARIETY

• Differences with AK model:
  – Sunk cost of product development, AND
  – Fixed costs make product markets
    monopolistically competitive rather than
    perfectly competitive. Imperfect competition
    creates profits, and these profits act a reward
    for the creation of new products.

• Production function:
  \[ Y_t = \sum_{i=0}^{N_t} K_{it}^{\alpha} \]
  • There are \( N \) varieties of intermediate
    products, each produced using \( K_t \) units of
    capital. By symmetry, aggregate stock of
    capital is divided into the \( N \) varieties evenly
    \[ Y_t = N_t^{1-\alpha} K_t^\alpha \]

• The degree of product variety \( N \) is the economy’s
  aggregate productivity parameter, and its growth
  is the long-run growth rate of per capita worker.
• More product variety raises output potential
  because a given capital stock is spread over a large
  number of uses, each of which shows diminishing
  returns.

• Increasing product variety sustains growth.
  • New varieties (new innovations) themselves result
    from R&D investments by research-entrepreneurs,
    who are motivated by the prospect of (perpetual)
    monopoly rents if they successfully innovate.
  • There is only one kind of innovation, which
    always results in the same kind of new product.
  • There is no role for exit and turnover in the
    economy.

3.5: SCHUMPETERIAN MODEL

• This is the third wave (“third family”) in
  modern economic growth. Again
  innovation-based growth model. Also
  known as the Schumpeterian model since it
  involves “creative destruction” (Schumpeter, 1942): quality-improving
  innovations created by new technologies
  render old products obsolete (Aghion and
SCHUMPETERIAN MODEL

- The model begins with a Cobb-Douglas type of production function at the industry level:
  \[ Y_t = A_t^{1-\alpha} K_t^\alpha \]

- Each intermediate product is produced and sold exclusively by the most recent innovator. A successful innovator in sector \( i \) improves the technology parameter \( A_t \) and is thus able to displace the previous product in that sector, until it is displaced in turn by the next innovator.

SCHUMPETERIAN MODEL

- First implication of the model: faster growth generally implies a higher rate of firm turnover, because this process of creative destruction generates entry of new innovators and exit of former innovators.

SCHUMPETERIAN MODEL

- Even though the focus is on individual industries, the assumption that all industries are equal \emph{ex ante} offers a simple (Cobb-Douglas) structure:
  \[ Y_t = A_t^{1-\alpha} K_t^\alpha \]

SCHUMPETERIAN MODEL

- There are two main inputs to innovation:
  - The private expenditures made by the prospective innovator, and
  - The stock of innovations that have already been made by past innovators: publicly available stock of knowledge (current innovators can add to it).

SCHUMPETERIAN MODEL

- (Cont.) Stock of innovations available:
  - An innovation that leapfrogs ("salto de rana") the best available technology available before the innovation, resulting in a new technology parameter \( A_t \) in the innovating sector \( i \), which is some multiple \( \gamma \) of its preexisting value: LEADING-EDGE INNOVATION.
  - An innovation that catches up to a global technology frontier \( \hat{A} \) (the stock of global technological knowledge available to innovators in all sector in all countries): IMPLEMENTING (IMITATING) INNOVATION.
SCHUMPETERIAN MODEL

• If leading-edge innovations take place at the frequency $\mu_n$ and implementation innovations (or imitations) at the frequency $\mu_m$, then the aggregate productivity parameter evolves as

$$A_{t+1} - A_t = \mu_n(y-1)A_t + \mu_m(A_t - A_i)$$

• And the growth rate will be given by

$$g_t = \frac{A_{t+1} - A_t}{A_t} = \mu_n(y-1) + \mu_m\left(\frac{A_t}{A_i} - 1\right)$$

where

$$a_t = \frac{A_t}{A_i}$$

Is an inverse measure of “distance to the frontier”

SCHUMPETERIAN MODEL

• Growth policies are highly context-dependent:
  – How does country performance vary with its proximity to the technological frontier $a_t$?
  – To what extent will the country converge to the technological frontier $a_t$?
  – What kinds of policy changes are needed to sustain convergence as country approaches to the technological frontier $a_t$?

SCHUMPETERIAN MODEL

• The critical innovation frequencies could be:
  – Taken as given.
  – Derived endogenously from profit maximization strategies. They will depend on:
    • Economic institutions, such as property right protection, the financial system, ...
    • Government policy.
  – The equilibrium intensity and mix of innovation will depend on the institutions and policies, and this in turn from the country’s distance to the technological frontier.

SAPIR REPORT

Contrary to the past two decades where growth and catching-up with the US could largely be achieved through factor accumulation and imitation, once European countries had moved closer to the technology frontier and also with the occurrence of new technological revolutions in communication and information, innovation at the frontier has become the main engine of growth (see Box 4.3). This in turn often calls for new organisational forms, less vertically integrated firms, greater mobility of both inputs and information, greater flexibility of labour markets, a greater reliance on market finance and a higher demand for both R&D and higher education. However, these necessary changes in economic institutions and organisations have not yet occurred on a large scale in Europe and it is this delay in adjusting our institutions, which accounts to a large extent for our growth deficit.

4. EMPIRICAL EVIDENCE

**EMPIRICAL EVIDENCE**

- Neoclassical and AK growth models focus on capital accumulation, while product-variety and Schumpeterian models focus on innovations that raise productivity.
- Two have been the main strands of empirical analysis:
  - Convergence (econometric). Mentioned for neoclassical vs. AK.
  - Growth accounting (non-econometric and econometric). Now.

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**EMPIRICAL EVIDENCE**

  - General framework based on Solow (1956).
  - First results focus on total factor productivity (TFP) growth. Capital accumulation is also an important factor.
  - Measuring capital is difficult.
  - Accounting for vs. Causation.

---

**EMPIRICAL EVIDENCE**

- Direction of new research, incorporating:
  - Human capital,
  - Information and Communication Technologies capital, and
  - Intangible assets.
- I will focus on the basic framework in the next Section in more detail.
5. TWO (PERSONAL) PRACTICAL EXAMPLES

• Broad recommendation for research: provide a coherent mix of theory and empirical evidence. It makes it much easier to “sell”.

5.1: GROWTH ACCOUNTING


Introduction

• Motivation:
  – Average productivity and TFP growth rates in Spain and the EU are very low since mid 1990s.
  – Few studies for the Basque Country. Additionally, they are ...
    • Mainly econometric,
    • They have become somewhat outdated, and
    • They show almost no evidence on ICT, infrastructures, ...

Objectives of the paper:
  – To study the sources of economic growth in the Basque Country, Navarre and Spain.
  – To compare the results with those of the EU and the US, and
  – To quantify the impact of ICT and infrastructures on economic growth.
Introduction

• Growth accounting is a useful method to analyze the sources of economic growth. It decomposes the growth rate in aggregate output into the contribution of the growth rate of inputs (labor, capital, ...) plus the growth in TFP.

Main results

• Growth rates were lower than in the US and higher than in the EU for 1986-2004. Labor and capital were the main sources of growth. TFP growth was residual.
• In the recent period 1995-2004 growth rates were higher. Labor was the main contributor. TFP growth was negative. ICT capital contribution increased, but they were below those for the EU and the US.
• Results were gloomier for 2000-2004. TFP growth was more negative. Poorer ICT capital contribution.

The growth accounting methodology

• Growth accounting decomposes the growth rate of output into:
  – Contribution of labor growth.
  – Contribution of capital growth.
  – Everything else: "black box".

The growth accounting methodology

• Neoclassical production function:
  \[ Y_t = A_t \cdot F(L_t, K_{INF,t}, K_{ICT,t}, K_{O,t}) \]
  \[ Y = \text{Output} \]
  \[ A = \text{Level of technology (TFP)} \]
  \[ L = \text{Labor} \]
  \[ K = \text{Services of capital} \]
  • Infrastructures (INF),
  • Information and Communication Technologies (ICT): hardware, software, and communications,
  • Others (O).

The growth accounting methodology

K=Services of capital
• Infrastructures (INF): road, water, railway, airport, port, and urban.
• Information and Communication Technologies (ICT):
  – Hardware: office machinery and computer equipment,
  – Software, and
  – Communications
• Other (O) type of non-residential capital:
  – Constructions other than dwellings and the infrastructures referred earlier,
  – Transport equipment.
  – Machinery, equipment and other products, except ICT.

The growth accounting methodology

• Under usual assumptions, the growth rate of output is:
  \[ \Delta \ln Y_t = \Delta \ln A_t + \pi_L \cdot \Delta \ln L_t + \pi_{INF} \cdot \Delta \ln K_{INF,t} + \pi_{ICT} \cdot \Delta \ln K_{ICT,t} + \pi_O \cdot \Delta \ln K_{O,t} \]
  where \( \pi \) denotes input shares.
• If we have data on Y, L, and K, and input shares...
The growth accounting methodology

\[
\Delta \ln A_t = \Delta \ln Y_t - \sigma_{Kt} \cdot \Delta \ln L_t - \sigma_{L, t} - \Delta \ln K_{\text{INF}}, - \Delta \ln K_{\text{ICT}}, - \Delta \ln K_{\text{O}}.
\]

= the growth rate of output that cannot be attributed to the (weighted) growth rate of inputs="Solow residual"="a measure of our ignorance"=technical innovations, organizational and institutional changes, changes in societal attitudes, fluctuations in demand, changes in factor shares, omitted variables, and errors of measurement.

The growth accounting methodology

• Alternatively:

\[
\Delta \ln Y_t = \Delta \ln A_t + \sigma_{K, t} \cdot (\Delta \ln K_{\text{INF}} - \Delta \ln L_t) + \sigma_{K, t} \cdot (\Delta \ln K_{\text{ICT}} - \Delta \ln L_t).
\]

which is very useful to analyze the growth rate of output per hour (or per worker).

Results of previous studies

• Several studies for Spain, but very few for the Autonomous Communities, or provinces in Spain.
• Gallastegui (2000). Period 1985-1994. 60% was explained by the evolution of private and public capital, employment, training of workers, and expenditure in R+D. 30% was explained by technological change.

Results of previous studies

• Goerlich and Mas (2001). Growth in TFP was the main source of growth, followed by private capital (1965-1996).

Results of previous studies

• Mas and Quesada (2005). Similar results to those of Timmer et al. (1985-2002).
  – Labor and capital were the main sources of growth.
  – The contribution of labor increased enormously, while that of TFP declined.
  – Increasing contribution of ICT capital.
Results of previous studies

- EUKLEMS (2007-). New database. Results:
  - Slowdown of labor productivity in EU-15, from mid-1990s again. Backed mainly by capital growth. ICT contribution increased.
  - “Poor” performance for Spain in terms of productivity. Labor was the main contributor during 1995-2004. ICT contribution increased slightly. TFP fell significantly.

Data sources

- Data for the EU and the US: EUKLEMS (2007).
- Data for Spain:
  - National Accounts: Contabilidad Regional de España (base 1986, 1995, 2000): GVA, GVA deflator, total employment, number of employees, gross compensation of employees, ...
  - Number of hours: EUKLEMS (2007).
Conclusions

1. Growth rates of output.
   - They were generally lower than in the US and higher than in the EU during 1986-2004.
   - Navarre and Spain above the US.
Conclusions

2. Sources of economic growth.
   • Labor and capital were the main sources during 1986-2004. TFP growth was residual.

Conclusions

3. Contribution of infrastructures.
   • Around 0.10% to output growth during 1986-2004.
   • It has declined during 1995-2004.

Conclusions

   • Around 0.35% during 1986-2004.
   • Increased during 1995-2004. Similar levels to those of the EU, but still far from the US.
   • It declined substantially during 2000-2004.

Conclusions

5. Growth rates of output per hour.
   • Around 1.10% during 1986-2004.
     • Capital deepening was the main contributor.
     • Infrastructures: 0.04%.
     • ICT capital: 0.24%-0.30%
     • Capital deepening again.
     • Infrastructures: very low.
     • ICT capital increased.

5.2: CURRENT ACCOUNT BEHAVIOR


INTRODUCTION

• Motivation: huge movements in cross-border holdings of financial assets.
• “The intertemporal approach views the current-account balance as the outcome of forward-looking dynamic saving and investment decisions”.

\[ CA = S - I \]
INTRODUCTION

• Which is the impact of transitory shock?
  – Traditional rule: the impact is equal the amount of savings generated by the shock. However, it does not hold empirically.
  – New rule: the impact is equal to the amount of savings generated by the shock multiplied by the net foreign asset position. It seems to hold empirically. The original idea was proposed by Kraay and Ventura (2000).
• However, it is assumed that the country is a small open economy.

INTRODUCTION

• Contribution:
  – Extending the new rule to a not-so-small open economy: which is the impact of transitory income shocks on the current account in a not-so-small open economy (i.e. in a two-country world)?
  – Empirically test the main predictions: how does the theory fit with the empirical data?

THEORY

• Endogenous growth: domestic and foreign capital is subject to diminishing returns to capital. Aggregate capital stock has an external effect on labor productivity, but the firm faces decreasing returns to capital.
  – “We motivate diminishing returns to domestic capital bluntly as the result of congestion effects or negative externalities. Since the representative consumer is infinitesimal, he/she understands that his/her actions have no influence on the aggregate stock of capital.” (Kraay and Ventura, 2000).

THEORY

• Two countries.
• Stochastic shocks. This permits incorporating risk to the analysis. Mean-variance approach.
• Continuous time.

THEORY

• One homogeneous good.
• Three assets:
  – Risky domestic capital,
  – Risky foreign capital, and
  – Bonds: risk free endogenous interest rate.

THEORY

• Domestic and foreign wealth:
  \[ W = K_d + K_d^* + B \]
  \[ W^* = K_f + K_f^* - B \]
• Net foreign asset position:
  \[ P = K_d^* - K_f + B \]
• Current account:
  \[ CA = dP = dK_d^* - dK_f + dB \]
THEORY

\[ CA = S - I = dW - dK = dW - dW \frac{\partial K_d}{\partial W} - dW^* \frac{\partial K_f}{\partial W^*} \]

• When a transitory shock (an income shock, for instance) occurs:
  - Part of the shock is consumed.
  - Part of the shock is saved:
    • Traditional view: countries invest the marginal unit of wealth in foreign assets, when risk associated to investment is low compared to the diminishing returns effect.
    • New view: countries invest the marginal unit of wealth as the average one, when risk associated to investment is high compared to the diminishing returns effect.

TRADITIONAL RULE

\[ CA = dW \]

• Traditional view: \( \frac{\partial K_d}{\partial W} \to 0 \)
• Small open economy: \( dK_f \to 0 \)
• Result: the impact of transitory income shocks on the current account is equal to the saving generated by the shock.

NEW RULE

\[ CA = dW - dW \frac{K_d}{W} - dW^* \frac{K_f}{W^*} = dW \left( \frac{K_d + B}{W} \right) - dW^* \frac{K_f}{W^*} \]

• New view: \( \frac{dK_f}{dW} \to \frac{K_d}{W} \)
• Not-so-small open economy: \( \frac{\partial K_f}{\partial W^*} \to \frac{K_f}{W^*} \)
• Result: the impact of transitory income shocks on the current account is equal to the saving generated by the shock multiplied by the net foreign asset position of the country.

EXTENDED NEW RULE

\[ CA = dW - dW \frac{K_d}{W} - dW^* \frac{K_f}{W^*} = dW \left( \frac{K_d + B}{W} \right) - dW^* \frac{K_f}{W^*} \]

• New view: \( \frac{dK_f}{dW} \to \frac{K_d}{W} \)
• Not-so-small open economy: \( \frac{\partial K_f}{\partial W^*} \to \frac{K_f}{W^*} \)
• Result: the impact of transitory income shocks on the current account is equal to the saving generated by the shock multiplied by the net foreign asset position of the country plus a new term.

DATA SOURCES

• Data based on:
  – International Monetary Funds’s International Financial Statistics
  – World Bank’s World Development Indicators, and
  – Lane and Milesi-Ferretti (2007).
EMPIRICAL EVIDENCE

**Table 1**
The traditional rule

<table>
<thead>
<tr>
<th>Regression Type</th>
<th>Pooled Regression</th>
<th>Between Regression</th>
<th>Within Regression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross national saving/GDP</td>
<td>0.0190</td>
<td>0.0010</td>
<td>0.0001</td>
</tr>
<tr>
<td>R²</td>
<td>0.1756</td>
<td>0.2057</td>
<td>0.2003</td>
</tr>
<tr>
<td>No. of observations</td>
<td>408</td>
<td>10</td>
<td>060</td>
</tr>
</tbody>
</table>

Standard errors are in parentheses. Sources: IEPS, WIDER, Lane and Milesi Ferroni (2003), Nehru and Bhadur (1960), and own elaboration.

---

**Table 2**
The extended new rule (with control variables)

<table>
<thead>
<tr>
<th>Equation</th>
<th>Pooled regression</th>
<th>Between regression</th>
<th>Within regression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross national saving/GDP</td>
<td>0.0192</td>
<td>0.0010</td>
<td>0.0001</td>
</tr>
<tr>
<td>R²</td>
<td>0.1756</td>
<td>0.2057</td>
<td>0.2003</td>
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<td>060</td>
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Standard errors are in parentheses. Sources: IEPS, WIDER, Lane and Milesi Ferroni (2003), Nehru and Bhadur (1960), and own elaboration.

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**Table 3**
The new rule

<table>
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<th>Pooled Regression</th>
<th>Between Regression</th>
<th>Within Regression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross national saving/GDP</td>
<td>0.6749</td>
<td>0.0010</td>
<td>0.2003</td>
</tr>
<tr>
<td>R²</td>
<td>0.1756</td>
<td>0.2057</td>
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**Table 4**
The extended new rule (with control variables)

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CONCLUSIONS

• Increasing financial integration has important implications for the current account.
• The traditional rule has failed to account for the empirical evidence on current accounts.
• KV provided an insightful departure from the traditional rule: the new rule. Moreover, the empirical evidence seemed to validate the new rule. However, it is based on a small open economy assumption.

CONCLUSIONS

• The paper has suggested an extension to the new rule rule abandoning the small open economy assumption. It is broadly supported by the empirical evidence, which seems to reject the new rule.

6. CONCLUSIONS

• The literature on economic growth has provided many fruitful insights on many issues.
• However, many others remain unanswered, suggesting avenues for future research.
• When addressing an issue for research, I would recommend a mix of theoretical (adopting a model suitable for the objectives planned) and empirical content.

REFERENCES

REFERENCES (Textbooks)

• Aghion, Philippe and Peter Howitt (2009), *Economics of growth*, MIT Press.
<table>
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