THE EMPIRICAL FOUNDATION OF THE GOLDEN RULE

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Abstract

This working paper analyzes with cross-sectional data if the Golden Rule condition satisfies: where the saving index is equal to capital (β) or to the real interest rate, equal to the gross output growth of households.

Resumen

Este paper analiza con datos de corte transversal si se cumple la condición de la Regla de Oro: donde el índice de ahorro es igual al capital (β), o el tipo de interés real (i), igual al crecimiento bruto del producto de los hogares. Se analizarán las implicancias que podría tener ésta, para la pérdida de eficacia o bienestar.

JEL: E60, E10, 011, 020.

Keywords: Development, efficiency, welfare.

I. INTRODUCTION

The Golden Rule (GR) as developed by E. Phelps (1966) gives the condition under which a country will grow maximizing its consumption per capita. The condition is obtained when the country is growing in its long run path with stability fulfilled.

* I appreciate the comments of Professor Ricardo Caballero about the existence of a very interesting literature on the empirical assessment about dynamic efficiency specially the work of Abel-Mankiw-Summers-Zeckhauser (1989) where they use as criteria the comparison of total profits with total investment. Dynamic efficiency exist if profits are greater than investment for a reasonable long period. They suggest that this criteria is much better than to use the golden rule criteria. I will work also on this line than in some respects could be similar. My impression is that we should work much more on this empirical avenue. The suggestions of R. Cifuentes and the ones coming out from the conference were also very useful.

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The objective of this paper is to check with cross-country data if this condition provided by the GR: rate of saving (s) equal to the capital share ($\beta$), or real interest rate (i) equal to gross domestics product growth (GDP), are actually fulfilled. Even though these are long-run conditions could be of interest to analyze how far are they from current conditions, and what are the implications for efficiency or welfare loss.

This very preliminary exercise will use the data provided by the World Development Indicators 2000 (World Bank) and other studies that provides estimates of $\beta$, capital growth and Total Factor Productivity (TFP). For some of the parameters there are information for almost 150 countries, but much less of 100 of them covers all the relevant parameters.

II. DATA BEHAVIOR

In this section we present frequency distributions for real interest rate (i); annual GDP rate of growth for the period 1965-1998 ($y$); capital share ($\beta_1$); share of total income of the upper 10th decile group ($\beta_2$); annual capital stock rate of growth for the period 1950-1987 ($k$); annual Total Factor Productivity rate of growth for the period 1950-1987 ($g$); acceleration of the rate of change of the GDP ($\Delta y$) between the 90’s with respect to the 80’s.

FIGURE A
FREQUENCY OF DISTRIBUTION OF THE VARIABLES AND “PARAMETERS”

A.1. Frequency Distribution of Real Rate Interest 1998 (i)

A.2. Frequency Distribution of GDP Rate of Change 65-98 (y)
A.3. Frequency Distribution of “GDP Rate of Change 90-98 – GDP Rate of Change 80-90” ($\Delta y$)

A.4. Frequency Distribution of Gross Domestic Saving 1980 ($s_{80}$)

A.5. Frequency Distribution of Gross Domestic Saving 1980 ($s_{90}$)

A.6. Frequency Distribution of Capital Share ($\beta_1$)
FIGURE A (cont.)
FREQUENCY OF DISTRIBUTION OF THE VARIABLES AND “PARAMETERS”

A.7. Frequency Distribution of Share of Income of Top 10% (\(\beta_1\))

A.8. Frequency Distribution of GDP per capita 1998 (GDP/N)

A.9. Frequency Distribution of Change of TFP 1950-87 (g)

A.10. Frequency Distribution of Capital Rate of Growth 1950-87 (k)
### TABLE Nº 1
SUMMARY OF THE BEHAVIOR OF MAIN VARIABLES AND "PARAMETERS"

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Number of Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>$i$ Real rate of interest (1998)</td>
<td>10.5</td>
<td>12.7</td>
<td>105</td>
</tr>
<tr>
<td>$y$ GDP rate of change 65-98</td>
<td>2.1</td>
<td>2.4</td>
<td>110</td>
</tr>
<tr>
<td>$\Delta y$ GDP rate of change 90-98 – GDP rate of change 80-90</td>
<td>-0.2</td>
<td>4.1</td>
<td>144</td>
</tr>
<tr>
<td>$s_{90}$ Gross domestic saving 1980</td>
<td>19.7</td>
<td>17.1</td>
<td>113</td>
</tr>
<tr>
<td>$S_{98}$ Gross domestic saving 1998</td>
<td>15.1</td>
<td>13.3</td>
<td>136</td>
</tr>
<tr>
<td>$\beta_1$ Capital share (near 1998)</td>
<td>51.0</td>
<td>18.6</td>
<td>81</td>
</tr>
<tr>
<td>$\beta_2$ Share of income of top 10% (near 1998)</td>
<td>31.1</td>
<td>7.6</td>
<td>108</td>
</tr>
<tr>
<td>$Y/N$ GDP per capita 1998</td>
<td>6944.8</td>
<td>7533.8</td>
<td>135</td>
</tr>
<tr>
<td>$g$ Change of TFP (1950-1987)</td>
<td>1.1</td>
<td>1.4</td>
<td>92</td>
</tr>
<tr>
<td>$k$ Capita rate of growth (1950-1987)</td>
<td>4.8</td>
<td>3.0</td>
<td>92</td>
</tr>
</tbody>
</table>

### III. GOLDEN RULE’S “VERIFICATION”

In this section we “verify” how close is satisfied the GR. We make the following graphical analysis:

1. How far are the countries from their long run conditions: we compare GDP Growth ($y$) with the Capital Growth ($k$):

![Graph showing the relationship between GDP rate of change and capital rate of growth](image_url)

- $R^2 = 0.34$
- $k^* = 0.75 \cdot y^*$
2. How far are the countries from the GR’s condition $i = y^{(*)}$:

(*) Milton Friedman (1971) in some of his estimates of demand function for money used “y” as a proxy for “i”, based on this GR.
3. How far are the countries from GR’s $s = \beta$:
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Share of income of top 10% (near 1998)

Gross domestic saving 1998

"Lower GDP per capita"

"Upper GDP per capita"
IV. SOME IMPLICATIONS

As we do not get a “verification” of the GR’s we try to see if the departure from it could be explained by:

1. If the two GR’s are consistent:

2. If the departure of s from b are related to efficiency problems. We relate $s - \beta$ with TFP growth:
V. References


