THE NEGATIVE CORRELATION BETWEEN FOREIGN SAVINGS AND DOMESTIC SAVINGS*

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We show that the negative correlation between foreign and domestic savings arises from the non-stationarity of these variables. We propose a more appropriate technique for testing a causal relation such as the one claimed by the revisionist view.

1. Introduction

The empirical basis of the revisionist view (Griffin and Ffrench-Davis, 1964; Griffin, 1970; and Griffin and Enos, 1970) that foreign aid causes domestic savings to fall is the negative correlation between these variables.\textsuperscript{1} Snyder (1990) pointed out that such correlation is spurious, i.e., due to the omission of other explanatory variables from the domestic savings equation estimated. In his paper, he showed that per-capita income is one of these omitted variables and, when added into the domestic savings equation, makes the negative correlation insignificant.

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\textsuperscript{1} Although these authors focused their discussion on foreign aid, they (and number of other authors) used net foreign capital inflows as given by current account deficits in their empirical studies.
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The present paper recognizes the validity of Snyder's criticism of the revisionist view, but questions his choice of per-capita income as 'the' omitted variable and the source of the spurious correlation above. Relatedly, we will show that the correlations found by Snyder between per-capita income and domestic savings rate, and between per-capita income and foreign aid (as proportion of income) are themselves spurious.

This paper differs from Snyder's in that, firstly, it uses total foreign capital inflows (defined as the sum of foreign aid, direct foreign investment, portfolio investment, foreign loans, and other capital inflows) instead of foreign aid; secondly, it uses Philippine annual data from 1954 to 1992; and thirdly, it strongly points out that the revisionist view claims the existence of a causal relation between foreign savings and domestic savings and must be tested using a more appropriate methodology.

The paper is designed as follows. Section 2 contains a brief review of the relationship among domestic and foreign savings and income. Section 3 presents Snyder's critique of the revisionist view. In section 4, we present our critique of Snyder's argument and an alternative model. Section 5 inquires into the causal relation between foreign and domestic savings when per-capita income is included in the model. Section 6 concludes the paper.

2. The Basis for the Foreign Savings-Domestic Savings Relation

The early analysis of the effect of foreign aid (or, without altering the model’s implications, total foreign capital inflows) on income growth was based on standard growth models of the Harrod-Domar or neoclassical type. These models suggest that the growth of real income of a country is determined positively by the productivity of capital and the savings rate, the latter being an indication of the resources available to finance investment. That is,

(1) \[ g = \alpha (s + f) \]

(2) \[ i = s + f, \]
where \(g\) is the growth of real income, \(\alpha\) is the marginal productivity of capital, \(s\) is the domestic savings rate, \(f\) is the foreign savings rate (i.e., foreign capital inflows as a proportion of income), and \(i\) is the growth of domestic investment rate.

The implication of these models is that, on the one hand, foreign capital inflows will increase the amount of total savings (foreign savings will add to domestic savings) which the receiving country will use to pay for investment. Hence, for a given labor force and technological growth, the higher is the investment rate, the faster will be the growth of real income. On the other hand, a country’s dependence on foreign savings to finance investment is expected to be temporary. This is because, as seen above, the use of foreign savings will enhance income growth which, according to the life cycle theory will increase the proportion that is saved and, hence, the domestic savings ratio. As income growth is sustained, domestic savings rate will continue to rise so that continued increases in investment rate can be financed by using less and less of foreign savings. Eventually, the country mobilizes sufficient domestic savings to finance investment that she becomes independent of foreign savings.

That foreign savings will enhance the economic growth of the recipient country has been challenged by several authors, beginning 1964 when Griffin and Ffrench-Davis argued that foreign capital inflows (or aid, in particular) may not increase economic growth when foreign savings simply substitute for domestic savings, i.e., high inflows of foreign capital will lead to lower domestic savings.\(^2\) The objection to the prediction of the above model was what came to be known as the “substitution thesis”. The motivation for the revisionist argument is the concern over the notion of “dependence”, i.e., should the above thesis hold, the recipient country “would somehow increase dependence on the aid-giving country.” (Grinols and Bhagwati, 1976, 416)

\(^2\) They also argued that economic growth may decrease further because capital imports lower the productivity of capital (or equivalently, increases the capital-output ratio).
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This thesis was first tested empirically by Rahman (1968) who referred to it in his paper as the 'Haavelmo's hypothesis' which says that domestic savings do not only depend on income but (negatively) on foreign savings, as well. His test consisted of estimating a domestic savings function, \( s = a + b f \), using OLS and focusing on the statistical significance of \( b \) which was estimated to be \(-0.2473\) (p.137). He used 1962 cross-sectional data for 31 countries.

In 1970, Griffin, and Griffin and Enos estimated the same regression function as that used by Rahman and found the effect of foreign savings on domestic savings to range between \(-0.73\) (from cross-sectional data between 1962 and 1964 for 32 countries) and \(-0.84\) (for time-series data for Colombia between 1950 and 1963) (Griffin, pp. 105-6; and Griffin and Enos, pp. 321-2).3

3 Snyder's Critique of the Revisionist View

Snyder explained that the revisionist view focused on the negative and statistically significant value of \( b \) which is estimated from the following domestic savings function:

\[
(3) \quad s = a + b f, 
\]

where \( s \) is domestic savings-income ratio, \( f \) is foreign aid-income ratio, and \( a \) and \( b \) are OLS-estimated coefficients.

Snyder argued that equation (3) excludes other explanatory variables, one of which is per-capita income. He then modified equation (1) as follows:

\[
(4) \quad s = b' f + c y, 
\]

and also specified a foreign aid function as follows:

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3 Griffin's estimates of \( b \) also include 0.82 for 13 Asian and Middle East countries, 0.07 for 18 Latin American countries.
(5) \[ f = ds + ey, \]

where \( y \) is per-capita income, \( b' \), \( c \), \( d \), and \( e \) are OLS-estimated coefficients.

Snyder's results are summarized in Table 1 (p. 177) of his paper. First, using OLS, he regressed equation (3) without the constant term and found \( b \) to be negative (i.e., \(-0.40\)) and statistically significant. Then, he regressed equations (4) and (5) using both OLS and 'fixed effect' estimation and found \( b' \) and \( d \) to be negative but insignificant, positive and statistically significant, and \( e \) negative and highly significant. Based on these results, he concluded that "previous findings of a strong negative relationship appear to be explainable in terms of a combination of factors: a failure to control for omitted variables (especially per capita income),..." (p. 179).4

4...use of an unsuitable aid proxy (foreign capital inflows), and problems with sample size and composition.

The variables used are as follows: Domestic savings rate = (GDP – private public consumption)/GDP; Foreign savings rate = (direct foreign investment + portfolio investment + foreign loans + foreign aid + other capital)/GDP; Per-capita = GDP in 1 pesos/population. Data were taken from the International Monetary Fund, International Financial Statistics Yearbook 1979, 1995. Time period is 1950-1972, unless otherwise noted. We used TSP5 to process regressions.
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The above results are consistent with those obtained by Snyder in that the inclusion of per-capita income made the negative correlation between domestic and foreign savings rates insignificant (see points (i) and (ii) above). However, we will continue to argue that the cause of spurious correlation identified by Snyder was incorrect. What he overlooked is that the negative correlation between domestic and foreign savings (as also found in the Philippines) exists, not because of the omission of per-capita income from equation (1) but because of the omission of a different variable: a time trend, i.e., the negative correlation exists because both variables (and per-capita income, as well, as will be shown) are non-stationary. This was verified by introducing a time trend into equation (1) and finding its coefficient to be statistically significant. The same is true for \( f_t \).  

We confirm this result by using an augmented Dickey-Fuller (ADF) test which reveals that all three are integrated of degree one, i.e., I(1) processes. A test for cointegration yielded the result that the three variables are not cointegrated and must each enter the regression equations in their first-differenced form. We then modified equations (4) and (5) above as follows:

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6 The results of our regressions are as follows:

\[
s = 15.25 - 0.18f - 0.00003y \\
(6.06) (0.32) (-2.27)
\]

\[
f = -0.76 - 0.03s + 0.00001y \\
(-0.47) (-0.32) (2.92)
\]

where t-ratios are in parentheses. The signs are the opposite of Snyder's and may reflect the nonstationarity of variables.

7 Let \( T \) represent a time trend which is used as an explanatory variable in the regression of \( s \) and \( f \). We obtained the following results:

\[
s = 712.2 - 0.19f - 0.36T \\
(2.59) (-0.35) (-2.55)
\]

\[
f = -282.41 - 0.03s + 0.145T \\
(-2.49) (-0.35) (2.52)
\]

where t-ratios are in parentheses.

8 This test and others used here are explained elsewhere (see Mapalad, and Giles, Oles, and McCann).

9 F-statistics from the ADF tests are 2.17 for \( s_t \), 4.61 for \( f_t \), and 7.45 for \( y_t \). Critical value is approximately 7.5, lag order is one, number of observation is 21, with four parameters.

10 An F-ratio of 5.22 is obtained for the test of cointegration as compared to the critical value of approximately 7.5. Hence, the hypothesis of 'no integration' cannot be rejected.
\[ \Delta s_t = \alpha_0 + \alpha_1 \Delta f_t + \alpha_2 \Delta y_t \]

\[ \Delta f_t = \beta_0 + \beta_1 \Delta s_t + \beta_2 \Delta y_t \]

where \( \Delta \) indicates the first-difference of the variable, \( \alpha_0 \) and \( \beta_0 \) are estimated constant terms, and \( \alpha_1, \alpha_2, \beta_1, \) and \( \beta_2 \) are OLS-estimated coefficients.

Equations (6) and (7) are regressed using OLS and the following parameter estimates are obtained (t-ratios in parentheses):

\[
\begin{align*}
\alpha_0 &= -1.24 (-0.98) & \alpha_1 &= -0.24 (-0.44) & \alpha_2 &= 0.006 (1.06) \\
\beta_0 &= -0.26 (-0.49) & \beta_1 &= -0.04 (-0.44) & \beta_2 &= 0.002 (0.88)
\end{align*}
\]

The above results suggest that, when all three variables are transformed into stationary data series, the statistical significance of correlation estimates between \( s \) and \( y \) (given by \( \alpha_2 \)) and between \( f \) and \( y \) (given by \( \beta_2 \)) disappear. Hence, they are also spurious.

5. A Test of Causality

Snyder’s approach to analyzing the effect of foreign savings on domestic savings continues to be inadequate. Regardless of whether this effect is positive (as suggested by Harrod-Domar or classical growth models) or negative (as argued by the revisionists), the nature is one of a causal relation, i.e., foreign savings cause domestic savings to increase or decrease. Evaluating a causal relation such requires more than a correlation test.

A review of the literature on the debate over whether foreign savings increase or reduce domestic savings reveals only two attempts of using standard Granger causality models to test for the correlation between foreign and domestic savings. In this section

\[ ^{11} \text{These two attempts are Mapalad (1996), and Paul Bowles, “Foreign Aid and Domestic Savings in Less Developed Countries: Some Tests for Causality,” World Development, 15(1987): 789-96.} \]
also attempt to establish the existence and direction of this causal relation using a Granger causality test. We use a three-variable model with a lag order of three for each variable. The three variables used are domestic savings rate, foreign savings rate, and per-capita income. Since all three were I(1) processes but not cointegrated, they were transformed by first-differencing to make them stationary.

The Model

Our model is given by the following system of regression equations:

\[
\Delta s_t = \gamma_0 + \sum_{i=1}^{n} \gamma_{1i} \Delta s_{t-i} + \sum_{i=1}^{n} \gamma_{2i} \Delta f_{t-i} + \sum_{i=1}^{n} \gamma_{3i} \Delta y_{t-i} + \nu_{st}
\]

\[
\Delta f_t = \phi_0 + \sum_{j=1}^{n} \phi_{1j} \Delta s_{t-j} + \sum_{j=1}^{n} \phi_{2j} \Delta f_{t-j} + \sum_{j=1}^{n} \phi_{3j} \Delta y_{t-j} + \nu_{ft}
\]

\[
\Delta y_t = \theta_0 + \sum_{k=1}^{n} \theta_{1k} \Delta s_{t-k} + \sum_{k=1}^{n} \theta_{2k} \Delta f_{t-k} + \sum_{k=1}^{n} \theta_{3k} \Delta y_{t-k} + \nu_{yt}
\]

where \( \Delta s_t, \Delta f_t, \) and \( \Delta y_t \) are first differences, and \( \nu_{st}, \nu_{ft}, \) and \( \nu_{yt} \) are regression error terms of \( s_t, f_t, \) and \( y_t \), respectively, and \( i, j, \) and \( k \) are time indices indicating the lag order (= 1, 2, 3).

In equation (8), if \( \gamma_{2i} \neq 0 \) for some \( i \), then ‘\( f \) Granger causes \( s \)’ and if \( \gamma_{3i} \neq 0 \) for some \( i \), then ‘\( y \) Granger causes \( s \)’.

In equation (9), if \( \phi_{ij} \neq 0 \) for some \( j \), then ‘\( s \) Granger causes \( f \)’ while \( \phi_{3j} \neq 0 \) for some \( j \), then ‘\( y \) Granger causes \( f \)’.

In equation (10), if \( \theta_{1k} \neq 0 \) for some \( k \), then ‘\( s \) Granger causes \( y \)’ and if \( \theta_{2k} \neq 0 \) for some \( k \), then ‘\( f \) Granger causes \( y \)’.

As regards acceptance of the revisionist view, it must be that \( \gamma_{2i} < 0 \) for some \( i \).
The Empirical Results

The above model is applied using Philippine data between 1954 and 1992. The technique employed is OLS as no simultaneity exists among the three equations. We obtain the following findings. First, we find the s is exogenous of f and y, i.e., domestic savings rate was not influenced by foreign savings and per-capita income. This leads to rejection of the revisionist view, as it shows that domestic savings were not reduced by the flow of foreign savings into the country. It also confirms that per-capita income is not a significant determinant of domestic savings rate, contrary to Snyder's conclusion. This is consistent with other studies which found real income growth, not level, to be an important determinant of domestic savings rate (Tanhueco, 1997).

Second, we find that f is negatively affected by s, with a two-year lag, as given by the estimate of $\phi_{12} = -0.26$ (with a corresponding t-value of -2.35). That the sign is negative reflects the role of foreign savings as a releiver of the recipient country's domestic savings constraint. Hence, in order to maintain or increase the rate of investment, lower domestic savings rate would require more foreign savings as additional finance. The converse is also true. Furthermore, that this relationship does not occur simultaneously, but with a two-year lag, suggests that the performance of domestic savings rate over several years (i.e., some "average" instead of annual, rate) is more important in determining the country's foreign financing needs.

On the other hand, we find that foreign savings were independent of per-capita income. While some forms of foreign savings tend to be more responsive to per-capita income (which proxies market conditions), others are not as responsive. For instance, direct foreign investment, portfolio investment, and other short-term capital are attracted to countries with more favorable market conditions (e.g., a relatively well-off country will better attract these forms of foreign savings as infrastructure will tend to be more adequate and its investment climate...)

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12 Using data for a short period, 1954-1972, we obtained no significant correlation among domestic savings, foreign savings, and per-capita income in any possible direction.
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is more stable). On the other hand, foreign aid flow may respond less to per-capita income and more so to political and social factors. Somewhere in between are foreign loans which are influenced by both market and non-market factors (the latter includes funds obtained from "forced" lending in order to avoid default of a number of large debtor countries since such an event would produce a greater negative externality on the international financial system). Our results suggest that the effects of the different forms of foreign savings on domestic savings rate net out.\textsuperscript{13}

Third, our findings show that per-capita income is enhanced by foreign savings, as indicated by $\theta_{22} = 63.99$ and $\theta_{32} = 48.98$ (t-ratios are 5.88 and 2.06, respectively). This reflects the other role of foreign savings, i.e., as reliever of a country's foreign exchange constraint. A country at a lower level of development tends to rely on imports of capital goods and raw materials which are required in domestic production but could not yet be produced domestically. In order to pay for these imports, foreign exchange is necessary. To the extent that the country may be unable to earn sufficient foreign exchange from its exports, the availability of foreign savings can ease this constraint. The higher production that foreign savings make possible increases per-capita income.

This explanation is consistent with the finding that domestic savings rate does not affect per-capita income. This result appears to be heavily influenced by the period of study, which included years during which foreign savings were easily obtainable so that per-capita income was not constrained by the domestic savings rate.\textsuperscript{14}

\textsuperscript{13} Preliminary results of another study reveal that, given a lag order of three, causality tests reveal no causal relation between pairwise combinations of domestic savings rate and each of the following forms of foreign savings (expressed as proportion of GDP): direct foreign investment, portfolio investment, foreign loans, and foreign aid and grants. When the lag order was increased to five, earlier results remain except that an increase in domestic savings rate causes foreign aid and grants to fall (Mapalad, 1997).

\textsuperscript{14} Thomas E. Weisskopf, "The Impact of Foreign Capital Inflow on Domestic Savings in Underdeveloped Countries," \textit{Journal of International Economics}, 2(1972): 25-38, esp. 33, where Weisskopf classified the Philippines between 1953-62 as a country where the savings constraint is binding and the trade (and foreign exchange) constraint is not.
6. Conclusion

In this paper, we focus on the empirical basis of the revisionist view that foreign savings substitute for domestic savings in the receiving country. We join Snyder in arguing that the negative correlation which authors have generally used to lend empirical support for the above view is spurious in nature. We, however, disagree with Snyder over his choice of omitted variable (i.e., per-capita income) which is the source of the spurious correlation. We show that the significant correlations he obtained when per-capita income was included in the model are themselves spurious, arising from the non-stationarity of the variables included.

More importantly, we argue that the revisionist view is concerned with the existence of a causal relation between foreign and domestic savings and must be tested as such. This means that a correlation that continues to be inadequate. From the test of causality, we find no support for the revisionist view nor for the significance of per-capita income as a determinant of domestic savings rate. Hence, although foreign savings did complement domestic savings to some degree, the goal of increasing domestic savings rate in order to sustain high rates of investment must rely on factors which aid in domestic savings mobilization other than increases in per-capita income.

References


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