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ABSTRACT

This paper examines shares of fixed capital formation in GDP and rates of economic growth for more than 100 countries over successive 5-year periods between 1965 and 1985 to determine the direction of causality between them. Simple regressions and multiple regressions including several standard determinants of growth, as well as a simple causality test, provide more evidence that increases in growth precede rises in rates of capital formation than that increases in capital formation precede increases in growth. High rates of fixed capital formation accompany rapid growth in per capita income, but we find no evidence that fixed investment is the only or main source of ignition for economic growth.

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1. Introduction

Economists and economic historians can generally agree on the proposition that over the long run, fast economic growth does not take place without large investments in fixed capital. That close connection is demonstrated in the historical studies of Kuznets and Maddison[1] and again in the more recent outpouring of growth articles of what one might call the Summers and Heston generation[2]. What is not so clear, however, is something closer to a policy question: can a country create or accelerate growth by raising fixed capital formation, or are there broader policies that encourage growth and, as a consequence, induce high levels of capital formation?

The question of the causality between investment and growth is not a new one. Even Kuznets, who was a foremost proponent of the crucial role of investment in fixed capital, noted that there were cases where the acceleration in economic growth had preceded the rise in capital formation (see e.g. Kuznets, 1973, p. 129). Moreover, the long-term studies of Abramovitz (e.g. 1956) and Denison (1967) suggested that there was a great deal of economic growth that

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could not be accounted for by capital formation, whether as conventionally defined or broadened to include intangible forms. That question mark over the role of investment was also highlighted by studies stressing the importance of various aspects of the economic and political climate and economic policy, such as the extent of trade and exchange controls, openness to foreign investment, political stability, and monetary policy. The same question mark is raised by the fact that the postwar landscape has been strewn with the corpses of economic development programs based on forced saving and high levels of government capital investment.

Almost all the studies of post-World War II economic growth, taking advantage of the Summers-and Heston data that provide much larger number of country observations than were available before, show clear relations between capital formation proportions and growth rates. But since most of these studies are for spans of 20 or 25 years, they do not shed light on whether rapid growth induced high rates of fixed capital formation or whether high rates of fixed capital formation produced rapid growth, or both. In this paper we address that issue by examining changes in capital formation and growth over successive 5-year periods as an alternative to long-term period analyses. Our aim is to determine directions of influence and their timing.

The paper is organized as follows. Section 2 examines the question of the direction of causality between fixed capital formation and growth, using only those two variables. It first gives the period-by-period results, both pooled over all periods and for each period separately, and then performs a test to determine the

direction of causality. Section 3 presents a multiple regression analysis, based on the pooled 5-year period data, adding other explanatory variables to the regression equation. Section 4 concludes the study.

2. The Causality between Fixed Capital Formation and Growth.

The strong association between investment in fixed capital and economic growth, found in most recent empirical growth studies, has led many to conclude that the rate of capital formation determines the rate of a country's economic growth (e.g. de Long and Summers, 1991 and 1992).[3] It had also inspired a new generation of (endogenous) growth models (see e.g. Romer, 1987). Yet, the strong association between fixed investment and growth does not prove causality; the effects may very well run from growth to capital formation, so that rapid growth leads to high rates of capital formation.

There are both theoretical arguments and empirical findings that point to lines of causation that run from growth to saving rates and from saving rates to capital formation rates. Sturm (1983), reviewing studies of the determinants of saving, reported that the growth of income or productivity was the most consistent and significant influence. Both Ando (1986) and Hayashi (1986), attempting to explain high Japanese saving rates, identified rapid income growth as an important factor. This association, combined with the strong association between investment and saving rates, discussed first by Feldstein and Horioka (1980), Dooley, Frankel, and Mathieson (1987), and recently by Feldstein and Bacchetta (1991), suggests an impact of income growth on investment rates

through its effect on saving rates. Recently, Benhabib and Jovanovic (1991) have also developed a model where the "engine (of growth) is fueled primarily by something other than physical capital."

The idea that the rate of economic growth is largely dependent on the saving rate has been referred to by Sen as "...the traditional wisdom of development economics..." (1983, p. 750). This view, in its extreme forms, was unsympathetically labeled "Capital Fundamentalism" by Yotopoulos and Nugent (1976). In contrast, the lessons for successful growth policy, drawn in the concluding chapter of Harberger (1984), refer to tax policy, trade policy, inflation, and the roles of the public and private sectors, but not explicitly to policies aimed directly at increasing capital formation. Neither did Blomström and Meller (1991), in their comparison of a century of economic growth in Scandinavia and Latin America, stress differences in capital formation. In addition to most of the factors suggested by Harberger, they also emphasized the importance of population growth, the type of education provided, and the distribution of wealth in explaining the diverging growth paths between the northern and the southern countries.

The advent of systematically constructed international comparative income and output data provides a possible corrective to what could be illusory relations between income growth and capital formation. A country that invests heavily, but uneconomically, in industries favored by a distorted price system will appear to grow rapidly when output is valued at the country's own prices, as it is in the country's national accounts, the basis for most past growth studies. However, the illusion of growth disappears when output is measured at international prices, as it

would be if the country participates in the UN International Comparison Program, the basis for the Summers and Heston estimates.[4]

One possible route to understanding the economic growth mechanism is to break the post-World War II period into shorter sub-periods in which evidence might be found on "reverse" effects, running from the rate of growth to various forms of investment. We chose 5-year periods, partly to dilute cyclical influences, partly to maximize the number of countries included and to use most of the years of the ICP benchmark surveys, for which the data should be most reliable.[5] However, there is no theoretical basis for this interval and it might be worthwhile to experiment with others also. Much shorter intervals might, however, give results reflecting business cycle developments rather than the longer term influences that are important for development.

A first test of the timing issue is provided in Table 1, which shows simple cross-section regressions of 5-year growth rates in per capita GDP on preceding, current, and succeeding period fixed capital formation rates (ratios of fixed capital formation to GDP).[6] The coefficients, t-statistics, and $\overline{R}^2$s increase as one moves from the preceding period to the current one and then from there to the succeeding period. Although we would not conclude from this timing relationship that capital formation rates do not influence growth, we are led to suspect that there is at least a two-way relationship. The case for effects running from growth rates to subsequent capital formation is as strong as that for the opposite one.

Table 1

Equations Relating Fixed Capital Formation Ratios in Preceding, Current, and Following Periods to Growth in Real GDP per Capita: 101 Countries.

Period	Constant	Fixed Capital Formation/GDP			$\bar{R}^2$
		preceding period	current period	following period	
1970/1965	1.08 (36.5)	.53 (3.8)			.12
1975/1970	1.06 (28.7)	.53 (2.9)			.07
1980/1975	1.07 (26.8)	.18 (.95)			.00
1985/1980	.96 (23.8)	.19 (1.0)			.00
1970/1965	1.04 (34.4)		.78 (5.2)		.21
1975/1970	1.03 (28.7)		.69 (4.0)		.13
1980/1975	1.02 (23.8)		.46 (2.3)		.04
1985/1980	.94 (24.4)		.31 (1.6)		.02
1970/1965	1.02 (35.0)			.86 (6.1)	.27
1975/1970	.96 (26.7)			.10 (6.2)	.27
1980/1975	.97 (24.7)			.72 (3.7)	.11
1985/1980	.94 (26.3)			.35 (1.8)	.02

(t statistics in parentheses)

On the assumption that the underlying mechanisms remained essentially the same over the whole span of years, we then pooled the data for the five-year periods. Again, as shown in Table 2, the growth rate is more strongly related to current capital formation rates than to those of preceding periods, and more strongly related to the capital formation rates of the following periods than to the contemporary ones.

Table 2

Simple Regressions of Growth in Real GDP per Capita on Fixed Capital Formation Ratios

	Fixed Capital Formation/GDP		
	Preceding period	Current period	Following period
Coefficient	.30	.60	.80
t-statistic	(3.42)	(5.71)	(8.94)
$\bar{R}^2$	.03	.07	.16
No. of Obs.	404	404	404

Source: Appendix Table 1

One risk in using cross-section data, or pooled time series and cross-section data, is that the cross-sectional differences among countries reflect permanent characteristics of the countries that encourage or discourage both fixed investment and economic growth. Examples of such characteristics might be the efficiency of government, the degree of corruption, the level of violence, or the attitude of

governments and populations toward individual achievement or enterprise. Any such relationship could give a false impression that high fixed capital formation resulted in high growth, or vice versa.

One way to eliminate any such bias is to include country dummies in the regression. An equivalent method, used here, is to divide the variables by their averages over the whole period in which they are used. The effect is to remove cross-sectional differences among countries, leaving only time-series variations to be explained. The results are shown in Table 3.

Table 3

Simple Regressions of Growth in Real GDP per Capita on Fixed Capital Formation Ratios (Variables Divided by Their Averages)

	Fixed Capital Formation/GDP		
	Preceding period	Current period	Following period
Coefficient	-.166	.017	.191
t-statistic	(4.22)	(.42)	(5.37)
$\overline{R}^2$	.04	.00	.06
No. of Obs.	404	404	404

Source: Appendix Table 2

Eliminating inter-country differences makes the regressions weaker, but the results are persistent: growth seems to precede capital formation. The negative sign of the coefficient for investment in the preceding period illustrates the point made earlier about the impact of events that affect both capital formation and

growth. For example, the debt crisis of the 1980s had its strongest effects on growth in the countries that had enjoyed high growth and high capital formation rates before the crisis.

A more formal way of examining the direction of causality is to estimate the following equations:

(i) $RGDPC_t = f(RGDPC_{t-1}, RGDPC_{t-2})$

(ii) $RGDPC_t = f(RGDPC_{t-1}, RGDPC_{t-2}, INV_{t-1})$

where RGDPC is real income per capita growth, INV is the ratio of fixed capital formation to GDP, and t is the period (see Appendix). We interpret investment to be causing growth when a prediction of growth on the basis of its past history can be improved by further taking into account the previous period's investment. An F-test is carried out to see whether the gain in explanatory power from adding the lagged independent variable is statistically significant.

Estimating (i) and (ii) gives the following results:

$$RGDPC_t = \underset{(7.0)}{.661} + \underset{(3.7)}{.227}\ RGDPC_{t-1} + \underset{(2.1)}{.142}\ RGDPC_{t-2} \qquad \begin{array}{l} R^2 = .07 \\ \bar{R}^2 = .06 \\ n = 303 \end{array}$$

$$RGDPC_t = \underset{(6.7)}{.660} + \underset{(3.5)}{.228}\ RGDPC_{t-1} + \underset{(1.9)}{.142}\ RGDPC_{t-2} - \underset{(0.01)}{.002}\ INV_{t-1} \qquad \begin{array}{l} R^2 = .07 \\ \bar{R}^2 = .06 \\ n = 303 \end{array}$$

(t-values in parentheses)

The test statistic[7] is

$$F_{1,299} = .003$$

far below significance at the 5 per cent level. Thus, we cannot reject the null hypothesis that capital formation in the preceding period has no explanatory power with respect to growth in the current period, given the past history of growth in that country. The past history of growth is a poor predictor of current growth, but lagged investment does not improve the prediction.

We can then reverse the question to ask whether past growth has an effect on current capital formation rates, given the history of capital formation rates. The results are as follows:

$$INV_t = \underset{(4.6)}{2.48} + \underset{(15.3)}{.948}\ INV_{t-1} - \underset{(1.26)}{.075}\ INV_{t-2} \qquad R^2 = .79,\ \bar{R}^2 = .79,\ n = 303$$

$$INV_t = \underset{(4.9)}{-7.35} + \underset{(13.7)}{.828}\ INV_{t-1} - \underset{(.21)}{.012}\ INV_{t-2} + \underset{(6.9)}{9.49}\ RGDPC_{t-1} \qquad R^2 = .82,\ \bar{R}^2 = .82,\ n = 303$$

(t-values in parentheses)

The F-test statistic is

$$F_{1,299} = 47.6$$

which seems to suggest that past growth has a significant effect on current capital formation even after past capital formation is taken into account. Even though the past history of capital formation rates predict current rates well, past growth rates improve the prediction.

In sum, single variable tests give evidence that economic growth precedes capital formation, but no evidence that capital formation precedes growth. Thus, the causality seems to run in only one direction, from economic growth to capital formation.

3. Multiple Regressions.

In an earlier paper, studying growth over the whole post-War II period, particularly in developing countries, we found, in addition to fixed capital formation ratios, several other determinants of real GDP per capita growth (Blomström, Lipsey and Zejan, forthcoming). Among the significant variables were the initial (1960) real per capita income level (i.e. a convergence or catch-up variable), the proportion of the population in the relevant age group enrolled in secondary education (a proxy for the level of secondary education in the population), income changes that were due to changes in the world price structure (we used this variable as a more general alternative to excluding oil producing countries), changes in the labor force participation rate (intended to catch the effects of demographic changes, particularly in birth rates, on the ratio of dependent population to working population), and inflows of foreign direct investment relative to GDP (a measure of the inflow of disembodied technology from abroad). Here we include these variables in our equations and re-run the multiple regression, using pooled five-year period data instead of data for the full 1960-1988 period (all variables are defined in the Appendix).

In the multiple regressions in Table 4, pooling cross-section and time-series observations, we use current period values for all variables other than fixed capital formation[8]. In the first equation we use fixed capital formation for the preceding period; the capital formation data in the second equation are for the current period, while the third equation uses capital formation data for the following period.

Table 4

Coefficients for Fixed Capital Formation Ratios in Multiple Regressions Explaining Growth in Real GDP per Capita

	Fixed Capital Formation/GDP		
	Preceding period	Current period	Following period
Coefficient	.25	.62	1.00
t-statistic	(1.94)	(4.56)	(8.85)
$\overline{R}^2$	.12	.16	.26
No. of Obs.	364	364	364

Source: Appendix Table 1.

As in the single-variable equations presented above, the results improve when capital formation rates dated later relative to output growth are used. The explanatory power of the model, the coefficients, and the t-values for capital formation increase when we use INV_t instead of INV_{t-1}. There is a further improvement when we substitute INV_{t+1} for INV_t. The coefficients for the capital formation ratios in the multiple regressions are almost identical to those in the simple regressions of Table 2.

As in the single variable regressions above, we can eliminate the cross-sectional differences among countries by dividing the variables by their period averages. The results from doing that in the multiple regressions are shown in Table 5. Since a rise in the number of people in school is not expected to add to current production, the secondary education variable was excluded from the models.

Table 5

Coefficients for Fixed Capital Formation Ratios in Multiple Regressions Explaining Growth in Real GDP per Capita (Variables Divided by Their Averages)

	Fixed Capital Formation/GDP		
	Preceding period	Current period	Following period
Coefficient	-.155	.008	.137
t-statistic	(4.89)	(.23)	(4.85)
$\bar{R}^2$	.097	.038	.096
No. of Obs.	371	371	371

Source: Appendix Table 2.

The pattern for the three fixed capital formation measures survive the elimination of inter-country differences. The only fixed capital formation coefficient that is positive and significantly different from zero is that for fixed capital formation in the following period.[9]

4. Conclusions

Relating the growth rate of real GDP per capita to the share of fixed investment in GDP, and to other variables, most studies conclude that investment exerts a major influence on income growth. For instance, in their sensitivity analysis of the effect of different variables on GDP growth, Levine and Renelt (1992) find that the correlation between average growth rates and the average share of investment in GDP is one of the most robust results obtained and that this result "is in accord

with a wide assortment of growth studies". Although, they recognize that the direction of the relationship between growth and investment is ambiguous, others, such as de Long and Summers (1991) and (1992), treat it as unambiguous. We find, however, that the relationship between income growth and capital formation is more complex.

We have addressed the question of causality between investment and growth by dividing the post-World War II period into 5-year sub-periods. Both simple regressions and multiple regressions, including several standard determinants of growth, give stronger statistical results when per capita GDP growth in a period is related to subsequent capital formation than to current or past capital formation. Moreover, the results of simple causality tests suggest that growth induces subsequent capital formation more than capital formation induces subsequent growth. Thus, we find no evidence that fixed investment is the key to economic growth.[10]

Notes

1. See e.g. Kuznets (1973) and Maddison (1982).

2. See Levine and Renelt (1992) for a survey.

3. de Long and Summers study the effects of investment in machinery and equipment. To separate the different types of fixed investment outside of the OECD countries, however, requires a great deal of estimation without reliable support, and we decided not to attempt it at this stage for our 101 countries.

4. Unfortunately, many developing countries do not participate, and it is uncertain whether the Summers and Heston estimates for these non-participants succeed in imposing international prices on their accounts (see Blomström, Lipsey, and Zejan, forthcoming, for a discussion).

5. In an earlier, cruder version of our multiple regressions presented below, using different data, Lipsey and Kravis (1987) found that growth rates of GDP per capita over 5-year periods were more closely associated with capital formation in succeeding five-year periods than with capital formation in preceding periods. There was no indication that capital formation in the same period was more closely associated with growth than capital formation in the subsequent period.

6. A list of the countries included in the study is provided in Blomström, Lipsey and Zejan, forthcoming.

7. The test statistic is

$$F_{q,N-k} = [(R_2^2 - R_1^2)/q] \; / \; [(1 - R_2^2)/N - k]$$

where:

k = number of parameters in equation (ii)
q = number of parameters in equation (ii) less the number of parameters in equation (i)
N = sample size
R^2 = unadjusted coefficient of determination

8. We addressed the issue of timing and direction of causation also for these additional variables and found for all of them, a causality pattern similar to that we found for the investment variable. However, the effect of growth on the other variables was much smaller than the effect of growth on capital formation, and the impact of moving from preceding to current or to following-period values for these variables in the growth equations was small: nothing like that of the same process for fixed capital formation.

9. As shown in Appendix Table 2, changes in the participation rate and in the foreign direct investment ratio are insignificant here; they apparently are almost completely

a cross-section variable, possibly because there is little time-series variability within countries, but large differences among countries.

10. This conclusion, which is consistent with the model developed by Benhabib and Jovanovic (1991), is also in line with the last 25 years of research in development economics, which shows that the path to growth and development is much more than simply raising saving and investment rates from 5 to 15 per cent, as Arthur Lewis, Walt Rostow and others suggested in the 1950s Institutions, economic and political climate, and economic policy seem to be the chief foundations for economic growth.

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APPENDIX

Definition of variables:

RGDPC: Real income per capita growth, 1965-70, 1970-75, 1975-80, and 1980-85 (Ratio of end year over initial year). Data Source: Summers and Heston (1991).

GDUS: 1960 income per capita relative to that of the United States. Data Source: Summers and Heston (1991).

SCND: The average ratio of secondary education to the number in the "appropriate" age group, 1965-70, 1970-75, 1975-80, and 1980-85. Data Source: UNESCO Yearbook, various issues.

PRICE: Price deflator. Calculated as:

$$PRICE = \frac{\frac{RGDPC_t}{CGDPC_t}}{\frac{RGDPC_{t+5}}{CGDPC_{t+5}}}$$

where

$RGDPC_t$ = Real GDP per capita year t at 1985 international prices,

$CGDPC_t$ = GDP per capita year t at current international prices, and t = 1965, 1970, 1975, 1980. Data source: Summers and Heston (1991).

INV: Ratio of fixed capital formation to GDP, measured in current purchasing power parities, averaged over five-years periods (1960-65, 1965-70, 1970-75, 1975-80, 1980-85, and 1983-88). Data Source: Summers and Heston (1991).

PART: The change in the labor force participation rate, the ratio of labor force to total population, 1965-70, 1970-75, 1975-80, and 1980-85. Data Sources: ILO, Labor Statistics Yearbook and Summers and Heston (1991).

FDI: Ratio of inflow of foreign direct investment (x 10,000) to GDP, measured in current dollars, averaged over five-years periods (1965-70, 1970-75, 1975-80, and 1980-85). Data Sources: IMF Balance of Payments tape and UNCTC Transnational Corporations in World Development (1988).

Appendix Table 1

Regression Analysis of Growth in Real GDP Per Capita,
Pooled Data for Five-Year Periods, 1965-1985

Dependent Variable: $RGDPC_t$

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12
Constant	1.05 (52.6)	1.01 (50.0)	.96 (50.7)	.365 (1.73)	.347 (1.69)	.324 (1.70)	.055 (.25)	.038 (.17)	.065 (.31)	-.122 (.51)	-.082 (.35)	.028 (.12)
GDUS				-.182 (3.00)	-.174 (2.93)	-.198 (3.57)	-.267 (4.17)	-.259 (4.10)	-.265 (4.39)	-.261 (4.07)	-.260 (4.08)	-.269 (4.41)
$PRICE_t$				.213 (4.17)	.181 (3.59)	.132 (2.79)	.395 (7.13)	.364 (6.45)	.286 (5.15)	.382 (6.51)	.367 (6.23)	.297 (5.13)
$SCND_t$				.0015 (2.57)	.0008 (1.38)	.0004 (.72)	.003 (4.49)	.002 (3.44)	.0015 (2.60)	.003 (4.27)	.002 (3.29)	.002 (2.57)
$PART_t$				.373 (1.79)	.400 (1.96)	.444 (2.34)	.408 (1.90)	.437 (2.05)	.475 (2.34)	.426 (1.98)	.462 (2.15)	.496 (2.42)
FDI_t				.303 (3.33)	.209 (2.29)	.139 (1.66)	.317 (3.19)	.241 (2.37)	.144 (1.49)	.299 (2.91)	.246 (2.36)	.160 (1.60)
INV_{t-1}	.30 (3.42)			.25 (1.94)			.01 (.08)			-.11 (.71)		
INV_t		.60 (5.71)			.62 (4.56)			.35 (2.32)			.30 (1.84)	
INV_{t+1}			.80 (8.94)			1.00 (8.85)			.81 (5.80)			.80 (5.45)
$RGDPC_{t-1}$										.024 (.37)	-.015 (.22)	.041 (.65)
$RGDPC_{t-2}$										.150 (2.08)	.103 (1.47)	.041 (.61)
$\bar{R}^2$	.03	.07	.16	.12	.16	.27	.21	.22	.29	.21	.22	.29
Sample Size	404	404	404	364	364	364	280	280	280	280	280	280

t-statistics in parentheses

Appendix Table 2

Regression Analysis of Growth in Real GDP Per Capita, Pooled Data for Five-Year Periods, 1965-1985

[All variables (except GDUS) divided by their averages]

Dependent Variable: $RGDPC_t$

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12
Constant	1.28 (31.1)	1.09 (25.9)	.92 (24.7)	1.09 (4.78)	.894 (3.84)	.752 (3.31)	.529 (1.97)	.249 (.90)	.113 (.42)	.934 (3.36)	.783 (2.73)	.649 (2.32)
GDUS				-.059 (2.06)	-.064 (2.17)	.055 (1.93)	-.066 (2.17)	-.065 (2.05)	-.053 (1.72)	-.062 (2.13)	-.058 (1.93)	-.049 (1.69)
$PRICE_t$				.206 (3.52)	.203 (3.30)	.140 (2.33)	.400 (6.23)	.424 (6.20)	.346 (5.11)	.457 (7.13)	.477 (7.18)	.410 (6.21)
$PART_t$				-.134 (.60)	-.098 (.42)	-.022 (.10)	.227 (.90)	.292 (1.10)	.378 (1.46)	.209 (.85)	.257 (1.01)	.342 (1.38)
FDI_t				-.0001 (.06)	-.0011 (.54)	-.0024 (1.24)	.0015 (.75)	.0010 (.46)	-.0008 (1.46)	.0014 (.74)	.0006 (.30)	.0007 (.36)
INV_{t-1}	-.166 (4.22)			-.155 (4.89)			-.191 (5.35)			-.158 (4.47)		
INV_t		.017 (.42)			.008 (.23)			-.007 (.18)			.022 (.63)	
INV_{t+1}			.191 (5.37)			.137 (4.85)			.124 (4.25)			.122 (4.39)
$RGDPC_{t-1}$										-.233 (3.86)	-.277 (4.38)	-.276 (4.62)
$RGDPC_{t-2}$										-.229 (3.41)	-.284 (4.16)	-.268 (4.06)
$\bar{R}^2$	.04	.00	.06	.10	.04	.10	.21	.13	.19	.27	.22	.27
Sample Size	404	404	404	371	371	371	371	287	287	287	287	287

t-statistics in parentheses

Simple Correlation Matrices

Sample Size: 404								
	$RGDPC_t$	INV_{t-1}	INV_t	INV_{t+1}	GDUS	$PRICE_t$	$SCND_t$	$PART_t$
$RGDPC_t$								
INV_{t-1}	.17							
INV_t	.27	.90						
INV_{t+1}	.41	.79	.90					
GDUS	.07	.49	.50	.46				
$PRICE_t$	.14	-.06	.00	.07	.08			
$SCND_t$	.17	.60	.60	.54	.75	-.02		
$PART_t$	.15	.23	.24	.21	.34	.02	.43	
FDI.*	.18	.26	.31	.27	.10	-.22	.14	.07

* 373 obs.

Sample Size: 303										
	$RGDPC_t$	INV_{t-1}	INV_t	INV_{t+1}	$RGDPC_{t-1}$	$RGDPC_{t-2}$	GDUS	$PRICE_t$	$SCND_t$	$PART_t$
$RGDPC_t$										
INV_{t-1}	.12									
INV_t	.24	.89								
INV_{t+1}	.39	.77	.89							
$RGDPC_{t-1}$	.24	.33	.46	.41						
$RGDPC_{t-2}$	.17	.45	.41	.41	.23					
GDUS	.08	.51	.48	.47	.21	.24				
$PRICE_t$	.28	-.06	.02	.12	.18	.01	.09			
$SCND_t$	.20	.63	.59	.54	.27	.34	.75	-.10		
$PART_t$	.18	.23	.22	.20	.20	.09	.34	.42	.42	
FDI.**	.13	.23	.31	.28	.27	.12	.12	.16	.16	.06

** 290 obs.

Simple Correlation Matrices

Variables (except GDUS) Divided by Their Averages

Sample Size: 404

	RGDPC$_t$	INV$_{t-1}$	INV$_t$	INV$_{t+1}$	GDUS	PRICE$_t$	PART$_t$
RGDPC$_t$							
INV$_{t-1}$	-.22						
INV$_t$	.01	.39					
INV$_{t+1}$	.25	-.20	.42				
GDUS	-.10	.02	-.05	-.06			
PRICE$_t$	.19	-.01	.11	.19	.03		
PART$_t$	.01	-.03	.00	-.05	.07	.01	
FDI.*	.10	.10	.16	.07	-.05	.03	-.05

* 373 obs.

Sample Size: 303

	RGDPC$_t$	INV$_{t-1}$	INV$_t$	INV$_{t+1}$	RGDPC$_{t-1}$	RGDPC$_{t-2}$	GDUS	PRICE$_t$	PART$_t$
RGDPC$_t$									
INV$_{t-1}$	-.32								
INV$_t$	.00	.27							
INV$_{t+1}$	.28	-.33	.41						
RGDPC$_{t-1}$	-.10	.07	.26	.08					
RGDPC$_{t-2}$	-.22	.16	-.03	-.05	-.16				
GDUS	-.10	-.01	-.09	-.08	.01	.02			
PRICE$_t$	.38	-.10	.06	.18	.23	-.04	.05		
PART$_t$	.06	-.05	-.02	-.07	.07	-.09	.09	.03	
FDI.**	-.13	.09	.17	.09	-.05	-.05	-.04	-.43	-.02

** 290 obs.