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ECONOMIC GROWTH IN A CROSS SECTION OF COUNTRIES

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ABSTRACT

In neoclassical growth models with diminishing returns to capital, a country's per capita growth rate tends to be inversely related to its initial level of income per person. This convergence hypothesis seems to be inconsistent with the cross-country evidence, which indicates that per capita growth rates for about 100 countries in the post-World War II period are uncorrelated with the starting level of per capita product. However, if one holds constant measures of initial human capital—measured by primary and secondary school-enrollment rates—there is evidence that countries with lower per capita product tend to grow faster. Countries with higher human capital also have lower fertility rates and higher ratios of physical investment to GDP. These results on growth, fertility, and investment are consistent with some recent theories of endogenous economic growth. With regard to government, the cross-country data indicate that government consumption is inversely related to growth, whereas public investment has little relation with growth. Average growth rates are positively related to political stability, which may capture the benefits of secure property rights. There is also some indication that distortions of investment-goods prices are adverse for growth. Finally, the analysis leaves unexplained a good deal of the relatively weak growth performances of countries in sub-Saharan Africa and Latin America.

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In neoclassical growth models with diminishing returns to capital, such as Solow (1956), Cass (1965), and Koopmans (1965), a country's per capita growth rate tends to be inversely related to its starting level of income per person.[1] Therefore, in the absence of shocks, poor and rich countries would tend to converge in terms of levels of per capita income. However, this convergence hypothesis seems to be inconsistent with the cross-country evidence, which indicates that per capita growth rates are uncorrelated with the starting level of per capita product. Figure 1 shows this type of relationship for 98 countries. Using the data from the Summers-Heston (1988) international comparison project, the average growth rate of per capita real GDP from 1960 to 1985 (denoted GR6085) is unrelated to the 1960 value of real per capita GDP (GDP60)—the correlation is .09.[2] Although inconsistent with standard neoclassical growth theories, these findings accord with recent models, such as those of Rebelo (1987) and Lucas (1988), that assume constant returns to a broad concept of capital, which includes human capital. In these models the growth rate of per capita product is independent of the starting level of per capita product.

Models with constant returns to physical and human capital together also allow for transitional dynamics. Rebelo (1987) and Lucas (1988) use a

[1]The idea is that the starting level of per capita income is a proxy for the capital-labor ratio. The smaller the ratio the further the distance from the steady state and the higher the transitional rate of per capita growth. For further discussion, see Rebelo (1987).

[2]I use throughout the values of GDP expressed in terms of prices for the base year, 1980. Results using chain-weighted values of GDP are not very different.

two-sector production model, where one sector produces the usual kind of product (consumables and capital goods) and the other sector produces human capital. In this framework, the initial ratio of human to physical capital can depart from its steady-state value. For example, if human capital is high relative to physical capital (as in post-war situations where the main wartime destruction applied to physical capital), the subsequent path may feature high rates of physical investment and per capita growth. Then the prediction is that a country's rates of physical investment and per capita growth are increasing in its starting ratio of human to physical capital.

Becker and Murphy (1988) also consider transitional dynamics related to the level of human capital per person. They allow the rate of return on human capital to increase over some range, an effect that could arise because of spillover benefits from human capital. That is, the return to some kinds of ability (such as talent in communications) is higher if other people are also more able. In this setting, increases in the quantity of human capital per person tend to lead to higher rates of investment in human and physical capital, and hence, to higher per capita growth. (This conclusion applies in the Becker-Murphy model if the initial level of human capital per person is high enough to escape a trap of underdevelopment.) A supporting force is that more human capital per person reduces fertility rates, because human capital is more productive in producing goods or additional human capital rather than more children.

The existing theories suggest that growth rates and ratios of investment to GDP may relate to the starting value of human capital differently from the starting value of physical capital, which includes natural resources as well as reproducible capital. In my empirical analysis, I use a proxy for human capital that is based on school enrollment rates, and use initial real per capita GDP to measure the starting value of physical capital. That is, given the human capital proxy, differences in per capita GDP would reflect differences in reproducible capital or natural resources.

Basic Results for Growth Rates

Table 1 shows regressions for annual average growth rates of per capita real GDP. Most of the results apply from 1960 to 1985 to a cross section of 98 countries (the largest number of countries on which I have been able to assemble data on the variables employed). Since heteroskedasticity could be important across countries, the standard errors for the coefficients are based on White's (1980) heteroskedasticity-consistent covariance matrix. However, these standard errors do not differ greatly from those obtained by ordinary least squares. The table also includes regressions in which the observations are weighted in accordance with the levels of gross domestic product or population.

The GDP data come from Summers and Heston (1988), while other variables (to be detailed in a forthcoming data set) are from the United Nations, the World Bank, Banks's (1979) data base, and some other sources. Means, standard deviations, and definitions for all variables appear in Table 5, and a list of countries is in Table 6. For the moment, I will concentrate on results related to the initial (1960) values of per capita GDP and the human capital proxies. The other variables, discussed later, are not strongly correlated with these variables.

The two main proxies for human capital are the 1960 values of school-enrollment rates at the secondary (SEC60) and primary levels (PRIM60).[3] These variables, based on information from the United Nations, measure number of students enrolled in the designated grade levels relative to the total population of the corresponding age group. (Because of this definition it is possible for the values to exceed 1.0.) With these school-enrollment rates (and, less importantly, the other explanatory variables) held constant, the estimated coefficient on starting per capita product, GDP60, in regression 1 of Table 1 is negative and highly significant: -.0075, s.e. = .0012. Since GDP60 is measured in thousands of 1980 U.S. dollars, the result means that an increase in per capita real GDP by $1000 lowers the real per capita growth rate (GR6085) by .75 percentage points per year. Figure 2 plots GR6085, net of the value predicted by all explanatory variables except GDP60, versus GDP60. That is, the figure shows the partial correlation between GR6085 and GDP60. In contrast with Figure 1, there is now a strong negative relationship (correlation = -.74). Thus, the results indicate that—holding constant a set of variables that includes proxies for human capital—higher initial per capita GDP is substantially negatively related to subsequent per capita growth. The sample range of variation in GDP60 (in 1980 U.S. dollars) from $208 to $7380 "explains" a spread in average per capita growth rates of

[3] It would be better to use proxies for the initial stock of human capital per person rather than variables that relate to the flow of investment in human capital. The stock of human capital derived from formal education depends on current and lagged values of school-enrollment rates. In the subsequent discussion I consider effects from lagged values of the school-enrollment variables.

about five percentage points. (The sample range in per capita growth rates is -.017 to .074, with a mean of .022.)

Regression 2 adds the square of GDP60; that is, instead of a linear form, the relation between GR6085 and GDP60 is now quadratic. The estimated coefficient of the square term is positive but only marginally significant (t-value = 1.4), while the coefficient on the linear term remains significantly negative (t-value = 3.6). A positive coefficent on the square term means that the force toward convergence (negative relation between growth and level) attenuates as per capita GDP rises. The point estimates imply that the relation between growth and level is negative (holding constant the other variables) only if real per capita GDP is less than $10800. All values for GDP60 in the sample are below this figure, but values for several of the industrialized countries exceeded this amount after 1960. For example, the U.S. real per capita GDP surpassed $10800 in 1977.

Another result in regressions 1 and 2 of Table 1 is that per capita growth is positively related to the proxies for initial human capital, holding fixed GDP60 and the other variables.[4] The estimated coefficients of

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[4]As noted before, the quadratic in GDP60 in regression 2 implies that the marginal effect of the level of GDP on growth becomes nil when GDP60 reaches $10800. For GDP60 above $10800, the quadratic implies a positive relation between level and growth, but the true relation may remain close to zero. That is, the quadratic can be viewed as an approximation to a functional form that asymptotically approaches a zero relation between growth and level, with the relation coming close to zero when real GDP is above $10000. The human-capital variables, SEC60 and PRIM60, are positively correlated with GDP60 (correlations of .79 and .65, respectively). However, the school-enrollment rates each have an upper asymptote of around 100%, and each rate would typically be close to this asymptote once real GDP reached $10000. Thus, even considering the interplay between human capital and per capita GDP, it is likely that convergence effects would be absent once per capita real GDP was above $10000.

SEC60 and PRIM60 are individually significantly different from zero, with t-values in regression 1 of 3.8 and 4.4, respectively. A joint test for the significance of the two school-enrollment variables leads to the statistic, $F^2_{85} = 18.5$.

Figure 3 shows the relationship between the per capita growth rate, net of the value predicted by the regressors other than the school-enrollment variables, and a linear combination of SEC60 and PRIM60. (The variable on the horizontal axis is .0305 x SEC60 + .0250 x PRIM60, corresponding to the coefficients estimated in regression 1 of Table 1.) The partial correlation of GR6085 with the human capital proxy is .73, as opposed to a simple correlation of .43. (Figure 4 shows the simple relation between GR6085 and the human capital measure.)

Note from Figure 3 that the sample range of the human capital proxy "explains" a range of variation in per capita growth rates of about five percentage points; that is, roughly the same range as that related to GDP60 in Figure 2. Thus, given the strong positive correlation (.77) between GDP60 and the human capital measure, the results are consistent with the lack of a simple correlation between GR6085 and GDP60, as shown in Figure 1. Increases in initial GDP per capita that are accompanied by the typical increase in human capital per person are not systematically related to subsequent growth. But increases in initial GDP per capita with human capital held fixed are strongly negatively related to subsequent growth. Similarly, increases in human capital with GDP60 held fixed are strongly positively related to subsequent growth.

The results can be highlighted by noting three kinds of situations where an imbalance between GDP per capita and human capital leads to significant effects on subsequent growth rates. Many of the Pacific rim countries have initial (1960) school-enrollment rates that are high relative to those typically associated with the initial value of real GDP per capita. For example, for Japan, the value of SEC60 is .74, as compared to the value of .31 that would be predicted from a regression of SEC60 on a quadratic function of GDP60. For Korea and Taiwan, the values of PRIM60 are .94 and .96, respectively, as compared to the corresponding predicted values of .61 and .66. According to regression 1 in Table 1, the relatively high values for initial school-enrollment rates raised the estimated growth rates by .015 for Japan, .014 for Korea, and .012 for Taiwan. With this effect included, the fitted value of the growth rate for Japan, .057, is close to the actual value of .058. For Korea and Taiwan, the adjustments are in the right direction but are insufficient to explain the high rates of growth: for Korea, the fitted value is .037 and the actual is .060, while for Taiwan, the fitted value is .041 and the actual is .057.

The typical country in sub-Saharan Africa has 1960 school-enrollment rates that are low relative to the values associated with 1960 per capita GDP in the full sample. This pattern likely reflects physical capital from the colonial era that is high in relation to the amount of initial human capital, as well as relatively high quantities of natural resources. For example, the relatively low values for school enrollment reduced the estimated growth rates by .012 for Ethiopia (fitted value for growth of .001 versus an actual of .003), .011 for Sudan (fitted value for growth of -.003, actual of -.008), and by .011 for Senegal (fitted value for growth of .004, actual of .000). Given the remaining explanatory power of a dummy variable for Africa, as discussed later, it may be that the present specification does not capture this effect fully.

Finally, the oil-exporting countries typically have high values of GDP60 relative to their 1960 school-enrollment rates. The sample includes six members of OPEC: Algeria, Gabon, Indonesia, Nigeria, Iran, and Venezuela.[5] For Gabon, the school-enrollment rates are higher than would be predicted based on GDP60 (which helps to explain Gabon's high growth rate), while for Indonesia, the discrepancies are small. For the other four oil countries, the shortfalls of the school-enrollment rates from the predicted values reduces the estimated growth rate by an average of .012. Except for Iran, this effect improves the fit for growth rates.

Measurement Errors and Related Issues

Romer (1989) notes that a result such as that shown in Figure 2 would be sensitive to measurement error in GDP. If there is temporary measurement error, future growth rates of GDP will automatically have a negative correlation with the starting level. However, for this effect to account fo the findings, measurement error has to be very large, as well as temporary. For example, a 10% error in GDP that is corrected over the subsequent 25 years affects the computed annual average growth rate by only -.004. This value contrasts with the range of variation of about .05 that GDP60 appears

[5]My earlier study (Barro, 1989a) deleted the oil countries. However, with initial measures of human capital included along with initial per capita GDP these countries can be satisfactorily incoporated into the sample. Without the human capital variables, the oil countries particularly look like outliers with respect to fertility behavior, which is analyzed later.

to explain. For analogous reasons, business-cycle fluctuations in GDP could not explain very much of the results.

If measurement error in GDP were short lived, no estimation problem would arise in the relation between the 1960 level of per capita GDP and, say, the average growth rate of per capita GDP from 1970 to 1985 (GR7085). Regression 3 in Table 1 shows that the estimated coefficients for GDP60, SEC60, and PRIM60 are not much affected by this change in the dependent variable. Thus, measurement errors (or business-cycle effects) can be important for the results only if they persist in substantial magnitude over periods longer than ten years.

Regression 4 shows that the conclusions do not change greatly if GDP70 is added along with GDP60 (with the growth rate from 1970 to 1985 as the dependent variable). Although the high correlation (.98) between GDP60 and GDP70 implies high standard errors, the sum of the two coefficients is close to that for GDP60 in regression 3. The estimated relation between per capita growth and level of per capita GDP also looks similar if GDP70 is entered as a regressor with GDP60 used as an instrument.

Presumably, measurement error in GDP would be proportionately more important for the low-income countries. In fact, the squared residuals from regression 1 of Table 1 have a correlation of -.23 with GDP60. Regression 5 shows that the estimated coefficient of GDP60 changes little if the sample is restricted to the 54 countries for which GDP60 exceeds $1000 per capita. Regression 6 shows that the results also do not change greatly if the observations are weighted by the square root of GDP60 (which is appropriate if the variance of the error term is proportional to the reciprocal of GDP60). Regression 7 indicates similar findings when the weight is the square root of population (where population is measured at the midpoint of the sample for each country). This standard weighting scheme is appropriate if the variance of the error term is proportional to the reciprocal of population.[6] However, the correlation of the square of the residuals from regression 1 with population is only -.12.

Other Measures of Human Capital

Regressions 8-12 attempt to improve the proxies for initial human capital. Regression 8 adds the 1950 values of the school-enrollment rates (SEC50 and PRIM50) to a regression for GR6085. From the standpoint of the human capital available at the start of the sample in 1960, prior values of school enrollment would be more important than the 1960 values. Although the point estimate for SEC50 in regression 8 is positive, neither of the 1950 schooling variables are statistically significant. Since the estimated coefficients for SEC60 and PRIM60 remain significantly positive, the results cannot be attributed to the high correlation (.83 for secondary and .86 for primary) between the enrollment-rate variables for 1950 and 1960.

A possible explanation for the results is that the U.N. data for 1950 are less accurate than those for 1960 and later years. Some support for this view comes from regression 9, which includes enrollment rates for 1960 and 1970 in a regression for the growth rate from 1970 to 1985 (GR7085). For the

[6]This weighting scheme would arise if the growth rate of per capita GDP were an average of independent values for each person in the population. As many people have noted, this view is an uninteresting theory of the error term, since the error would likely vanish in the mean of several million independent observations. If the error term relates to common aggregate forces or to model specification, the error variance need not be closely related to population.

primary-school variables, PRIM60 is significantly positive, while PRIM70 is insignificant. Neither of the secondary-school variables are separately significant because of the high correlation (.94) between SEC60 and SEC70. (The correlation between PRIM60 and PRIM70 is only .84.)

As an attempt to measure differences in the quality of education across countries, I used data on student-teacher ratios in the initial year, 1960. Regression 10 for GR6085 shows that the ratio for primary schools (STTEAPRI) has a negative coefficient (t-value = 1.9), which accords with the idea that a higher ratio signals lower quality education. Student-teacher ratios for secondary schools in 1960 were available for only 88 of the 98 countries. Regression 11 shows that the estimated coefficient of this variable (STTEASEC) differed insignificantly from zero.

Regression 12 uses the human-capital proxy employed by Romer (1989)—the 1960 adult literacy rate (LIT60). With the school-enrollment rates entered, the estimated coefficient of LIT60 is negative (t-value = 2.0), which is difficult to interpret. (If the school enrollment variables are excluded, the coefficient of LIT60 is significiantly positive.) The literacy rate is attractive in that it relates to the stock of human capital rather than to the flow of investment. On the other hand, literacy rates appear to be measured in an inconsistent way across countries, and are particularly inaccurate for the less-developed countries. The school-enrollment rates, although not immune from measurement problems, are likely to be more accurate and more consistent cross sectionally.

Fertility and Investment

The theories where the initial values of human capital and per capita GDP matter for subsequent growth rates also suggest relations with fertility and investment. Table 2 shows results for fertility. The variable FERT is the average of the 1965 and 1985 values of the World Bank's estimate of the total fertility rate (the projected average number of live births for the typical woman over her lifetime). FERTNET is FERT x (1 - MORT04), where MORT04 is the average of the 1965 and 1985 values of the World Bank's figures on mortality rates for children aged zero through four. Thus, FERTNET is the per woman number of children who will live beyond the age of four.

Figures 5 and 6 show the strongly negative simple correlations between FERTNET and GDP60 (-.74) and between FERTNET and a human capital proxy (-.87). (The human capital measure is 3.01 x SEC60 + 1.56 x PRIM60, based on regression 15 in Table 2). In regression 15, the two school-enrollment rates have significantly negative coefficients, while the coefficient of GDP60 is insignificant. Thus, for a given value of per capita GDP, more human capital is associated with lower net fertility, as would be suggested by Becker and Murphy (1988), among others. For given human capital, higher per capita GDP (which means more physical capital or natural resources) has an insignificant relation with net fertility.

Regression 16 shows that, with no adjustment for child mortality, gross fertility (FERT) is positively related to the child mortality rate, MORT04. But regression 17 indicates that the estimated coefficient of MORT04 is no longer significantly different from zero when FERTNET is the dependent variable. That is, the adjustment of fertility rates to reflect the fraction of children that do not survive past the age of four is sufficient to account for most of the positive relation between gross fertility and child mortality. (From the standpoint of the costs of raising surviving children, one would predict, if anything, a negative relation between MORT04 and FERTNET.) Regression 18 shows that population growth (averaged for each country from 1960 to 1985) relates to GDP60 and the human capital variables in a way consistent with the findings for fertility rates.

Table 3 contains results for ratios of real physical investment to real GDP. Regressions 20 and 21 refer to private investment (i^{priv}/y), and regressions 22 and 23 to the total of private and public investment (i/y). The figures on i/y come from Summers and Heston (1988); note that these values reflect variations across countries in the ratio of the investment deflator to the GDP deflator. Values for i^{priv}/y equal i/y less estimates of the ratio of real public investment to real GDP. The data on public investment are described in Barro (1989a). (Figures on nominal public investment were divided by the Summers-Heston deflators for total investment, and were then divided by real GDP; this procedure is appropriate if the deflators for total investment are good approximations to the deflators for public investment.) Values for public investment at the level of consolidated general government (but excluding most government enterprises) were found only for the 1970-85 period, and only for 76 countries. Therefore, i^{priv}/y is an average of values from 1970 to 1985 for this limited sample.

The simple correlations of i^{priv}/y are .42 with GDP60 and .64 with a human capital proxy (.131 x SEC60 + .079 x PRIM60, based on regression 20 of Table 3)—see Figures 7 and 8. With GDP60 and the school-enrollment variables entered together, as in regression 20 of Table 3, the estimated coefficients of SEC60 and PRIM60 are significantly positive, and that on

GDP60 is significantly negative. That is, holding fixed the human capital measures, the partial association between i^{priv}/y and GDP60 becomes negative.

Regression 22 shows results for i/y. (This variable is measured over the period 1960 to 1985, but the main difference from regression 20 is the shift from private to total investment, and not the change in the averaging interval for the dependent variable.) The results for total investment are broadly similar to those for private investment, but the estimated coefficient on GDP60 is smaller in magnitude.

The results in Tables 1-3 treat per capita growth, fertility, and investment as endogenous variables that are jointly determined by the right-hand side variables (although the exogeneity of some of the explanatory variables can surely be questioned). In theoretical models, such as Becker and Murphy (1988) and Barro (1989b), per capita growth and the investment ratio tend to move together, while per capita growth and net fertility tend to move inversely. That is, even holding constant the explanatory variables included in the regressions, the theories predict that the residuals from the equations for GR6085 and i/y (or GR6085 and i^{priv}/y) would be positively correlated, while those for GR6085 and FERTNET would be negatively correlated. The results from Tables 1-3 accord with this pattern. For example, using regression 1 for GR6085, regression 22 for i/y, and regression 15 for FERTNET, the correlation of residuals is .32 between GR6085 and i/y and -.26 between GR6085 and FERTNET. Using regression 20 for i^{priv}/y, the correlation of the residuals for GR6085 and i^{priv}/y (for 76 countries) is .40.

Another way to bring out these patterns is to consider regressions for per capita growth in which an investment ratio and net fertility are included as regressors. Regression 24 of Table 4 shows that the estimated coefficient of i/y is significantly positive: .068, s.e. = .032. With FERTNET added in regression 25, the estimated coefficient of i/y is still significantly positive, and that for FERTNET is significantly negative: -.0043, s.e. = .0014.

Even with i/y and FERTNET held constant, the coefficient of GDP60 in regression 25 (-.0077, s.e. = .0009) is about the same as that in regression 1 of Table 1. Therefore, the negative effect of the level of per capita GDP on the subsequent growth rate does not work through effects on investment and net fertility (see regressions 22 and 15). The main channel appears to be a lower rate of return on investment. On the other hand, the estimated coefficients on the school-enrollment variables in regression 25 are much smaller than those in regression 1. Thus, the positive effects of the school-enrollment rates on GR6085 in regression 1 reflect partly the positive relation between school enrollment and i/y (regression 22 in Table 3) and the negative relation between school enrollment and FERTNET (regression 15 in Table 2).

Effects of Other Variables

Government Expenditures

In previous analysis (Barro, 1989a, 1989b), I found that the ratio of real government consumption expenditure to real GDP (g^c/y) had a negative association with growth and investment. The argument was that government consumption had no direct effect on private productivity (or private property rights), but reduced saving and growth through the distorting effects from taxation or government-expenditure programs. Government consumption is measured by the Summers-Heston (1988) figures on the ratio of real government consumption purchases to real GDP, less estimates of the ratio of nominal government spending on education and defense to nominal GDP. The idea is that expenditures on education and defense are more like public investment than public consumption; in particular, these expenditures are likely to affect private-sector productivity or property rights, which matter for private investment. I used nominal ratios for education and defense because deflators were unavailable. Since the numbers on education and defense are averages for 1970-85, the data on g^c/y are averages over this period.

The results in Table 1 indicate a significantly negative association between g^c/y and growth; for example, in regression 1 the estimated coefficient is -.12, s.e. = .03.[7] Figure 9 shows the nature of this relationship—the variable on the vertical axis is the per capita growth rate net of the fitted value obtained from all regressors other than g^c/y. Table 3 shows that g^c/y also has a negative association with private investment; the estimated coefficient in regression 20 is -.24, s.e. = .12. However, regression 22 shows that the relation with total investment is insignificant (-.02, s.e. = .11).

A negative effect of g^c/y on investment is one route whereby more government could reduce growth. However, even with the investment ratio held constant, the relation between g^c/y and growth is significantly negative. For example, in regression 24 of Table 4, which holds constant i/y, the estimated coefficient on g^c/y is -.12, s.e. = .03.

[7]If entered separately, the ratios to GDP of government expenditures on education and defense are each insignificant in an equation for per capita growth. These types of results were discussed in Barro (1989a).

Regression 26 of Table 4 includes the public investment ratio, g^i/y, as an explanatory variable. The estimated coefficient, .13, s.e. = .10, is positive, but insignificantly different from zero. I discussed this variable in my earlier empirical study (Barro, 1989a), and mentioned some difficulties in interpreting the estimated coefficient in terms of the marginal product of public services. In any event, regression 27 shows that public investment plays no special role if the total investment ratio, i/y (for 1970-85), is also included as a regressor. Given i/y, which includes public investment one-to-one with private investment, the estimated coefficient on g^i/y is essentially zero. Similarly, regression 28 shows that the estimated coefficient of the ratio of public to total investment, g^i/i, differs insignificantly from zero.

Political Instability

I included two variables from Banks's (1979) data set to measure political instability. The variable REV is the number of revolutions and coups per year, and the variable ASSASS is the number per million population of political assassinations per year. Each of these variables is significantly negative for growth in Table 1. The variable REV is also significantly negative for the investment ratios in Table 3, while ASSASS is significantly negative in regression 20 of that table.[8] I interpret these variables as adverse influences on property rights, and thereby as negative

[8]With these political instability variables and the school-enrollment rates included, Gastil's (1987) ordinal indices of political rights or civil liberties are insignificant for growth, fertility, or investment. My earlier study (Barro, 1989a) included the index of political stability as an explanatory variable.

influences on investment and growth. However, regression 25 of Table 4 shows that the coefficients on REV and ASSASS are still negative for growth when i/y and FERTNET are held constant. It is possible that these results reflect a positive influence of growth on political stability, rather than (or in addition to) the effects of stability on growth.

Economic System

Gastil (1987) divided countries into economic systems with respect to the role of government. I used this breakdown to construct a three-way division into primarily socialist, mixed between socialist and free enterprise, and primarily free enterprise. The estimated coefficient on the dummy variable for socialist (SOC) is negative on growth in regression 13 of Table 1 (t-value = 1.8), while that for mixed systems (MIXED) is essentially zero. Since the division of economic systems into groups is subjective and since there are only nine "socialist" countries in the sample (which excludes the eastern European countries), these results are not very reliable.

Market Distortions

It is often argued that distortions of market prices impact negatively on economic growth (see, for example, Agarwala, 1983.). Because of the intimate connection between investment and growth, such market interferences would be especially important if they apply to capital goods. As an attempt to quantify these types of market distortions for a large sample of countries, I considered the purchasing-power-parity numbers for investment goods that were computed by Summers and Heston (1988). It is well known (for example, from Balassa, 1964) that PPP ratios calculated with broad price indices, such as

GDP deflators or consumer price indices, are systematically related to the level of economic development and perhaps to the presence of natural resources and other variables. Figure 10 shows the significantly positive relation for the 98 countries between the 1960 PPP ratio based on the GDP deflator (PPPY60) and GDP60. This relation presumably reflects the relatively low prices of services and some other non-traded goods in low-income countries. On the other hand, Figure 11 indicates the absence of a regular relationship between the 1960 PPP ratio based on the investment deflator (PPPI60) and GDP60. To proxy for market distortions, I would have filtered out the normal relation of PPPI60 to variables such as the level of income. But, given the absence of a systematic relation in Figure 11, I calculated just the magnitude of the deviation of PPPI60 from the sample mean. In this view, either artificially high investment prices or artificially low investment prices proxy for distortions.

The regressions in Table 1 indicate a significantly negative relation between growth and the magnitude of the PPPI60 deviation (denoted PPI60DEV)--the estimated coefficient in regression 1 is -.014, s.e. = .005. This result implies that a one-standard-error (.25) increase in the magnitude of PPPI60 is associated with a reduction in the per capita growth rate by 4-tenths of a percentage point. On the other hand, the sign of the deviation does not seem to matter; if the algebraic value for purchasing-power parity, PPPI60, is added to the equation, its estimated coefficient is insignificant (-.001, s.e. = .005), while that on PPI60DEV remains significant (-.014, s.e. = .007). Not surprisingly, the results in Table 3 indicate that the algebraic value, PPPI60, matters negatively for the investment ratios. (However. this relationship could be induced from measurement error in the investment price deflators.)

These results on the relation of growth and investment to market distortions are preliminary. I plan to look further into alternative measures of price distortions, including the indices of effective protection in manufacturing and agriculture that Agarwala (1983) compiled for a limited sample of countries.

Africa and Latin America

A common view is that countries in Africa or Latin America have poorer growth performances than other countries. Of course, if the nature of being in Africa or Latin America is already held constant by the other explanatory variables, continent dummies would be insignificant in equations for growth, fertility, or investment. Thus, the finding of significant coefficients on these dummies would indicate that some regularities are missing from the model.

The dummy variable AFRICA equals one for countries in sub-Saharan Africa and the dummy variable LAT. AMER. equals one for countries in South and Central America, including Mexico. The estimated coefficient on AFRICA is significantly negative for GR6085 (Table 1, regression 14) and significantly positive for FERTNET (Table 2, regression 19). Although the point estimates are positive, the estimated coefficients for the investment ratios differ insignificantly from zero (Table 3, regressions 21 and 23). Holding fixed i/y and FERTNET in regression 29 of Table 4, the estimated coefficient of AFRICA in a growth equation is still significantly negative, with a magnitude of about one percentage point per year. Thus, there appear to be adverse effects on growth from being in sub-Saharan Africa, and these effects do not result from the unexplained behavior of the investment ratio or fertility.

The variable LAT.AMER. is significantly negative for GR6085 (Table 1, regression 14) and significantly positive for FERTNET (Table 2, regression 19). For the investment ratios, the point estimates of the coefficients are negative, but not statistically significant at the 5% level (t-value of 1.3 for i^{priv}/y in regression 21 of Table 3 and t-value of 1.6 for i/y in regression 23). Again, the negative effect on growth—with a magnitude of about one percentage point per year—appears even when i/y and FERTNET are held constant (Table 4, regression 29). Thus, it appears that something is also missing to explain the typically weak growth performance in Latin America.

Note from a comparison of regressions 1 and 14 of Table 1 that one effect from the inclusion of the AFRICA and LAT.AMER. dummies is a reduction in the estimated coefficient of SEC60 in the equation for GR6085 from .0305, s.e = .0079, to .0133, s.e. = .0070 (see also regressions 25 and 29 in Table 4). The average value of SEC60 for sub-Saharan Africa is well below the sample mean (.04 versus .23), while that for Latin America (.19) is slightly below the sample mean.[9] The variables SEC60 and PRIM60 are imperfect proxies for the level of human capital, which is especially low in Africa. But, since these proxies are imperfect, it may be that continent dummies—especially the one for Africa—retain some explanatory power for human capital and hence for the rate of economic growth. If this

[9] For PRIM60, the means are .50 for Africa, .85 for Latin America, and .78 for the overall sample.

interpretation is correct, a better proxy for human capital would eliminate the AFRICA dummy as a significant influence on growth. However, the variables considered before—student-teacher ratios, prior values of school-enrollment rates, and the adult literacy rate—do not eliminate AFRI(as a significant variable.

Concluding observations

Using recent theories of economic growth as a guide, this study brings out some empirical regularities about growth, fertility, and investment for 98 countries in the period 1960-85. Although the simple correlation between per capita growth and the initial (1960) level of per capita GDP is close to zero, the correlation becomes substantially negative once initial human capital per person (proxied by school enrollment rates) is held constant. Moreover, given the level of initial per capita GDP, the growth rate is substantially positively related to the starting amount of human capital. Thus, poor countries tend to catch up with rich countries if the poor countries have high human capital per person (in relation to their level of per capita GDP), but not otherwise. As a related matter, countries with hig human capital have low fertility rates and high ratios of physical investmen to GDP.

Per capita growth and the ratio of private investment to GDP are negatively related to the ratio of government consumption expenditure to GDP An interpretation is that government consumption introduces distortions, suc as high tax rates, but does not provide an offsetting stimulus to investment and growth. On the other hand, there is little relation of growth to the quantity of public investment.

Measures of political instability (proxied by figures on revolutions, coups, and political assassinations) are inversely related to growth and investment. These relations could involve the adverse effects of political instability on property rights and the linkage between property rights and private investment. However, the correlation could also reflect a political response to bad economic outcomes.

A proxy for price distortions (based on purchasing-power parity numbers for investment deflators) is negatively related to growth. These results are preliminary but do suggest a payoff to further research on the interplay between economic growth and government-induced distortions of markets.

Finally, the results leave unexplained a good deal of the relatively weak growth performances of countries in sub-Saharan Africa and Latin America. That is, the analysis does not yet isolate the fundamental characteristics of the typical country on these continents that lead to below-average economic growth.

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Table 1: Regressions for Per Capita Growth

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
dep. var.	GR6085	GR6085	GR7085	GR7085	GR6085 (GDP60>1)	GR6085	GR6085	GR6085
no. obs.	98	98	98	98	55	98	98	98
weight	--	--	--	--	--	$\sqrt{GDP60}$	$\sqrt{POP}$	--
const.	.0302 (.0066)	.0320 (.0068)	.0287 (.0080)	.0294 (.0082)	.0406 (.0077)	.0334 (.0063)	.0360 (.0055)	.0288 (.0065)
GDP60	-.0075 (.0012)	-.0111 (.0031)	-.0089 (.0016)	-.0071 (.0048)	-.0065 (.0010)	-.0062 (.0009)	-.0074 (.0009)	-.0073 (.0011)
GDP70	--	--	--	-.0015 (.0037)	--	--	--	--
GDP60SQ	--	.00051 (.00038)	--	--	--	--	--	--
SEC60	.0305 (.0079)	.0323 (.0080)	.0331 (.0137)	.0350 (.0128)	.0211 (.0079)	.0258 (.0069)	.0261 (.0075)	.0254 (.0110)
PRIM60	.0250 (.0056)	.0270 (.0060)	.0276 (.0070)	.0279 (.0072)	.0180 (.0077)	.0198 (.0060)	.0254 (.0051)	.0324 (.0077)
SEC50	--	--	--	--	--	--	--	.0183 (.0121)
PRIM50	--	--	--	--	--	--	--	-.0085 (.0064)
g^c/y	-.119 (.028)	-.122 (.028)	-.142 (.034)	-.147 (.036)	-.122 (.032)	-.106 (.024)	-.178 (.024)	-.121 (.027)
REV	-.0195 (.0063)	-.0200 (.0063)	-.0236 (.0071)	-.0241 (.0071)	-.0151 (.0091)	-.0192 (.0067)	-.0165 (.0044)	-.0189 (.0060)
ASSASS	-.0333 (.0155)	-.0309 (.0156)	-.0485 (.0185)	-.0490 (.0188)	-.0344 (.0160)	-.0342 (.0159)	-.0241 (.0271)	-.0298 (.0130)
PPI60DEV	-.0143 (.0053)	-.0148 (.0053)	-.0171 (.0078)	-.0174 (.0079)	-.0316 (.0101)	-.0237 (.0069)	-.0165 (.0044)	-.0141 (.0052)
R^2	.56	.56	.49	.50	.63	.53 (.72)	.52 (.84)	.56
$\hat{\sigma}$	.0128	.0128	.0168	.0169	.0109	.0131 (.0115)	.0133 (.0120)	.0129

Table 1, continued

	(9)	(10)	(11)	(12)	(13)	(14)
dep. var.	GR7085	GR6085	GR6085	GR6085	GR6085	GR6085
no. obs.	98	98	88	98	98	98
const.	.0331 (.0081)	.0476 (.0112)	.0438 (.0120)	.0286 (.0065)	.0332 (.0065)	.0345 (.0067)
GDP60	-.0092 (.0017)	-.0082 (.0009)	-.0078 (.0009)	-.0069 (.0011)	-.0075 (.0010)	-.0068 (.0009)
SEC60	.0142 (.0207)	.0281 (.0079)	.0233 (.0076)	.0385 (.0085)	.0303 (.0076)	.0133 (.0070)
PRIM60	.0305 (.0125)	.0240 (.0057)	.0268 (.0058)	.0350 (.0077)	.0223 (.0058)	.0263 (.0060)
SEC70	.0209 (.0186)	--	--	--	--	--
PRIM70	-.0096 (.0097)	--	--	--	--	--
STTEAPRI	--	-.00038 (.00020)	-.00049 (.00022)	--	--	--
STTEASEC	--	--	.00024 (.00022)	--	--	--
LIT60	--	--	--	-.0171 (.0087)	--	--
g^c/y	-.148 (.033)	-.120 (.026)	-.103 (.026)	-.118 (.028)	-.113 (.027)	-.094 (.026)
REV	-.0244 (.0069)	-.0217 (.0064)	-.0190 (.0065)	-.0179 (.0062)	-.0203 (.0064)	-.0167 (.0062)
ASSASS	-.0478 (.0184)	-.0343 (.0146)	-.0309 (.0153)	-.0325 (.0151)	-.0313 (.0130)	-.0201 (.0131)
PPI60DEV	-.0163 (.0076)	-.0148 (.0049)	-.0193 (.0043)	-.0147 (.0054)	-.0156 (.0050)	-.0140 (.0046)
SOC	--	--	--	--	-.0100 (.0055)	--
MIXED	--	--	--	--	.0000 (.0026)	--
AFRICA						-.0114 (.0039)
LAT.AMER.						-.0129 (.0030)
R^2	.50	.58	.63	.57	.58	.62
$\hat{\sigma}$	.0168	.0125	.0123	.0127	.0126	.0119

Notes to Table 1:

See Table 5 for definitions of variables.

Standard errors of coefficient estimates appear in parentheses. Except for the weighted regressions 6 and 7, the values are based on White's (1980) heteroskedasticity-consistent covariance matrix.

For regression 6, only the 55 observations with GDP60 above \$1000 per capita were used. For regression 7, the observations are weighted by $\sqrt{\text{GDP60}}$, and for regression 8 by $\sqrt{\text{POP}}$. In these cases the statistics for R^2 and $\hat{\sigma}$ shown in parentheses are the weighted values.

Table 2: Regressions for Fertility

	(15)	(16)	(17)	(18)	(19)
dep. var.	FERTNET	FERT	FERTNET	GPOP6085	FERTNET
const.	6.08 (0.35)	5.38 (0.62)	5.35 (0.56)	.0326 (.0034)	5.92 (0.37)
GDP60	-.105 (.069)	-.093 (.068)	-.100 (.067)	-.0005 (.0007)	-.129 (.062)
SEC60	-3.01 (0.59)	-2.62 (0.67)	-2.62 (0.66)	-.0229 (.0059)	-2.36 (0.58)
PRIM60	-1.56 (0.41)	-1.27 (0.51)	-1.14 (0.46)	-.0072 (.0037)	-1.60 (0.43)
g^c/y	1.0 (1.5)	0.8 (1.6)	0.7 (1.5)	-.009 (.013)	0.1 (1.4)
REV	-.13 (.32)	-.31 (.34)	-.25 (.31)	-.0015 (.0025)	-.24 (.33)
ASSASS	1.45 (0.55)	1.65 (0.57)	1.61 (0.55)	.0065 (.0051)	0.95 (0.60)
PPI60DEV	.40 (.26)	.42 (.28)	.41 (.26)	.0034 (.0026)	.39 (.27)
MORT04	--	10.6 (3.1)	4.0 (2.8)	--	--
AFRICA	--	--	--	--	.43 (.23)
LAT.AMER.	--	--	--	--	.49 (.21)
R^2	.76	.83	.77	.58	.78
$\hat{\sigma}$	.72	.77	.72	.0066	.70

Notes: Each regression has 98 observations. See Table 5 for definitions of variables. See the notes to Table 1 for additional information.

Table 3: Regressions for Investment Ratios

	(20)	(21)	(22)	(23)
dep. var.	i^{priv}/y	i^{priv}/y	i/y	i/y
no. obs.	76	76	98	98
const.	.175 (.032)	.164 (.029)	.168 (.027)	.158 (.026)
GDP60	-.0098 (.0048)	-.0093 (.0047)	-.0041 (.0046)	-.0034 (.0044)
SEC60	.131 (.041)	.121 (.044)	.140 (.045)	.139 (.047)
PRIM60	.079 (.027)	.098 (.026)	.086 (.022)	.104 (.021)
g^c/y	-.24 (.12)	-.25 (.13)	-.02 (.11)	-.04 (.10)
REV	-.055 (.021)	-.039 (.018)	-.058 (.021)	-.049 (.020)
ASSASS	-.068 (.027)	-.036 (.029)	-.035 (.042)	.015 (.042)
PPI60DEV	.023 (.023)	.021 (.022)	.040 (.025)	.044 (.025)
PPPI60	-.065 (.016)	-.072 (.018)	-.087 (.019)	-.098 (.021)
AFRICA	--	.015 (.019)	--	.022 (.017)
LAT.AMER.	--	-.018 (.013)	--	-.020 (.012)
R^2	.58	.60	.62	.65
$\hat{\sigma}$	.047	.047	.050	.049

Notes: See Table 5 for definitions of variables. See the notes to Table for additional information.

Table 4: Interactions between Growth and Investment

	(24)	(25)	(26)	(27)	(28)	(29)
no. obs.	98	98	76	76	76	98
const.	.0229 (.0073)	.0494 (.0119)	.0391 (.0079)	.0315 (.0081)	.0401 (.0094)	.0447 (.0119)
GDP60	-.0072 (.0009)	-.0077 (.0009)	-.0075 (.0010)	-.0068 (.0010)	-.0076 (.0010)	-.0070 (.0009)
SEC60	.0225 (.0090)	.0100 (.0087)	.0312 (.0074)	.0240 (.0086)	.0330 (.0073)	.0004 (.0084)
PRIM60	.0181 (.0060)	.0118 (.0057)	.0138 (.0068)	.0074 (.0082)	.0151 (.0077)	.0150 (.0063)
g^c/y	-.119 (.027)	-.114 (.026)	-.132 (.028)	-.115 (.028)	-.131 (.028)	-.094 (.024)
REV	-.0159 (.0062)	-.0167 (.0065)	-.0158 (.0067)	-.0128 (.0066)	-.0169 (.0066)	-.0146 (.0059)
ASSASS	-.0315 (.0182)	-.0254 (.0172)	-.0345 (.0169)	-.0298 (.0152)	-.0341 (.0152)	-.0179 (.0149)
PPI60DEV	-.0119 (.0058)	-.0103 (.0059)	-.0202 (.0052)	-.0174 (.0055)	-.0215 (.0047)	-.0106 (.0052)
i/y	.068 (.032)	.064 (.032)	--	--	--	.061 (.031)
i/y (70-85)	--	--	--	.073 (.039)	--	--
FERTNET	--	-.0043 (.0014)	--	--	--	-.0028 (.0013)
g^i/y	--	--	.128 (.103)	-.015 (.119)	--	--
g^i/i	--	--	--	--	.014 (.022)	--
AFRICA	--	--	--	--	--	-.0104 (.0035)
LAT.AMER.	--	--	--	--	--	-.0104 (.0028)
R^2	.59	.62	.62	.65	.60	.66
$\hat{\sigma}$	.0123	.0120	.0115	.0111	.0117	.0114

Notes : The dependent variable is the growth rate of real per capita GDP from 1960 to 1985. See Table 5 for definitions of variables. See the notes to Table 1 for additional information.

Table 5: Means, Standard Deviations, and Definitions of Variables

Variable	98-country sample Mean	98-country sample σ	76-country sample Mean	76-country sample σ
GR6085	.022	.019	.024	.018
GR7085	.016	.023	.019	.022
GDP60 ($1000)	1.92	1.81	2.21	1.89
GDP85 ($1000)	3.74	3.59	4.34	3.69
i/y	.190	.078	.205	.076
i/y (70-85)	.196	.078	.209	.076
i^{priv}/y	--	--	.176	.069
g^i/y	--	--	.033	.017
g^i/i	--	--	.164	.076
g^c/y	.107	.053	.106	.053
FERT	4.70	1.80	4.39	1.79
MORT04	.087	.061	.074	.057
FERTNET	4.20	1.42	3.98	1.43
GPOP6085	.0205	.0098	.0194	.0100
POP (mill.)	24.6	63.8	26.2	70.5
SEC50[a]	.10	.14	.13	.15
SEC60	.23	.21	.27	.22
SEC85[b]	.53	.29	.59	.28
PRIM50[c]	.65	.39	.73	.36
PRIM60	.78	.31	.85	.27
PRIM85	.96	.19	.98	.16
STTEAPRI	36.5	9.4	34.9	8.4
STTEASEC[d]	19.6	6.9	19.5	7.2
LIT60	.56	.33	.63	.30
REV	.18	.23	.16	.23
ASSASS	.031	.086	.036	.096
SOC (dummy)	.092	.290	.039	.196
MIXED (dummy)	.480	.502	.500	.503
PPPI60	.75	.34	.74	.37
PPI60DEV	.23	.25	.24	.28
PPPY60	.57	.18	.60	.18
AFRICA (dummy)	.276	.449	.197	.401
LAT.AMER. (dummy)	.235	.426	.250	.436

[a] Samples of 95 and 74 countries, respectively.

[b] Samples of 97 and 75 countries, respectively.

[c] Samples of 97 and 76 countries, respectively.

[d] Samples of 88 and 69 countries, respectively.

Table 5, continued

Definitions of Variables in Tables 1-5:

GR6085 (GR7085): Growth rate of real per capita GDP from 1960 to 1985 (1970 to 1985).
GDP60 (GDP70, GDP85): 1960 (1970, 1985) value of real per capita GDP (1980 base year).
GDP60SQ: Square of GDP60.
i/y (i/y, 70-85): Average from 1960 to 1985 (1970 to 1985) of the ratio of real domestic investment (private plus public) to real GDP.
i^{priv}/y: Average from 1970 to 1985 of the ratio of real private domestic investment to real GDP.
g^{i}/y: Average from 1970 to 1985 of the ratio of real public domestic investment to real GDP.
g^{i}/i: Average from 1970 to 1985 of the ratio of real public domestic investment to real domestic investment (private plus public).
g^{c}/y: Average from 1970 to 1985 of the ratio of real government consumption (exclusive of defense and education) to real GDP.

FERT: Total fertility rate (children per woman), average of 1965 and 1985.
MORT04: Mortality rate for ages 0 through 4, average of 1965 and 1985.
FERTNET: FERT x (1 - MORT04).
GPOP6085: Growth rate of population from 1960 to 1985.
POP: Population in millions (geometric average of values from 1960 and 1985).

SEC50 (SEC60, SEC85): 1950 (1960, 1985) secondary-school enrollment rate.
PRIM50 (PRIM60, PRIM85): 1950 (1960, 1985) primary-school enrollment rate.
STTEAPRI (STTEASEC): Student-teacher ratio in primary (secondary) schools in 1960.
LIT60: Adult literacy rate in 1960.

REV: Number of revolutions and coups per year (1960-85 or sub-sample).
ASSASS: Number of assassinations per million population per year (1960-85 or sub-sample).
SOC: Dummy variable for socialist economic system.
MIXED: Dummy variable for mixed free enterprise/socialistic economic system.

PPPI60: 1960 PPP value for the investment deflator (U.S. = 1.0).
PPI60DEV: Magnitude of the deviation of PPPI60 from the sample mean.
PPPY60: 1960 PPP value for the GDP deflator (U.S. = 1.0).

AFRICA: Dummy variable for sub-Saharan Africa.
LAT.AMER.: Dummy variable for Latin America.

Table 6: List of Countries in Samples

ID number	Country	Missing from 76-country sample (*)
1.	Algeria	*
4.	Botswana	
5.	Burundi	*
6.	Cameroon	
7.	Central African Republic	*
10.	Egypt	
11.	Ethiopia	*
12.	Gabon	*
14.	Ghana	
16.	Ivory Coast	*
17.	Kenya	
19.	Liberia	
20.	Madagascar	*
21.	Malawi	
24.	Mauritius	
25.	Morocco	
28.	Nigeria	*
29.	Rwanda	*
30.	Senegal	
31.	Sierra Leone	
33.	South Africa	
34.	Sudan	*
35.	Swaziland	
36.	Tanzania	*
37.	Togo	*
38.	Tunisia	
39.	Uganda	
40.	Zaire	
41.	Zambia	
42.	Zimbabwe	*
43.	Bangladesh	*
44.	Burma	
45.	Hong Kong	*
46.	India	
47.	Iran	

ID number	Country	Missing from 76-country sample (*)
49.	Israel	
50.	Japan	
51.	Jordan	
52.	Korea (South)	
54.	Malaysia	
55.	Nepal	*
56.	Pakistan	
57.	Philippines	
59.	Singapore	
60.	Sri Lanka	
62.	Taiwan	
63.	Thailand	
64.	Austria	
65.	Belgium	
66.	Cyprus	
67.	Denmark	
68.	Finland	
69.	France	
70.	Germany (West)	
71.	Greece	
72.	Iceland	
73.	Ireland	
74.	Italy	
75.	Luxembourg	
76.	Malta	
77.	Netherlands	
78.	Norway	
79.	Portugal	*
80.	Spain	
81.	Sweden	
82.	Switzerland	
83.	Turkey	
84.	United Kingdom	
85.	Barbados	
86.	Canada	
87.	Costa Rica	
88.	Dominican Republic	
89.	El Salvador	
90.	Guatemala	
91.	Haiti	*

ID number	Country	Missing from 76-country sample (*)
92.	Honduras	*
93.	Jamaica	*
94.	Mexico	
95.	Nicaragua	
96.	Panama	
97.	Trinidad and Tobago	*
98.	United States	
99.	Argentina	
100.	Bolivia	
101.	Brazil	
102.	Chile	
103.	Colombia	
104.	Ecuador	
105.	Guyana	
106.	Paraguay	
107.	Peru	
109.	Uruguay	
110.	Venezuela	
111.	Australia	
112.	Fiji	
113.	New Zealand	
114.	Papua New Guinea	
118.	Indonesia	*

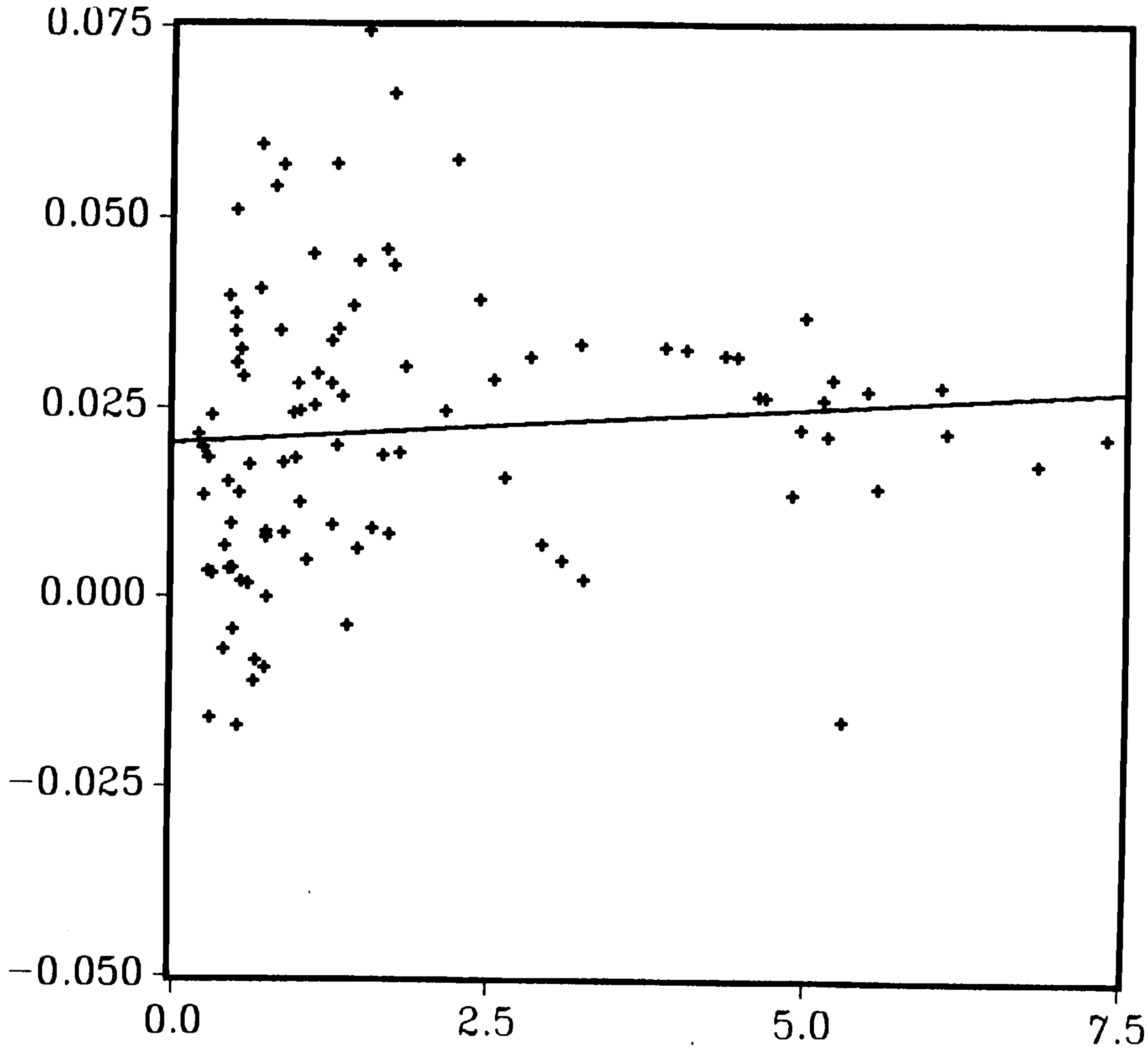

Figure 1 GR6085 versus GDP60

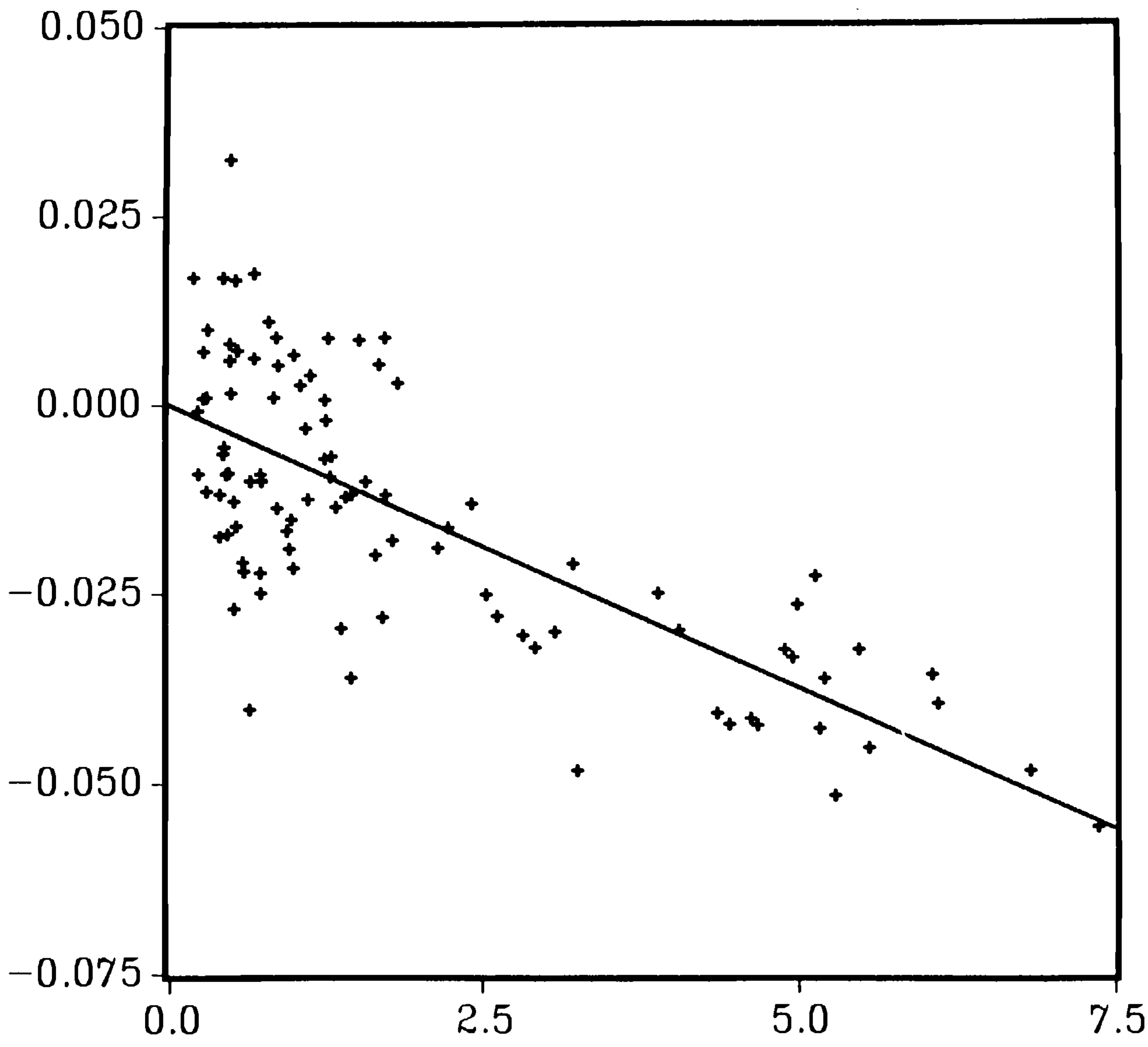

Figure 2 Partial Association between GR6085 and GDP60 (Regression 1)

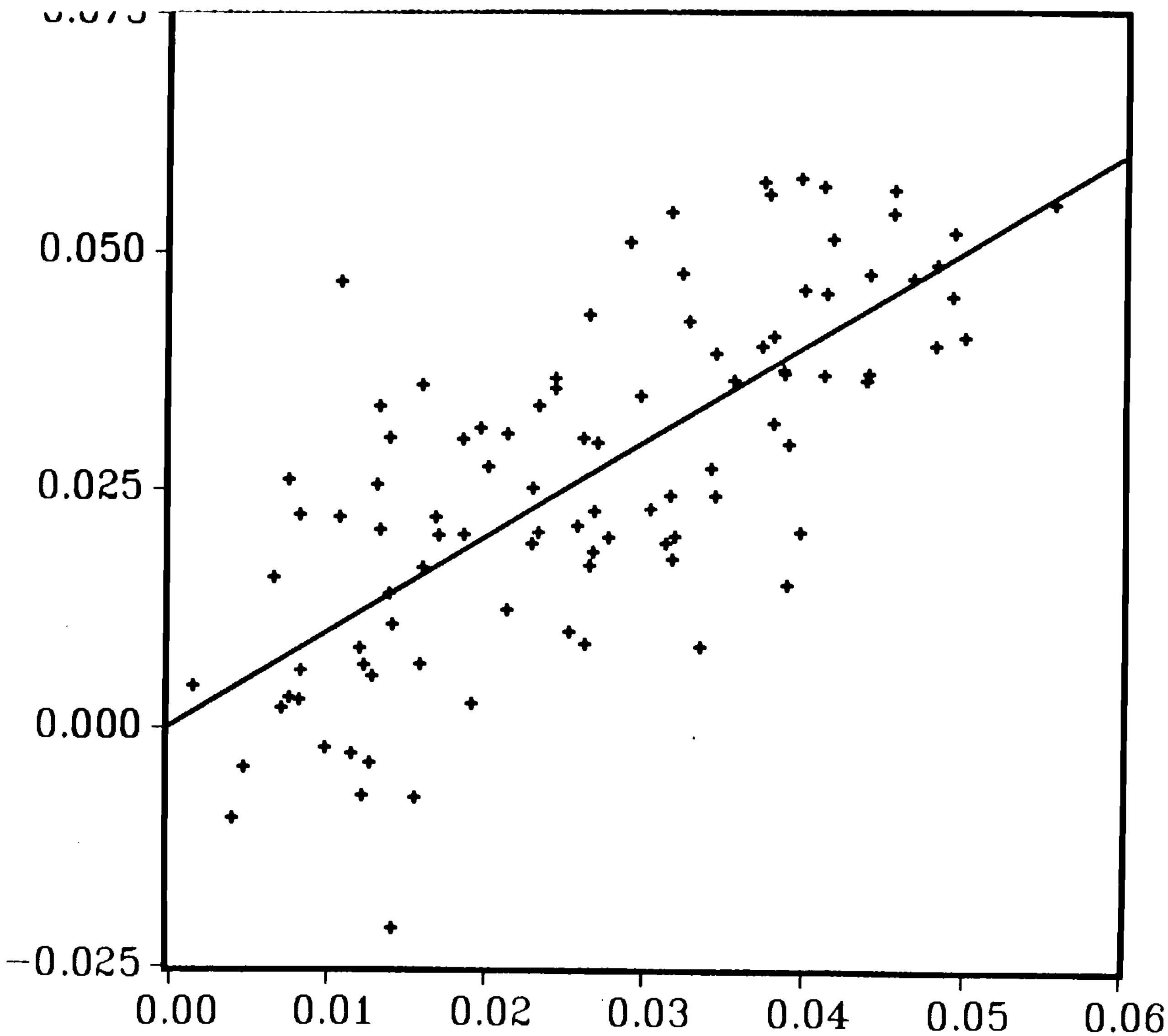

Figure 3 Partial Association between GR6085 and School Enrollment Rates (Regression 1)

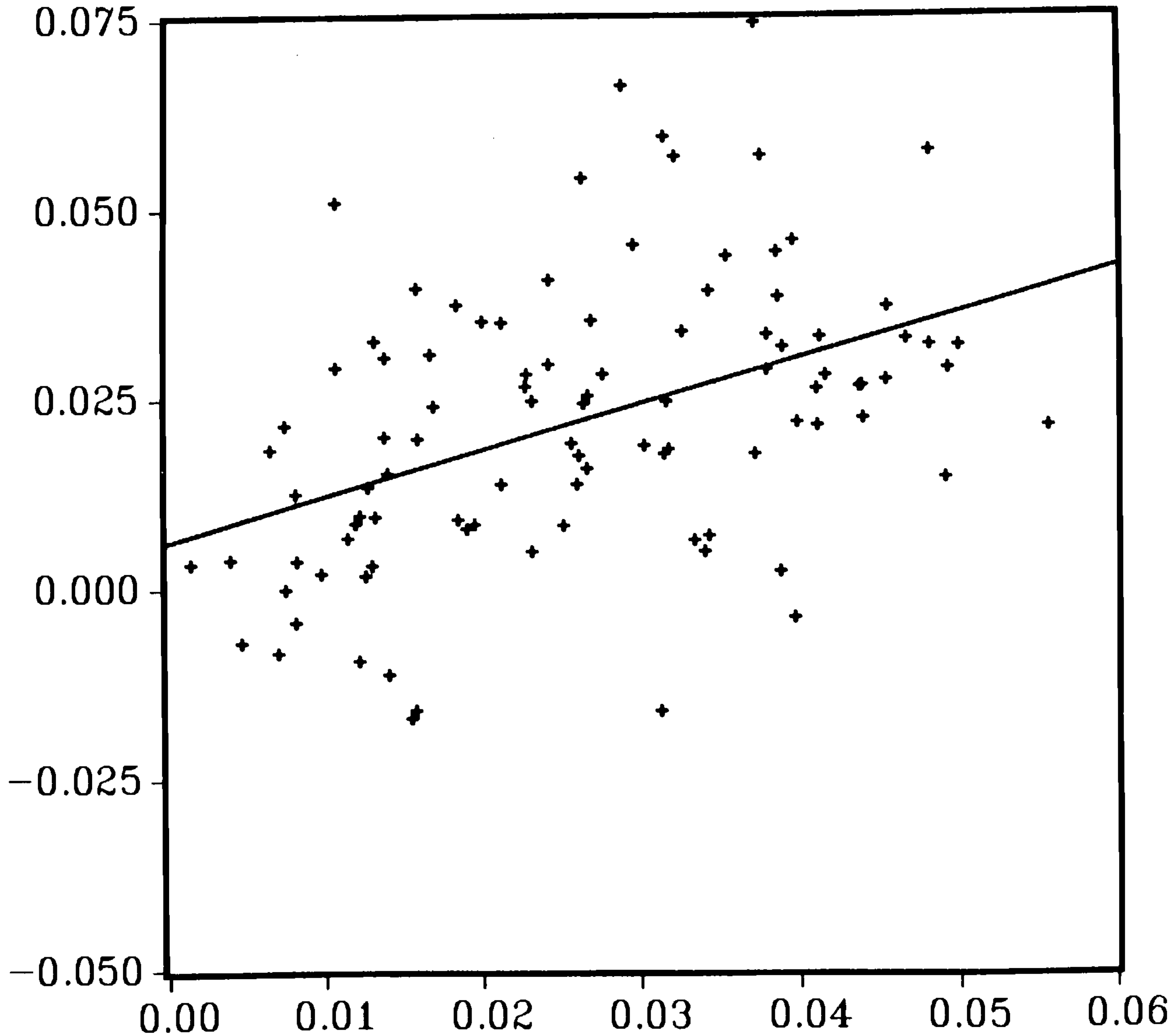

Figure 4 GR6085 versus School Enrollment Rates

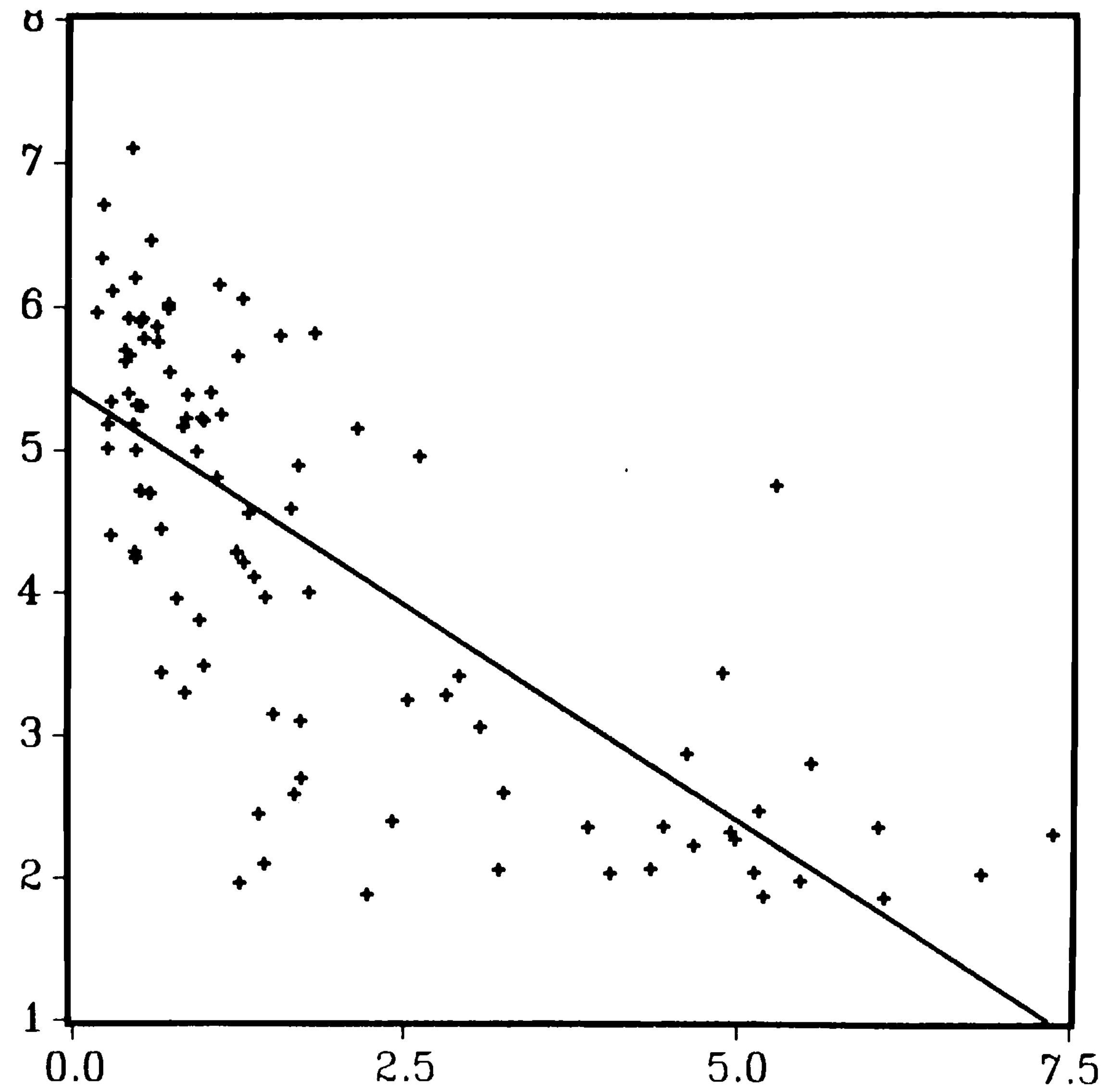

Figure 5 FERTNET versus GDP60

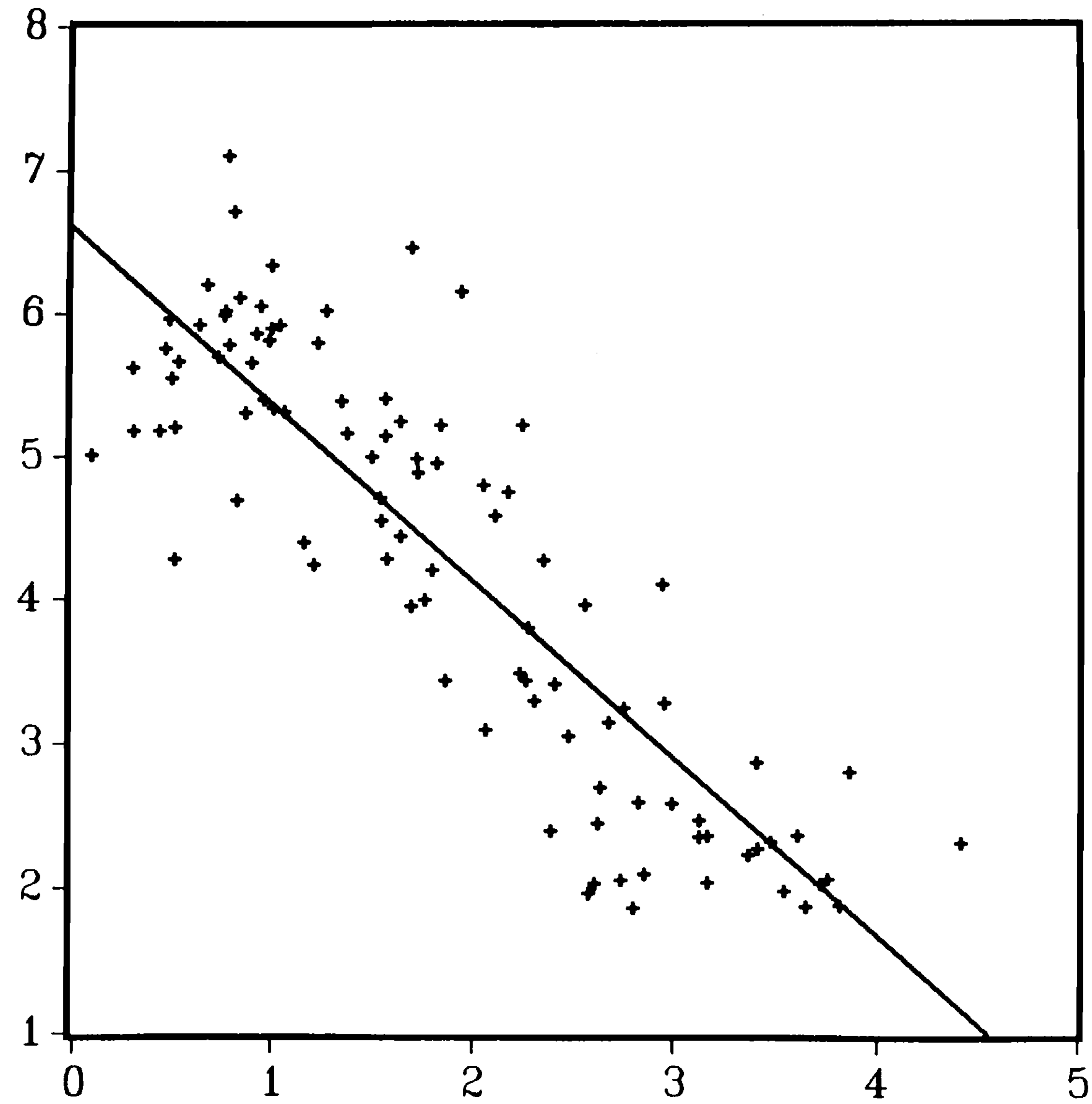

Figure 6 FERTNET versus School Enrollment Rates

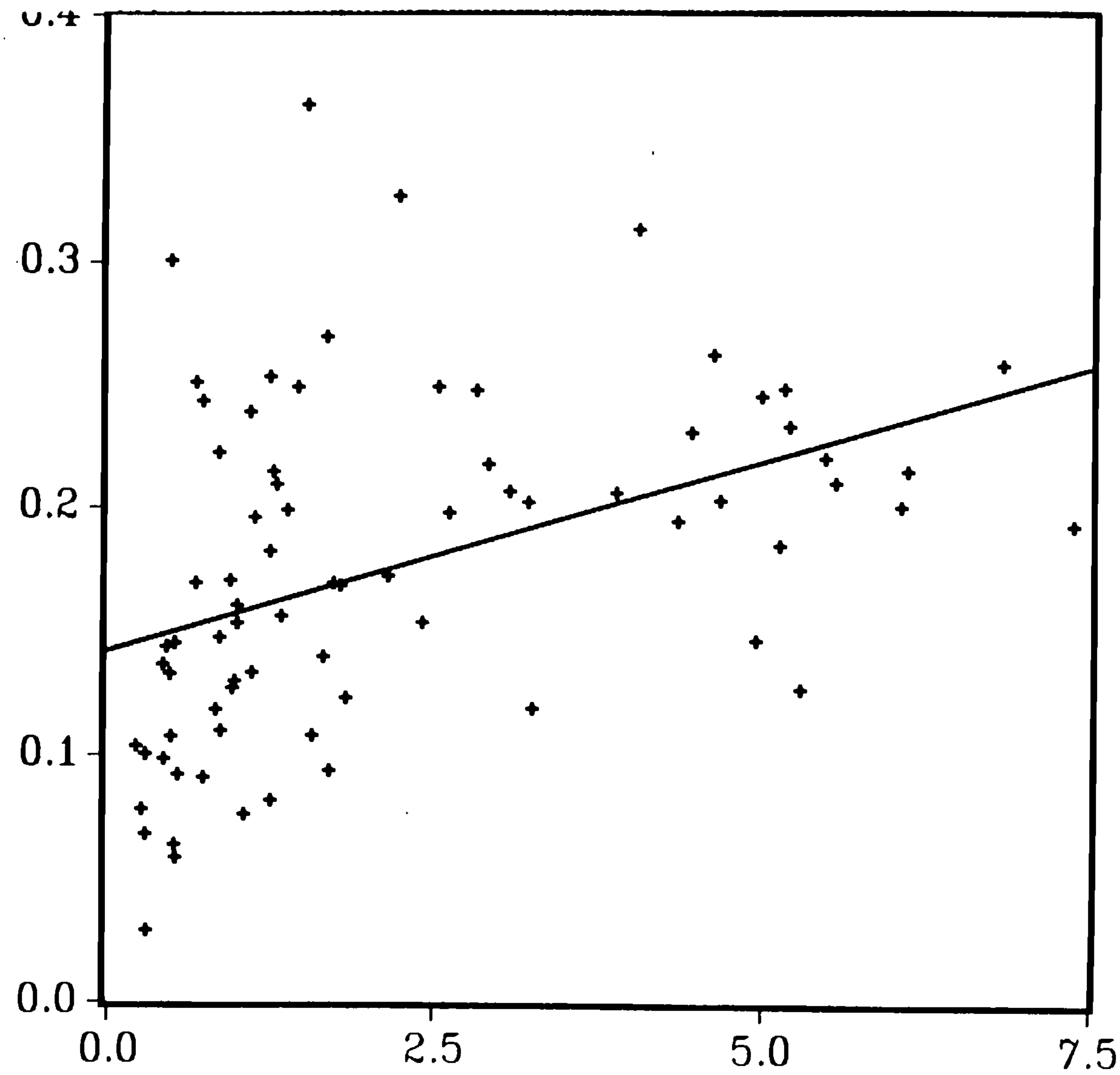

Figure 7 Ratio of Private Investment to GDP versus GDP60

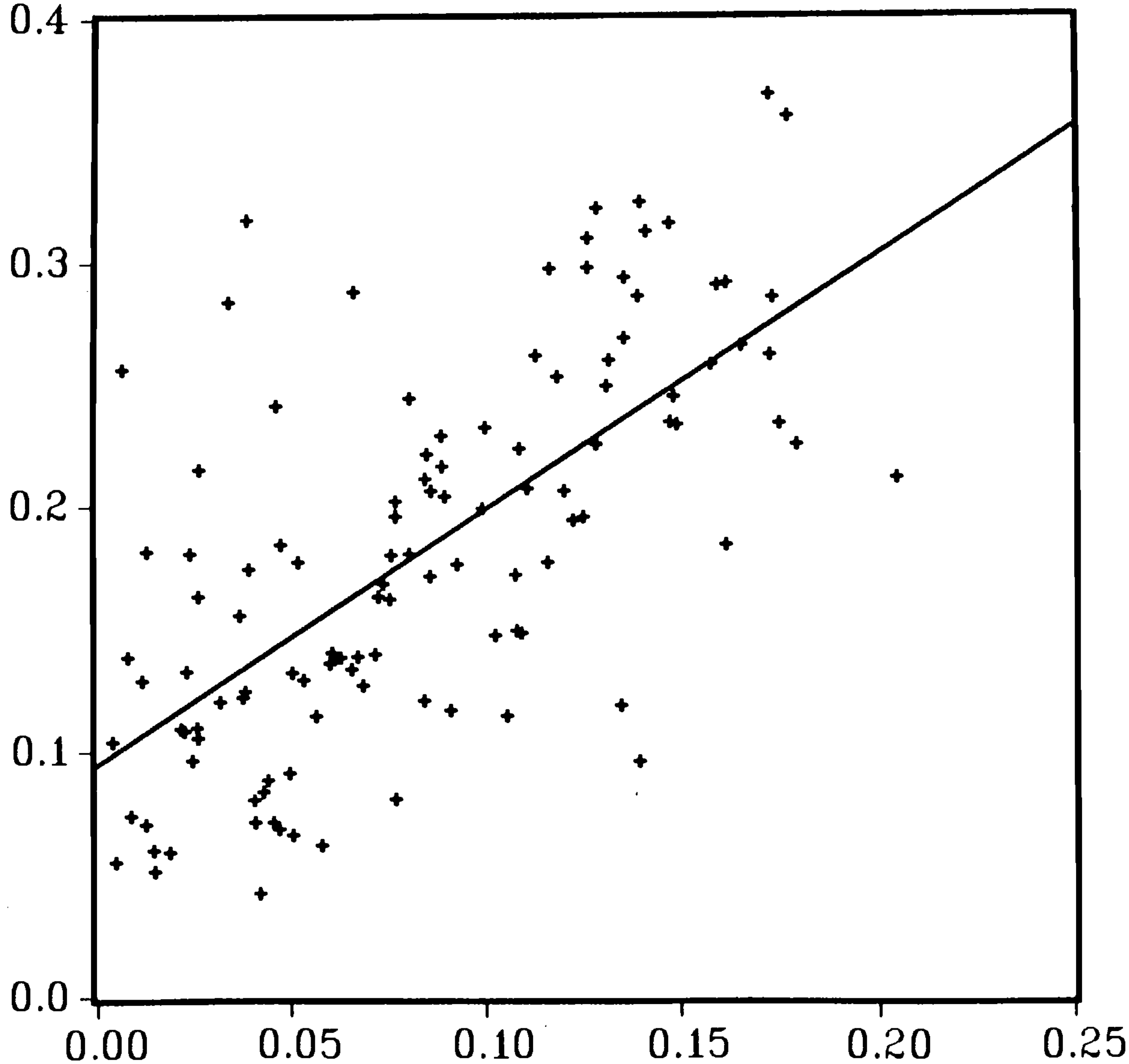

Figure 8 Ratio of Private Investment to GDP

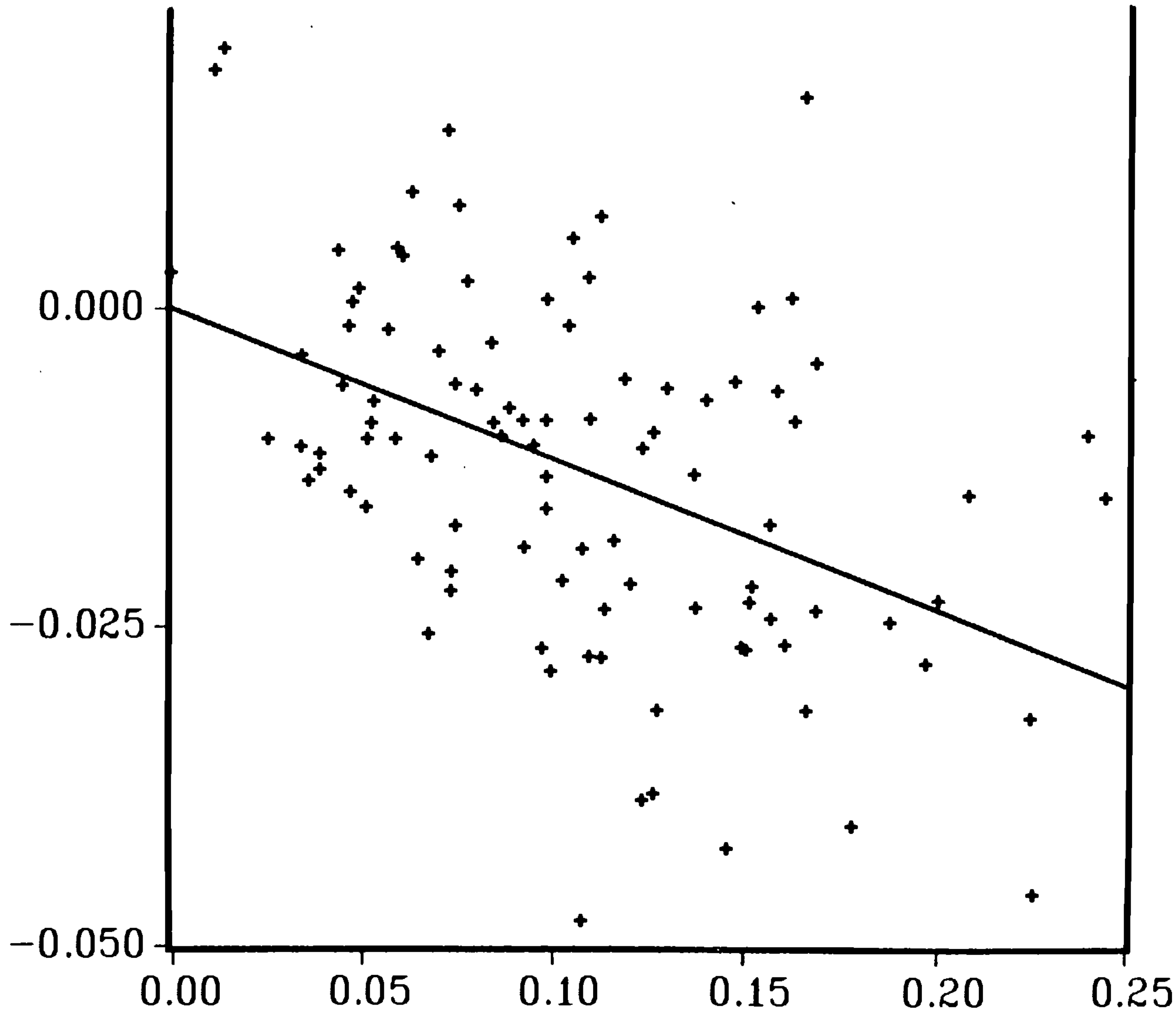

Figure 9 Partial Association between GR6085 and g^c/y (Regression 1)

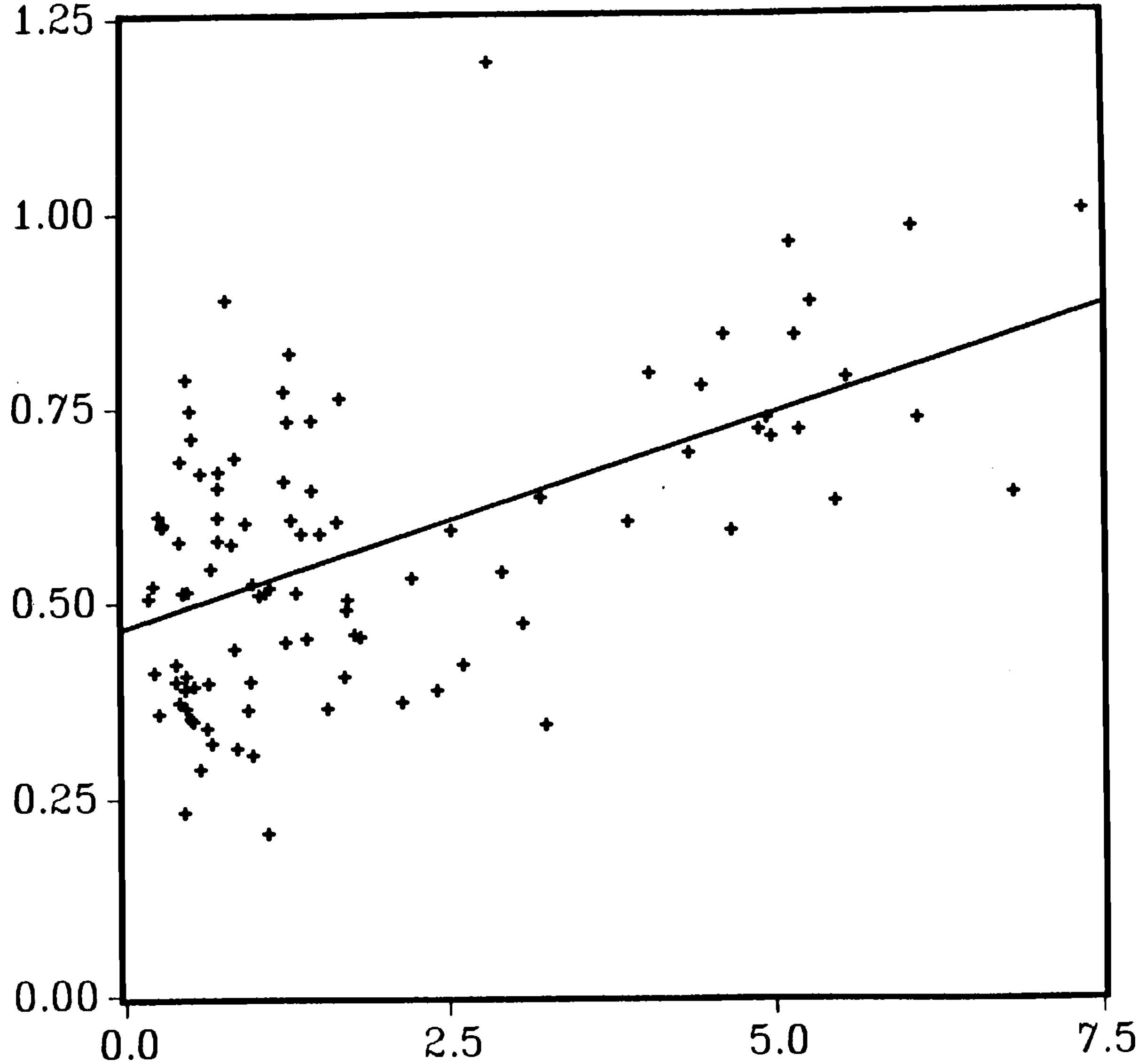

Figure 10 PPPY60 versus GDP60

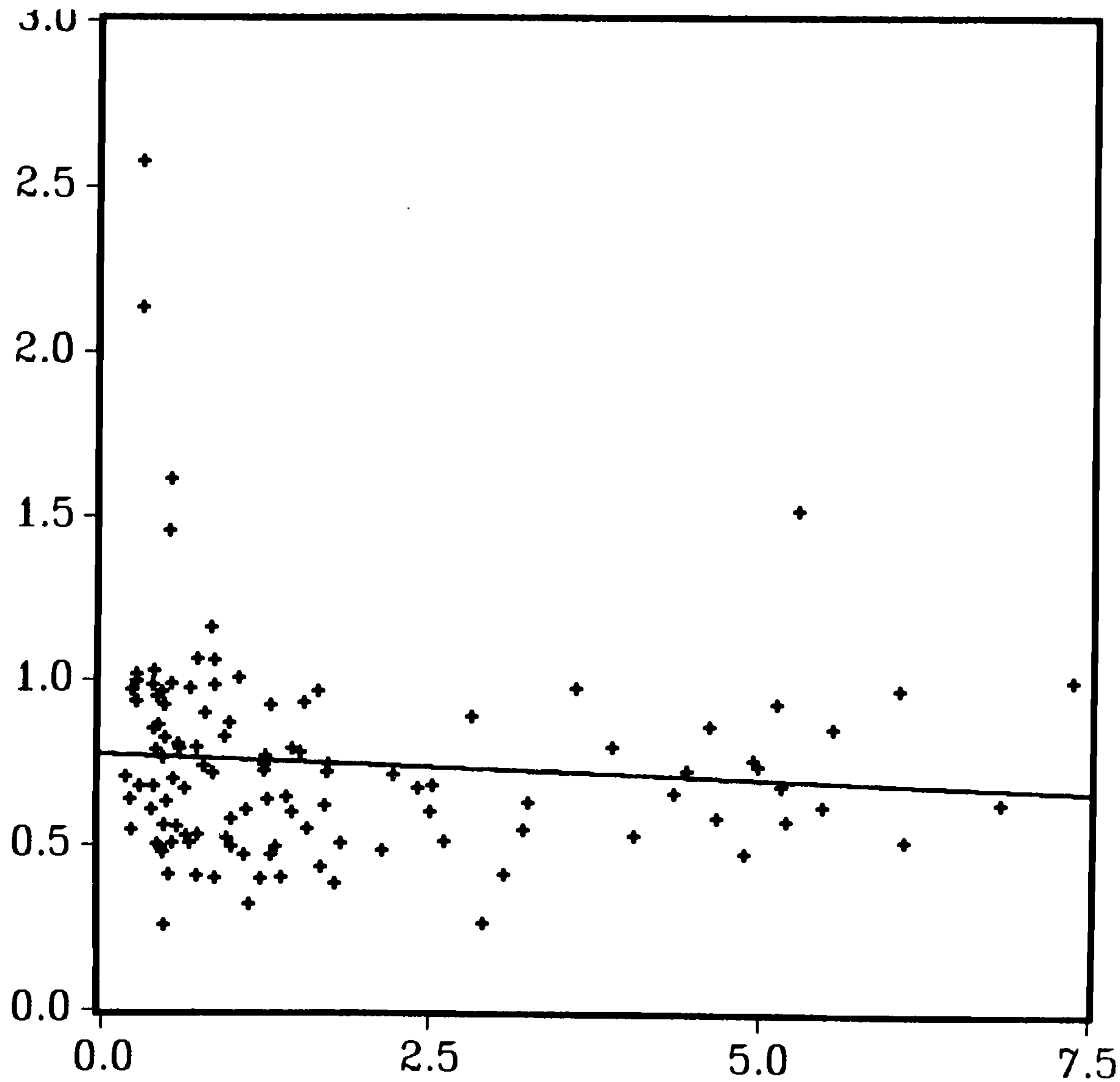

Figure 11 PPPI60 versus GDP60