Insight

Investment and poverty reduction

Practical thinking on investing for development

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Summary

Over recent decades the world has made great progress in reducing extreme poverty, but in some regions of the world the number of people living in extreme poverty is still rising. How could that trend be reversed?

In this paper, we show that higher rates of private investment are associated with faster poverty reduction. Although we do not conduct an exhaustive survey of possible causes of poverty reduction, we show that investment is a more powerful predictor of poverty reduction than two other candidates for which data are readily available: increases in the prices of primary commodities (from which many lower-income countries derive income) and improvements in 'institutional quality'.

The relationship is such that if Kenya's investment rate were to rise to equal that of Bangladesh, one would predict a halving of the gap between their poverty rates within two decades. The association between investment and poverty reduction remains strong after we control for a set of other variables. The link is somewhat stronger when poverty is initially high and is present in both sub-Saharan Africa and South Asia, whether inequality is high or low. Booms in investment are particularly strongly associated with rapid poverty reduction.

The simple statistical association between investment and poverty in the data suggests an elasticity of roughly 2, meaning that when the rate of capital accumulation rises by 1% the rate of poverty reduction might be expected to increase by 2%.[1]

What does this mean for Kenya? These numbers suggest that raising the level of investment in Kenya by $10,000 would lift one additional person out of extreme poverty that year. This is for an average private sector investment, not targeted to reach those people living in extreme poverty and it should be recalled than an investment is not a cost in the same sense as a grant.[2]

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1 These are percentage changes to the proportionate rate of change, rather than percentage point changes. This means that, if the poverty rate is initially falling by 10% per year, a 5% increase would take that to 10.5%, not 15%.

2 Whether investments by DFI are a cost-effective method of reducing poverty is a complicated question beyond the scope of this paper. Comparisons are complicated by the one-time nature of grants, as opposed to investments that are recycled, and by the fact that investments create a flow of benefits (higher wages and lower prices) as opposed to a one-time increase in consumption.

It must be stressed that other considerations, such as any change in inequality in a country, should be expected to affect the relationship between investment and poverty reduction, so that the relationship will not be stable over time or place.

We should be cautious interpreting statistical associations as implying the presence of a simple causal link between investment and poverty reduction. The process of development is complicated, and many things happen at once in a country when poverty falls. Some of those things, not captured by the other variables we have included in our analysis, could be responsible for the statistical association we report here. If so, that might suggest that a policy or intervention that raises investment in the absence of these other things could have less impact on poverty.

However, we know that poverty can only fall when national income grows or it is distributed more equitably and that although investment is not *necessary* for growth, few would argue with the idea that investment is *instrumental* in growth.[3] We show that sustained episodes of major poverty reduction are disproportionately associated with elevated levels of investment.

We regard these empirical facts as useful background evidence for forming an expectation of the impact of development finance institutions (DFIs)' investments on poverty, although a sharper prediction would account for how DFIs' investments translate into changes in the level of overall investment in an economy and for how DFIs' investments differ from the average private sector investment.

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3 It is possible to imagine scenarios in which an increase in aggregate investment does not cause output to grow, but economic models invariably assume that future output is an increasing function of investment. Investment is not necessary for growth because the productivity of the existing capital stock can be raised in various ways, but once those possibilities are exhausted it is necessary to add factors of production (capital and labour) to increase output.

01

Introduction

This paper presents the relationship between investment and poverty reduction at a macroeconomic level. It finds that higher rates of private investment are associated with more rapid reduction in the share of the population living in extreme poverty.

The accumulated investment per person in an economy predicts its poverty level more than five times better than changes in income distribution. This relationship is particularly strong among lower-income countries.

We do not conduct an exhaustive survey of possible causes of poverty reduction, but we do compare investment against two likely candidates for which data are readily available: increases in the prices of primary commodities, which many lower-income countries derive income from, and improvements in 'institutional quality' (using an index designed to summarise different dimensions of economic governance). Investment predicts falling poverty at least as well as commodity prices do, and much better than changes in institutional quality.

According to the most recent data, roughly 37 percent of Kenyans live in extreme poverty (under $1.90/day PPP) compared with 14 percent of Bangladeshis.[4] The relationship between investment and poverty is strong enough that if Kenya's investment rate were to rise to equal that of Bangladesh, from around 20 per cent of GDP to around 30 per cent, one would predict a halving of the gap between their poverty rates within two decades. The relationship between investment and poverty holds in countries without large commodity sectors.

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4 'PPP (purchasing power parity) dollars are a means of adjusting for variations in prices across countries, so that a PPP dollar can purchase the same quantity of a bundle of of goods and services in different countries.

When we focus on episodes of sustained changes in the poverty rate – a top quartile performance of more than 10 percentage points (pp)– we find a very strong relationship with investment. Over half of the episodes of sustained poverty reduction were accompanied by an investment boom, compared with around a seventh of the episodes without sustained poverty reduction. This relationship is much stronger than the relationships between large sustained poverty reductions and large changes in either political institutions or commodity prices.

These results are not too surprising. We know from many studies that poverty can be expected to fall when the overall economy grows (adjusted for population growth) and we also know that investment is often associated with economic growth.[5] But economic growth is by no means completely explained by private investment and in principle it is possible that poverty reduction happens when economic growth is not led by higher levels of private investment. However, the findings of this paper do suggest that private investment-led growth does reduce poverty.

Direct evidence of the relationship between private investment and poverty reduction is also useful evidence in support of development policies that seek to reduce poverty by encouraging private investment. Statistical associations, such as those reported in this paper, do not prove beyond doubt that raising private investment will cause poverty to fall, but they do provide a reasonable initial expectation.[6] Certainly, we would be concerned if there was no sign in the data that private investment is associated with poverty reduction.

In this paper we use data that disaggregates private and government investment where it is available, and total investment where it is not. Results from the sample of countries and years in which separate private and government investment data are available suggest that higher levels of private investment are associated with poverty reduction, but less so with government investment. To benefit from a larger sample, some results in this paper are presented using total investment – if the results from the smaller sample are representative, we may suppose that the private investment component of total investment that is driving poverty reduction the most.

5 Pritchett (2020) shows that growth is "empirically necessary" for poverty reduction. Looking at countries with similar levels of average (median) income, those that have done the most to reduce poverty – by whatever means – have not managed to do so by very much, compared with what happens when average income increases. Dollar et al (2016) show that average incomes in the poorest two quintiles tend to increase at the same rate as overall average incomes, because changes in inequality are uncorrelated with changes in average income. Bergstrom (2020) shows that poverty is more responsive to inequality reduction than it is to aggregate growth, but growth explains most historical poverty reduction because inequality tends not to vary so much as growth. The evidence concerning the links between investment and growth is sparser. Easterly and Levine (2001) argue that changes in economic growth do not closely track changes in factor accumulation (human and physical capital). Others, such as Moral-Benito (2012), find that investment is one of the most robust predictors of growth. The evidence is ambiguous because empirical research into the determinants of growth is complicated and can be sensitive to the choice of model and data. See Rockey and Temple (2016) for a discussion. Many economists would say that the *productivity* of investments matters more than the *level* of investment.

6 Correlation is not causation. Investment and poverty reduction could be correlated because they are both caused by something else, and causation could flow from poverty reduction to investment or vice versa. Some early studies claimed that growth caused investment and not vice versa (Blomstrom et al, 1996). In the case of investment and growth, the question of causality is more analogous to asking whether petrol causes the car to move, or whether moving the car causes petrol to be consumed. Petrol is necessary to drive the car; investment is not quite necessary for growth, because growth could result from existing investments being used more efficiently, but after a point it is impossible to produce more output without adding to the means of producing it. The fact that private investment tends to reduce poverty raises the question of what causes investment. We may look for proximate causes (the car moved because the driver depressed the accelerator pedal) and deeper causes (the car moved because the driver needed to get to work).

The relationship between private investment and poverty reduction is only part of what we would need to form an idea of the expected impact of investments made by development finance institutions (DFIs) on poverty. We would also want to know the relationship between DFIs' investments and overall investment, and whether DFIs' investments differ from the typical private investment.[7]

There may be a less than one-for-one relationship between DFIs' investments and overall investment, if DFIs partially substitute for other investors (either because other investors would have financed the same firm, or because the firms that DFIs invest in substitute for other firms). There may be a more than one-for-one relationship between DFIs' investments and total investment, if they are transformational in the sense of mobilising investment by others. This could happen, for example, when DFIs' investments ameliorate binding constraints on growth, such as electricity, transportation, irrigation or the supply of finance to firms, or when they help to create new markets so that other firms enter.

The investments made by DFIs may also have a greater impact on poverty than the private investments behind the data used in this paper. In addition to targeting more transformational investments, DFIs also prioritise investments in firms that directly reach lower-income communities (either as workers or customers). Not every investment in DFIs' portfolios will fall into one of those categories, but it might be hoped that the balance of DFIs' investments is more pro-poor than the typical private sector investment. The data used in this paper includes investments that we may expect to have less impact on poverty, such as domestic real estate and natural resource extraction. On the basis that DFIs screen and manage investments for greater development impact, the relationship between investment and poverty reduction reported in this paper could understate the expected impact of DFIs.

A macro–micro paradox

Usually when people want to understand the impact of a development intervention, they seek microeconomic evidence. What impact did the project have on the intended beneficiaries?

But often there is the hope that development interventions will add up to something more than the sum of the immediate impacts. These positive spillover effects may sometimes account for most of the impact.[8] In such cases the macro impact is larger than the micro – so to speak – but the opposite is also possible. Perhaps individual projects have immediate local benefits but displace other activity, unseen elsewhere.[9] Evidence of impact at a macro level is useful because it should capture any spillovers, both positive and negative.

7 Kasem (2020) shows how the expansion of the electricity grid in Indonesia caused new firms to enter and more productive firms to expand. Liu (2019) presents more general theory and evidence about how raising the productivity of firms that play a central role in production networks has spillovers to other firms. IEG (2019) discusses opportunities for creating markets and presents case studies.

8 For example, improvements in health and education are thought to have positive effects on economic development that extend beyond the people who directly benefit from receiving better education or healthcare. See Bloom et al (2019) for a discussion of health. There is also evidence that cash transfers have positive effects on non-recipients. In Kenya, Egger et al (2019) found an estimated impact of cash transfers on the local economy that is 2.6 times greater than the sum of the transfers. Breza and Kinnan (2018) showed the economy-wide impact of microfinance is much larger than the estimated direct impact on the borrowers.

9 Economists would use the term 'general equilibrium effects' to capture the final impact of an intervention, once all the knock-on effects have finished knocking on.

Researchers studying foreign aid sometimes talk about the micro–macro paradox, because evidence of positive results at the micro level is relatively easy to find, but evidence that aggregated aid flows have a positive impact at the macro level is less so. That is not necessarily because micro benefits are being cancelled out – there are many other reasons why evidence of the impact of aid at the macroeconomic level is harder to find. When it comes to the impact of investments, we might say that conversely there is a macro–micro paradox. Evidence that aggregate investment has positive economy-wide effects is clear. But it is harder to find evidence of the indirect impact of individual investments, beyond the direct effects on workers and customers. Yet, we know that the direct and indirect impacts of individual investments on outcomes such as poverty must sum to the overall impact we observe. The results in this paper suggest that private investment does lift people out of extreme poverty, even if we may suppose that the typical private investment does not reach them directly.

It is often possible to observe the direct benefits of the investments made by DFIs on the lives of people living in poverty. The Indian technology business iMerit, for instance, into which CDC invested $19 million in 2019 to finance expansion, draws 80% of its employees from the poorest 40% of the Indian income distribution and those workers reported that the job has doubled their incomes, on average. But sometimes the people who work for the formal sector businesses that DFIs invest in (often indirectly via funds or other financial institutions) will be those with relatively good employment prospects, and the goods and services that these firms produce may also mainly serve people who are relatively well off. Can investments in such firms be expected to indirectly benefit people living in more extreme poverty?[11]

The experience of Bangladesh illustrates how people can be rapidly lifted out of extreme poverty by an increase in the overall level of investment. Figure 1 shows that the rise and fall in the poverty rate in Bangladesh mirrors a fall and then a rise in the investment rate, defined as the fraction of GDP spent on gross investment in structures and physical equipment.
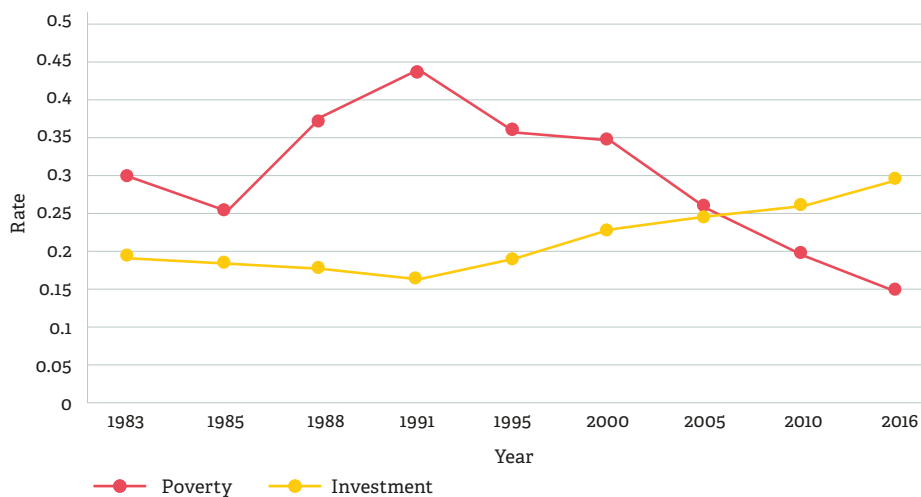

Figure 1: Poverty fell when investment rose in Bangladesh

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10 Although researchers reach different conclusions, they seem to find a positive impact of aid at the macro level more often than not. See Temple (2010) for a discussion. The UN University World Institute for Development Economics Research (UNU-WIDER, 2012) discusses the micro–macro paradox

11 This is sometimes, mistakenly, referred to as 'trickledown' economics. That term should be preserved for the discredited idea that the best way to benefit poor people is to cut taxes for rich people. The existence of spillovers within economies is exhaustively documented and is the foundation of policies often associated with the political left, such as fiscal stimulus and active industrial policy.

In this paper we study how the level of and changes in poverty have been related to investment. We measure the strength and reliability of the poverty-investment association across a broad sample of countries. We seek to answer the following questions:

1. How typical is the pattern we see in Bangladesh – poverty rising when investment is falling and vice versa – across other countries?

2. How many extra dollars of investment are associated with an extra person coming out of poverty?

3. How do these answers depend on economic conditions, such as initial income, inequality between households, political institutions or the strength of the commodities sector?

The core of this paper is a set of stylised facts (simple empirical relationships) that speak to these questions. These facts are largely presented graphically. Appendix A corroborates the figures with regression results. Appendix B contains a detailed description of the dataset we use in the paper.

02

Stylised facts

The amount of physical capital in a country predicts its poverty rate very well

The level of GDP per person accounts for more than half of the variation in the poverty rate across countries and over time. The level of capital – that is, accumulated investment – per person works almost equally well. Either variable accounts for more than five times as much as the share accounted for by other sources of income (such as official development assistance (ODA)) or the share accounted for by the level of inequality. The relationship is strongest at low levels of income and robust to different poverty lines.

The poverty rate is the fraction of households whose incomes fall below a certain level.[12] This fraction depends on the average level of income and on how evenly that income is distributed among households – if incomes are low on average, or distributed unevenly, there will be more people with very low incomes. Average incomes in turn depend on how productive a country is – how much of its own income it can generate – plus the net flows of disposable income received from abroad, in the form of remittances, development assistance or net factor income (profits and wages).

12 In what follows, unless otherwise specified, the poverty level is the 2015 standard World Bank level of $1.90 per person per day in 2011 US$ prices.

Figure 2 shows that poverty and GDP per head are strongly associated, particularly at lower levels of income. The figure also shows that the relationship holds whether countries have levels of inequality above or below the median.
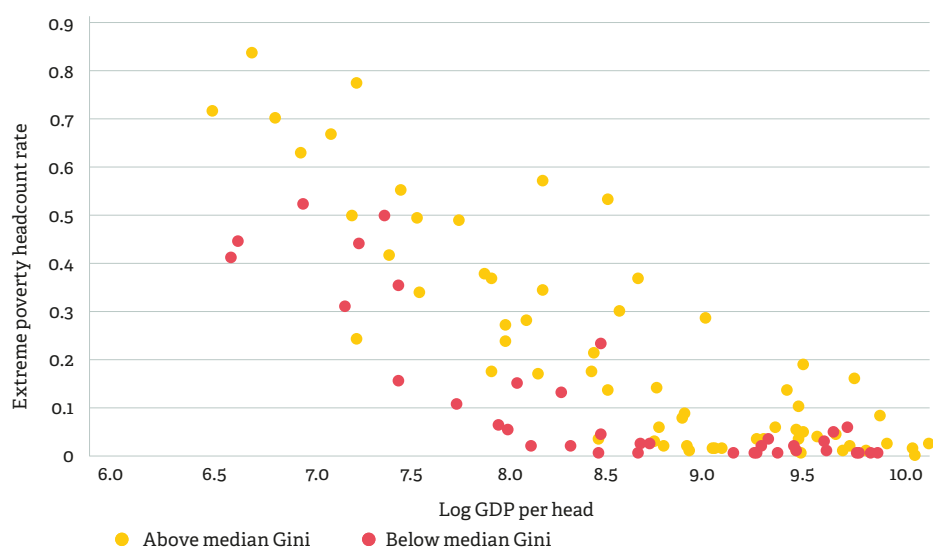

Figure 2: Poverty is tightly related to national income

We can get a sense of the relative contributions of GDP, other income and inequality with a regression analysis, where we standardise each of the coefficients to measure the impact of a typical (that is, one standard deviation) change in the respective variable. A one standard deviation increase in GDP per head reduces the poverty rate by around 0.13 pp, more than twice the impact of the Gini coefficient, around ten times when both are controlled for at the same time. GDP per head alone accounts for around 56 per cent of the variation in poverty rates across countries and adding inequality and gross national disposable income (GNDI)/GDP only explains an additional 1 per cent of the variation in poverty rates (see Table A1 in Appendix A). This finding is robust to restricting the sample to countries in South Asia and sub-Saharan Africa, or to only low and lower-middle-income countries (as classified by the World Bank). The level of national income is still by far the most important determinant of poverty, even when considering variation among these narrower subsets of countries (see Tables A2 and A3). Tables A5 and A6 show that these results are qualitatively robust to using different poverty lines.

Figure 3 (and Table A4) show that our results remain remarkably similar when we include total (private and public) capital services per head in place of GDP per head. In other words, the accumulated levels of past investment in an economy do almost as good a job at accounting for the level of poverty as the production that it facilitates. Tables A5 and A6 show that this is robust to halving or doubling the poverty line. This demonstrates the centrality of investment and capital accumulation in the process of development and poverty reduction.
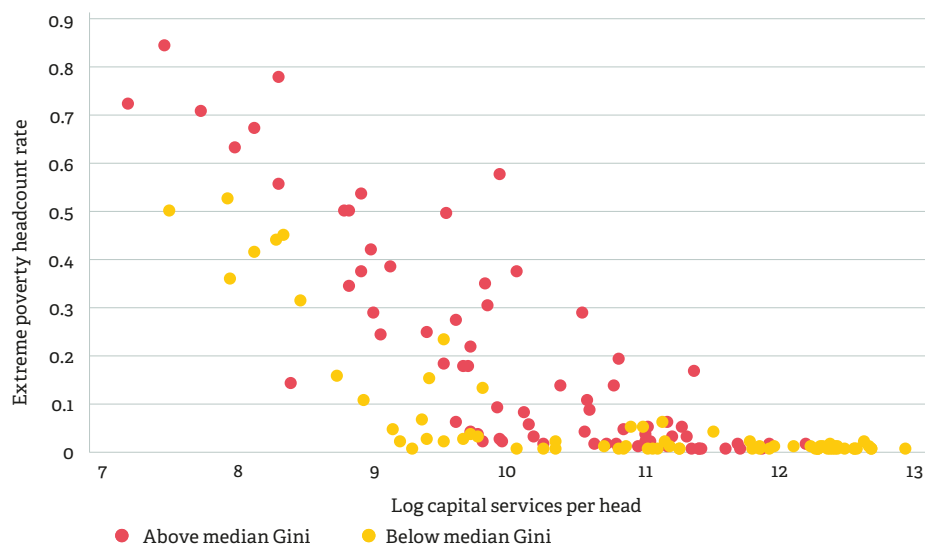

Figure 3: Poverty is also tightly related to capital

The strength of this relationship was not inevitable. Possibilities exist for investment to have no effect on poverty reduction, and for poverty to fall without large capital investments. For example, in one of the oldest theories of development– known as the Lewis model after its inventor, the Caribbean economist and Nobel laureate William Arthur Lewis – in early phases of development, investment leads workers to move from agriculture to manufacturing. However, the extra output accrues as profits for investors rather than as higher wages for workers, with consequently little impact on poverty. Only much later, when the modern sector has absorbed all surplus labour, does the labour market tighten and wages start to rise. Other possibilities include technological improvements, such as the improved crop varieties that formed part of the Green Revolution, that can raise rural incomes and provide cheaper food to urban dwellers without requiring much capital investment. In practice, as Figure 3A shows, over half of the variation in poverty across time and place is explained by capital accumulation.

Figure 4 shows that the correlation is present between the incidence of extreme poverty and both the private and general government capital stocks, for those countries where this disaggregated data is available.[13]
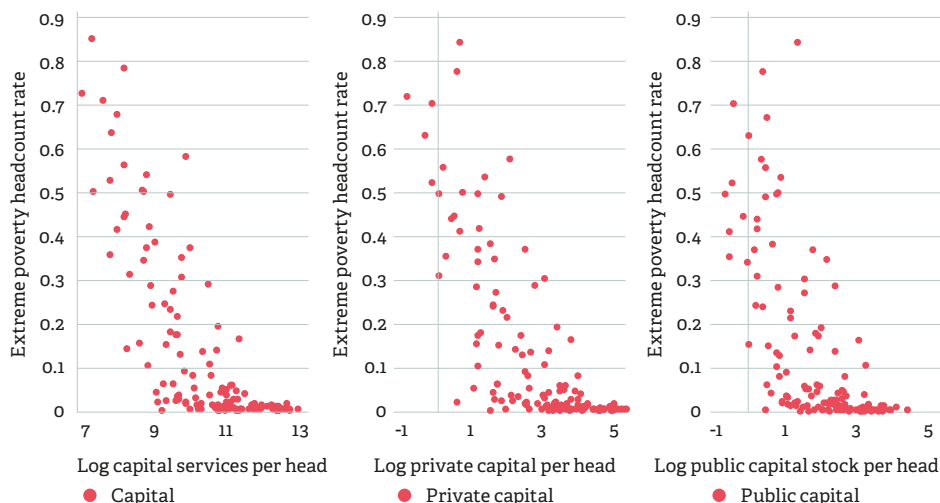

Figure 4: The relationship holds for public and private capital

Investment predicts falling poverty better than aid, trade or the quality of governance

The previous section looked at the relationship between the level of capital and the level of poverty rate. A complementary approach is to look at the relationship, loosely speaking, between changes in these two things – the investment rate, which is the key determinant of the change in the capital stock, and the change in the poverty rate, within a given country. In so doing, we can control for time-invariant country-specific factors that may either drive or obscure the relationship between these variables that we see between countries. This approach may also bring us somewhat closer to, albeit still some way from, making causal statements about the impact of investment on poverty.

13 We use data on private and general government capital stocks (not services) taken from the August 2019 update of the International Monetary Fund (IMF)'s Fiscal Affairs Department's Investment and Capital Stock Dataset, 1960-2017.

First, we plot the association between the 3-year average investment-to-GDP ratio[14] and the 3-year change in the poverty rate. We use a 3-year change as this is the typical time period between observations of the poverty rate in our dataset. Next we plot the association between poverty reduction and the extent to which investment differs from the average level for each country (deviation from mean), and then with the change in investment between 3-year periods (first differenced). Figure 5 shows the results.[15] The slope of the line shows by how much, on average, an increase in the investment rate is associated with a more rapid fall in the poverty rate.
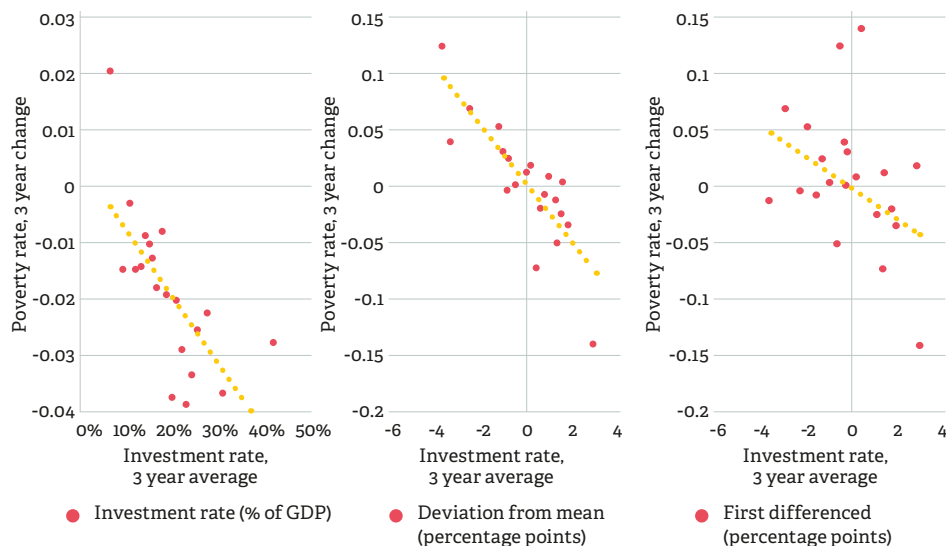

Figure 5: Higher investment is accompanied by faster poverty reduction

Table A7 shows the regression analogue of these charts. Depending on how the panel regression is specified (with fixed effects, first differences or simple pooling of all cross-country data), we find that a 1pp rise in the investment rate is associated with a 0.1–0.2pp fall in the poverty rate over the 3 years. This means that a 1pp rise in the average investment rate will, over time, be associated with a 0.05pp per year faster fall in the poverty rate.[16] Table A7 shows that, when we disaggregate private and public investment in our baseline fixed effects regression, the coefficient on private investment is statistically significant and of a similar size than the one on total investment, while the coefficient on general government investment is smaller and less well determined.

14 The investment–GDP ratio measured in current prices.

15 Figure 5 shows "binscatter" plots that group the x-axis variable into 20 equal-sized bins, and plots the means of the x-axis and y-axis variables within each bin.

16 The elasticity of 2 reported earlier was for the relationship between poverty reduction and capital per worker. The relationship estimated here is for the poverty reduction and the investment rate, but the magnitude is similar. For example, these estimates suggest that in a country with an initial investment rate of 20% and poverty falling by 0.5 percentage points per year, if the investment rate increased by 5% to 21% we might expect the rate of poverty reduction to increase by 10% to 0.55 percentage points per year.

To put these coefficients into context, in the latest year for which we have data, the investment rate in Kenya was a little over 20 per cent of GDP, compared with around 30 per cent of GDP in Bangladesh. In contrast, their poverty rates were around 35 and 15 per cent respectively (see Figure 6). If Kenya were to raise its investment rate to equal that of Bangladesh, it would be forecast to close an extra 5pp of the difference in the poverty rate per decade.[17]
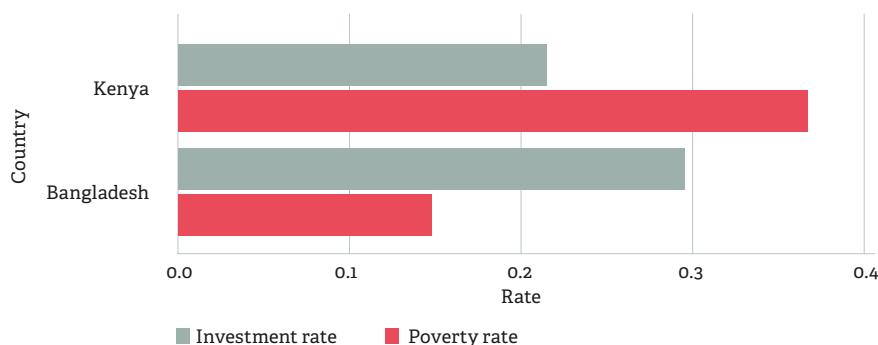
Figure 6: High poverty and low investment in Kenya, vice versa in Bangladesh

Investment has a stronger effect on poverty in poorer countries

We next investigate whether this association between investment and poverty is stronger when incomes are low and poverty starts high. Figure 7 shows that the association is somewhat stronger if countries start with higher poverty or lower income. This makes intuitive sense: when average incomes are higher, people in poverty lie further into the tails of the income distribution. The tails of the distribution are likely to be thinner than the centre, such that a given increase in average incomes will move fewer people out of poverty. Consistent with this, Table A8 shows that halving the initial level of GDP per head or doubling the initial poverty headcount roughly doubles the size of the association between investment and poverty reduction, compared with the estimate in Table A7, although only the interaction with initial GDP per head is statistically significant.

Figure 7: The relationship is stronger in poorer countries

17 This is roughly a third of the interquartile range of the 10-year change in the poverty rate in our sample (IQR 16pp).

We can transform the investment and poverty data to generate measures which are slightly further from the raw data but closer to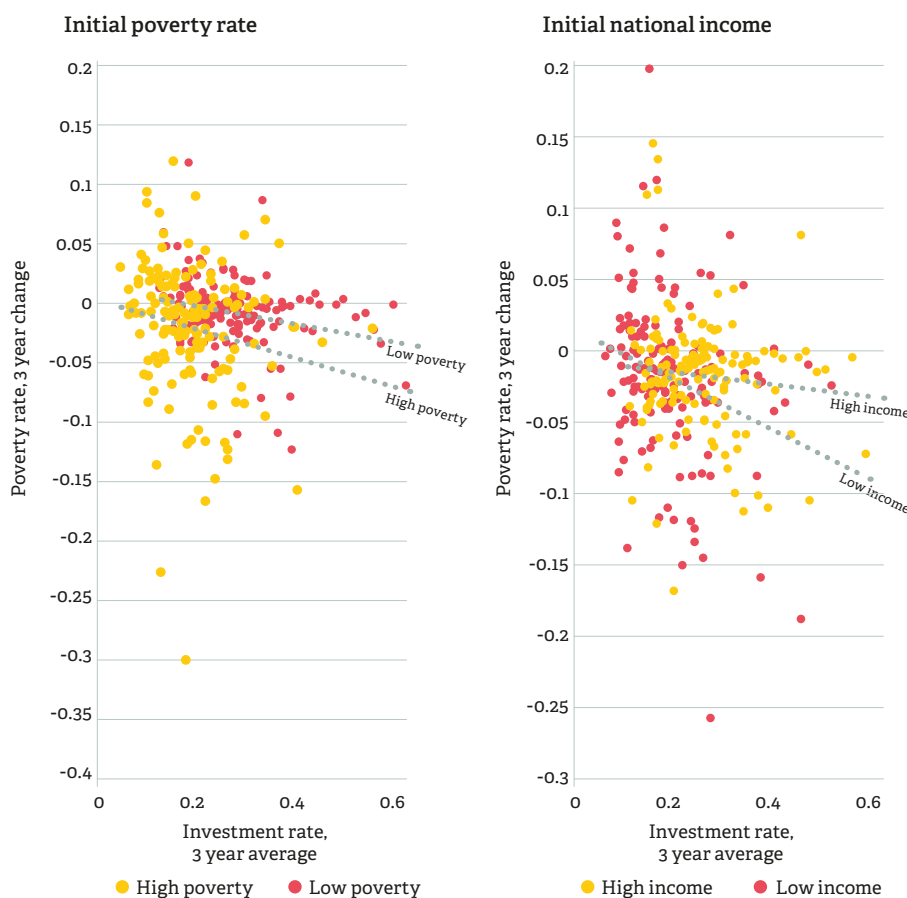 how investment and poverty would be related in basic growth theory. The growth rate of the capital stock and the income-generating productive capacity that results from it, depends not only on the investment rate but also on the price of the capital this investment buys and the rate at which the existing capital stock depreciates. The growth rate of the ratio of capital per head, which determines how much capital each member of the population has to work with, also depends on the growth rate of that population. This suggests that the change in the capital–labour ratio is a more precise measure of the amount of extra productive capacity generated by investment. On the poverty side, under some theoretical conditions, a rise in average incomes will generate a constant proportional reduction in poverty.

Figure 8 plots low-frequency transformations of the poverty and investment data. Concretely, the x axis measures the annualised 10-year growth rate in the ratio of capital services to the number of workers, while the y axis measures the annualised proportional change in the poverty rate. Each point corresponds to a country, measured over 10 years. The figure corroborates what we have already seen – that is, that capital accumulation and poverty reduction are related. But as Table A9 shows, on this 10-year timescale the relationship loses statistical significance, which could simply reflect the smaller sample or perhaps that other considerations become more important over the longer term (the 'dark matter' of development: total factor productivity).

Across regions, higher long-run investment rates are associated with more rapid poverty reduction. The median country growth rate of capital services per head in South Asia was 1.1 per cent per year between 2005 and 2015 (IQR: 0.8 per cent, 1.2 per cent) and the median country fall in the poverty rate was 7.3pp. In sub-Saharan Africa, the median country growth rate of capital services per head was 0.8 per cent (IQR :0.5 per cent, 1.2 per cent) and the median country fall in the poverty rate was just.[18] When both public and private capital are included together in a regression over this time span, neither is statistically significant but the estimated coefficient on public capital is -0.03 whereas private capital is -0.44 (see Table A15).[19]
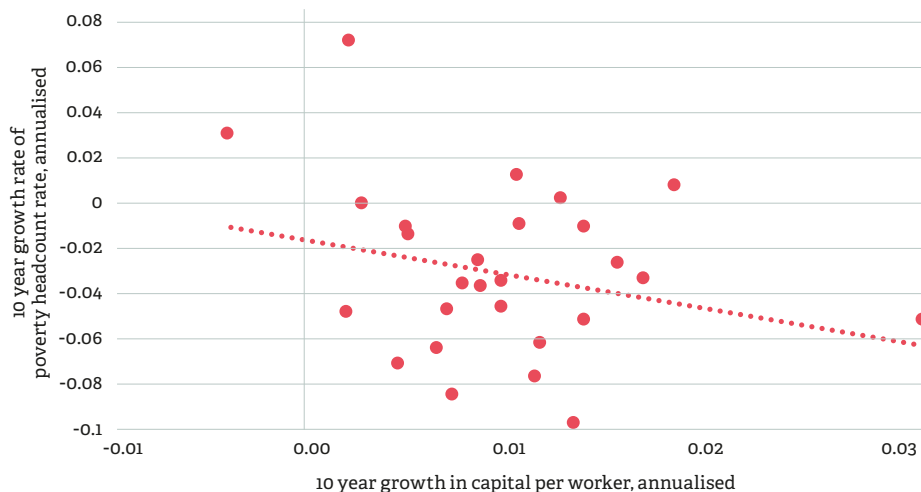
Figure 8: Growth in capital per worker is associated with poverty reduction over the long run

18 IQR is the interquartile range, a measure of the variation in the data that describes the spread in the middle 50% of the sample. So, in this case the country that lies between the first and second quartile grew capital services at 0.8%, and the country between the third and fourth quartiles at 1.2%.

19 See Cubas (2020) for very interesting evidence on the relative roles of public and private capital in development.

Investment and improved terms of trade have the strongest relationships with poverty reduction

It could be the case that investment and poverty are highly correlated, but that many other variables are too. With this in mind, we now compare the strength of the relationship between poverty and investment to that between poverty and other candidate variables for which data are easily available. In Table A10, we repeat the simple univariate regression analysis in Table A7 with four alternative variables: the share of ODA in GDP; the quality of governance, measured as the simple average of the World Bank's Worldwide Governance Indicators; the terms of trade – a measure of the favourability of the external environment; and the share of primary commodities in total exports.[20] In each case we transform the variable in the same way as we did with the investment rate – by looking at the 3-year change in the variable in question.

Table A10 shows that an improvement in the terms of trade (that is, a rise in price of exports relative to imports) and an improvement in the governance indicator are both statistically significantly associated with poverty reduction. The terms of trade have explanatory power comparable with investment, both of which far exceed that of governance.[21] The share of commodities in exports and the share of aid in GDP are both associated with a *higher* poverty rate, but the correlation is statistically insignificant at standard levels. While we should be wary of making causal claims on the basis of pure correlations, these latter two positive correlations are consistent with a story of reverse causation: more aid is allocated to poorer countries, while a high share of commodities in exports may be evidence of a low degree of industrialisation rather than being indicative of a high-resource endowment that potentially perpetuates poverty. Furthermore, Table A11 shows that when we separately add these regressors to our baseline regression, investment remains statistically significant and is always more powerful than any of the alternative regressors.

One potential concern with these results could be that they are driven by resource booms that result in higher investment and poverty reduction, but which are not susceptible to policy choices, or at least not available in resource-poor countries. With this in mind, we re-run our results, controlling for the role of extraction in the economy in two ways. First, we control for the fraction of mining and utilities in total value added in the regressions above. An increased share of resources is typically associated with reductions in poverty, but it doesn't make a large difference to the impact of investment (Table A12). Secondly, we re-run the regression, splitting the sample either side of the median extraction share. We find little change in the relationship between investment and poverty relative to the baseline full sample (Table A13).

Investment booms are strongly associated with episodes of sustained poverty reduction

Another way to quantify the relationship between investment and poverty reduction is to consider episodes of large and persistent changes in investment and poverty rates, as exemplified by the case of Bangladesh, above. It could be that the true association between these variables is non-linear, such that the lines of best fit and the linear regression analysis given in the previous section understate or overstate the truth. Put another way, investment might feature more or less prominently in the largest changes in the poverty rate, compared with the smallest changes.

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20 The ratio of export prices to import prices in the Penn World Tables.

21 The finding that improvements in the terms of trade reduce poverty in poor countries is consistent with Simson (2018).

With this in mind, we define a set of episodes of changes in the poverty rate by measuring changes in the rate between local peaks and troughs in low-income and lower-middle-income countries. This gives us 165 episodes across 54 countries, ending between 1985 and 2017.[22] Within these episodes, we define *sustained* poverty-reduction episodes as those with a fall in the poverty rate of at least 10pp, corresponding to the best-performing quartile of our sample. These episodes have a median duration of 12 years. We then measure changes in the investment rate in all 165 episodes and similarly define *investment booms* as the top quartile of this set. This amounts to an increase in the investment rate of at least 4pp.

Finally, we use a cross-tabulation (Table 1 below) and a logistic regression model (Table A13) – which encode the same information in different ways – to quantify how the proportion of one of these episodes, constituting a big fall in poverty, changes in the presence of an investment boom. By construction, by defining the best quartile of these episodes as `large falls', the proportion of these episodes that is a large fall in poverty is one in four. Of the 123 episodes when investment does not boom, only one in six of these saw a large fall in poverty; when investment has boomed, roughly half of the episodes saw a large fall in poverty.

Looking at the 20 top-quartile episodes of poverty reduction that were not accompanied by an investment boom, around half of these had a top-quartile improvement in terms of trade. So roughly three-quarters of all top-quartile poverty reductions were accompanied by either a top-quartile rate investment or a top-quartile terms-of-trade improvement.

Of the 18 investment booms without sustained poverty reduction, 11 had above median falls in poverty, so there are 7 historical episodes with investment booms without a decent performance on poverty.

		Investment boom	
		NO	**YES**
Big fall in poverty	**NO**	103	18
	YES	20	21

Table 1: Cross-tabulation of investment boom episodes

The coefficients in Table A14 show how the proportion of episodes is affected by the presence of a boom in the respective variable. A coefficient of 1 suggests that the proportions are unchanged, while coefficients of 2 or 0.5 would imply a doubling or halving of the proportions respectively. Consistent with the cross-tabulation, the proportion (expressed in terms of an odds ratio) of a 10pp or larger fall in poverty is increased by a factor of 6 when the investment rate rises by 4pp or more. The remaining columns in the table above show that no other variable has a comparable association. A top-quartile episode in the share of commodities in exports is associated with *lower* odds of poverty reduction, although potentially for the reasons of reverse causation discussed above, but the coefficient is not statistically significant.[23]

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22 We add the last observation for each country to the dataset.

23 As before we should not assume these coefficients tell us by how much a 'boom' in any of these variables would cause the probability of an occurrence of sustained poverty reduction to increase.

Table A15 analyses the classification ability of booms in private and public investment separately. It shows that booms in both kinds of investment are associated with sustained poverty reductions. The strength of the signal, as measured by the odds ratio, is smaller for either of them separately than when we use total investment, suggesting that private investment accompanied by public investment is more frequently accompanied by poverty reduction. And when both are used as classifiers and both included in the regression, only public investment has statistical significance. Because public and private investment are highly correlated, it is harder for them both to be statistically significant in this smaller sample. This result contrasts to the regression results in Table 7A, in which private investment has a stronger association with poverty reduction, being both stronger and more precisely estimated.

'Booms' in the terms of trade or governance during a given episode increase the proportion of major poverty reduction episodes by factors of 3.8 or 7.2 respectively, although the latter parameter is estimated with much less precision, given the paucity of data for the governance variable (we have only 66 episodes). This might hint at a non-linear effect of governance, in the sense that regressions reported elsewhere in this paper suggest that variations in governance are only weakly related to poverty reduction, but here exceptionally large (top-quartile) improvements in governance have a strong association (but this could be an artefact of this much smaller sample).

03

Conclusion

We have shown that investment and poverty reduction are closely linked. Investment is more strongly associated with poverty reduction than aid, terms of trade or governance, as we have measured them and the association remains strong even after we control for these variables. The association is somewhat stronger when poverty is high and is present in both sub-Saharan Africa and South Asia, whether inequality is high or low. Booms in investment are particularly strongly associated with rapid poverty reduction.

We should be cautious interpreting statistical associations as implying the presence of a simple causal link from investment to poverty reduction. The process of development is complicated and many things happen at once in a country when poverty falls. Some of those things, not captured by the other variables we have included in our analysis, could be driving the statistical association we report here. If so, that might indicate that a policy or intervention that raises investment in the absence of these other things could have less impact on poverty.

However, we know that poverty can only fall when national income grows or it is distributed more equitably, and that although investment is not necessary for growth, few would argue with the idea that it is instrumental in growth. We have shown that sustained episodes of major poverty reduction are disproportionately associated with elevated levels of investment.

We regard these empirical facts as useful background evidence for forming an expectation of the impact of DFIs' investments on poverty, although a sharper prediction would account for how DFIs' investments translate into changes in the level of overall investment in an economy and for how DFIs' investments differ from average private sector investments.

Appendix A: Regression tables

Table A1: Covariates of poverty rates across countries and over time

	1	2	3	4
Log GDP per head	-0.13*** (0.00)			-0.13*** (0.00)
Gini coefficient		0.06*** (0.00)		0.01* (0.00)
Ratio of GNDI to GDP			0.03*** (0.00)	-0.02*** (0.00)
Observations	1586	1579	1586	1579
R-squared	0.56	0.12	0.04	0.57

Dependent variable: Headcount poverty rate
***p<0.001; **p<0.01; *p<0.05; standard errors in parenthesis
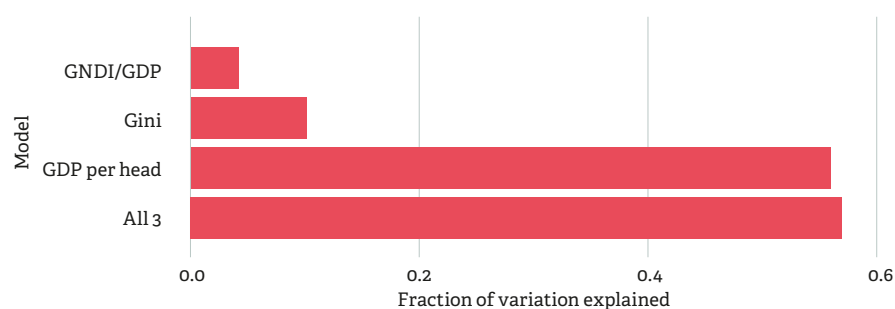
Table A2: Covariates of poverty rates across countries and over time, South Asia and sub-Saharan Africa

	1	2	3	4
Log GDP per head	-0.17*** (-0.01)			-0.19*** (-0.01)
Gini coefficient		0.03 (-0.02)		0.08*** (-0.01)
Ratio of GNDI to GDP			0.02 (-0.02)	-0.02* (-0.01)
Observations	206	202	206	202
R-squared	0.52	0.02	0.01	0.65

Dependent variable: Headcount poverty rate: South Asia and Sub-Saharan Africa
***p<0.001; **p<0.01; *p<0.05; standard errors in parenthesis

Table A3: Covariates of poverty rates across countries and over time, Low- and Lower-Middle-Income Countries

	1	2	3	4
Log GDP per head	-0.19*** (-0.01)			-0.18*** (-0.01)
Gini coefficient		0.07*** (-0.01)		0.05*** (-0.01)
Ratio of GNDI to GDP			-0.01 (-0.01)	-0.03*** (-0.01)
Observations	388	384	388	384
R-squared	0.62	0.09	0.00	0.69

Dependent variable: Headcount poverty rate: Low and lower-middle income countries

***p<0.001; **p<0.01; *p<0.05; standard errors in parenthesis

Table A4: Covariates of poverty rates across countries and over time: squared GDP per head and capital per head

	1	2	3	4	5
Log GDP per head	-0.12*** (0.00)	-0.10*** (0.00)			
Squared diff of log GDP per head from mean		0.05*** (0.00)			
Log capital services per head			-0.10*** (0.00)		
Log private capital stock per head				-0.10*** (0.00)	
Log public capital stock per head					-0.10*** (0.00)
Observations	1586	1586	1586	1547	1547
R-squared	0.56	0.72	0.55	0.53	0.41

Dependent variable:

***p<0.001; **p<0.01; *p<0.05; standard errors in parenthesis

Table A5: Doubled poverty line

	1	2	3	4	5
(intercept)	0.23*** (0.00)	0.23*** (-0.01)	0.23*** (-0.01)	0.23*** (0.00)	0.23*** (0.00)
Log GDP per head	-0.24*** (0.00)			-0.25*** (0.00)	
Gini index		0.11*** (-0.01)		0.01 (0.00)	
Ratio of GNDI to GDP			0.07*** (-0.01)	-0.02*** (0.00)	
Log capital stock per head					-0.23*** (0.00)
Observations	1586	1579	1586	1579	1586
R-squared	0.75	0.15	0.07	0.76	0.71

Dependent variable: Headcount poverty rate (doubled poverty line). Doubled poverty line means using $1.90 x 2 in PovcalNet.

***p<0.001; **p<0.01; *p<0.05; standard errors in parenthesis

Table A6: Halved poverty line

	1	2	3	4	5
(intercept)	0.03*** (0.00)	0.03*** (0.00)	0.03*** (0.00)	0.03*** (0.00)	0.03*** (0.00)
Log GDP per head	-0.04*** (0.00)			-0.04*** (0.00)	
GNI index		0.03*** (0.00)		0.01*** (0.00)	
Ratio of GNDI to GDP			0.01*** (0.00)	0.00 (0.00)	
Log capital per head					-0.04*** (0.00)
Observations	1586	1579	1586	1579	1586
R-squared	0.32	0.14	0.03	0.35	0.33

Dependent variable: Headcount poverty rate (halved poverty line). Halved poverty line means using $1.90 x 0.5 in PovcalNet

***p<0.001; **p<0.01; *p<0.05; standard errors in parenthesis

Table A7: Baseline panel regression

	1	2	3
3-year change in investment rate	-0.12*** (-0.03)	-0.10*** (-0.03)	-0.07 (-0.05)
(intercept)		0.00 (-0.01)	0.00 (0.00)
Observations	597	579	534
R-squared	0.03	0.02	0.00

Dependent variable: 3-year change in poverty rate

Column 1 is fixed effects; column 2 is pooled; column 3 is first differences.

***p<0.001; **p<0.01; *p<0.05; standard errors in parenthesis

Table A7A: Baseline panel regression, private and public investment disaggregated

	1	2	3
3-year change in investment rate	-0.12*** (-0.03)		
3-year change in private investment rate		-0.15*** (-0.04)	
3-year change in public investment rate			-0.05 (-0.08)
Observations	597	589	589
R-squared	0.03	0.02	0.00

Dependent variable: 3-year change in poverty rate

***p<0.001; **p<0.01; *p<0.05; standard errors in parenthesis

Table A8: Panel data with interactions

	1	2	3
(intercept)	-0.02*** (-7.71)	-0.02*** (-7.62)	-0.02*** (-8.15)
3-year change in investment rate	-0.10*** (-3.91)	-0.08** (-3.02)	-0.11*** (-4.07)
Poverty		0.02 (-1.87)	
Investment:poverty interaction		-0.08 (-0.76)	
Log (GDP per capita)			0.00 (-0.38)
Investment:log (GDP per capita) interaction			0.09** (-2.67)
Observations	597	597	597
R-squared	0.02	0.03	0.04

Dependent variable: 3-year change in poverty rate
***p<0.001; **p<0.01; *p<0.05; standard errors in parenthesis

Table A9: Long run regressions

	1	2	3	4
(intercept)	-0.02 (-0.01)	-0.02* (-0.01)	-0.03*** (-0.01)	-0.02* (-0.01)
10-year growth in capital per capita	-1.58 (-1.15)			
10-year growth in private capital per capita		-0.51 (-0.33)		-0.44 (-0.35)
10-year growth in public capital per capita			-0.06 (-0.06)	-0.03 (-0.07)
Observations	27	27	27	27
R-squared	0.07	0.09	0.04	0.10

Dependent variable: 10-year growth in poverty headcount rate
***p<0.001; **p<0.01; *p<0.05; standard errors in parenthesis

Table A10: Panel data with other regressors

	1	2	3	4	5
3-year change in investment rate	-0.12*** (-0.03)				
3-year change in ODA		-0.04 (-0.04)			
3-year change in WGI			0.03 (-0.02)		
3-year change in ToT				-0.12*** (-0.03)	
3-year change in commodity share					0.05 (-0.04)
Observations	597	573	273	597	390
R-squared	0.03	0.00	0.01	0.03	0.00

Dependent variable: 3-year change in poverty rate
***p<0.001; **p<0.01; *p<0.05; standard errors in parenthesis

Table A11: Other regressors as controls

	1	2	3	4
3-year change in investment rate	-0.12*** (-0.02)	-0.08** (-0.03)	-0.14*** (-0.03)	0.01 (-0.03)
3-year change in terms of trade	-0.07*** (-0.02)			
3-year change in share of commodities and exports		0.03 (-0.02)		
3-year change in share of ODA in GDP			-0.06 (-0.04)	
3-year change in governance				-0.01 (-0.01)
Observations	1428	1165	1028	669
R-squared	0.04	0.01	0.03	0.00

Dependent variable: 3-year change in poverty rate
All continuous predictors are mean-centered and scaled by 1 standard deviation
***p<0.001; **p<0.01; *p<0.05; standard errors in parenthesis

Table A12: Extraction control

	1	2	3
3-year change in investment rate	-0.12*** (-0.02)	-0.08*** (-0.02)	-0.12*** (-0.03)
Fraction of mining and resources in total value added	-0.16*** (-0.03)	0.00 (-0.01)	-0.17*** (-0.05)
(intercept)		0.01 (0.00)	0.00 (0.00)
Observations	1400	1400	1256
R-squared	0.04	0.02	0.02

Dependent variable: 3-year change in poverty rate
Column 1 fixed effects; column 2 pooled; column 3 first differences.
***p<0.001; **p<0.01; *p<0.05; standard errors in parenthesis

Table A13: Extraction split sample

	1	2	3
3-year change in investment rate	-0.12*** (-0.02)	-0.05 (-0.03)	-0.10*** (-0.02)
Observations	1428	724	692
R-squared	0.03	0.00	0.03

Dependent variable: 3-year change in poverty rate
All continuous predictors are mean-centered and scaled by 1 standard deviation
Column 1 full sample; column 2 below median commodities; column 3 above median commodities.
***p<0.001; **p<0.01; *p<0.05; standard errors in parenthesis

Table A14: Logistic regression of major poverty reduction episodes

	1	2	3	4	5
(intercept)	0.17*** (-0.26)	0.36*** (-0.21)	0.21*** (-0.24)	0.25*** (-0.26)	0.04*** (-0.72)
Investment boom	6.01*** (-0.40)				
ODA boom		0.71 (-0.45)			
Terms of trade boom			3.73*** (-0.40)		
Commodities share boom				0.80 (-0.56)	
Governance boom					5.19 (-0.97)
Observations	162	155	162	120	63
AIC	162.59	178.25	171.90	121.11	35.98
BIC	168.76	184.34	178.08	126.68	40.27
Pseudo R-squared	0.18	0.01	0.10	0.00	0.11

Dependent variable: odds of top-quartile poverty improvement
***p<0.001; **p<0.01; *p<0.05; standard errors in parenthesis

Table A15: Logistic regression of major poverty reduction episodes on investment booms by sector				
	1	2	3	4
(intercept)	0.17*** (-0.26)	0.24*** (-0.24)	0.22*** (-0.25)	0.19*** (-0.27)
Investment boom	6.01*** (-0.40)			
Private investment boom		3.12** (-0.41)		2.08 (-0.44)
Public investment boom			4.36*** (-0.41)	3.44** (-0.44)
Observations	162	149	149	149
AIC	162.59	165.59	160.37	159.72
BIC	168.76	171.60	166.38	168.73
Pseudo R-squared	0.18	0.07	0.12	0.15

Dependent variable: odds of top-quartile poverty improvement
***$p<0.001$; **$p<0.01$; *$p<0.05$; standard errors in parenthesis

Appendix B: Data sources

The analysis in the paper is based on a dataset that is merged from several sources

- The poverty rate is obtained from the PovcalNet dataset produced by the World Bank. We use the baseline definition of $1.90 per day unless specified otherwise.

- Investment, capital (services) and GDP in PPP dollars come from the Penn World Table. The investment rate is defined as the current price investment-to-GDP ratio.

- Data on official development assistance comes from the World Bank.

- The governance data is from the World Bank's Worldwide Governance Indicators. We take the simple average of the separate governance indicators.

- The GDP–GNDI gap is calculated as the difference between the current account and the trade balance in the IMF International Financial Statistics. We then calculate GNDI as GDP plus GNDI, and take the ratio of this to GDP as our explanatory variable. We use data on private and general government capital stocks (not services) taken from the August 2019 update of IMF Fiscal Affairs Department's Investment and Capital Stock Dataset, 1960-2017.

References

Bergstrom, K. (2020). *The Role of Inequality for Poverty Reduction.* World Bank Policy Research Working Paper 9409.

Blomström, M., Lipsey, R. E. and Zejan, M. (1996). Is Fixed Investment the Key to Economic Growth?. *The Quarterly Journal of Economics, 111(1),* 269-276.

Bloom, D. E., Canning, D., Kotschy, R., Prettner, K. and Schünemann, J. J. (2019). *Health and economic growth: reconciling the micro and macro evidence* (No. w26003). National Bureau of Economic Research.

Breza, E. and Kinnan, C. (2018). *Measuring the equilibrium impacts of credit: Evidence from the Indian microfinance crisis.* No. w24329. National Bureau of Economic Research.

Cubas, G. (2020). Public Capital and Economic Development. *The Economic Journal, 130(632),* 2354-2381.

Kassem, Dana (2020). *Does Electrification Cause Industrial Development? Grid Expansion and Firm Turnover in Indonesia.* CRC TR 224 Discussion Paper Series, University of Bonn and University of Mannheim, Germany.

Dollar, D., Kleineberg, T. and Kraay, A. (2016). Growth still is good for the poor. *European Economic Review, 100(81),* 68-85.

Easterly, W. and Levine, R. (2001). What have we learned from a decade of empirical research on growth? It's Not Factor Accumulation: Stylized Facts and Growth Models. *The World Bank Economic Review, 15(2),* 177-219.

Egger, D., Haushofer, J., Miguel, E., Niehaus, P. and Walker, M. W. (2019). *General equilibrium effects of cash transfers: experimental evidence from Kenya* (No. w26600). National Bureau of Economic Research.

IEG (2019). *Creating Markets to Leverage the Private Sector for Sustainable Development and Growth. An Evaluation of the World Bank Group's Experience Through 16 Case Studies.* World Bank Independent Evaluation Group.

Liu, E. (2019). Industrial policies in production networks. *The Quarterly Journal of Economics, 134(4),* 1883-1948.

Moral-Benito, E. (2012). Determinants of economic growth: a Bayesian panel data approach. *Review of Economics and Statistics, 94(2),* 566-579.

Pritchett, L. (2020). Randomizing Development: Method or Madness? In Bedecarrats. F., Guerin, I. and Roubaud, F. (eds) *Randomized Control Trials in the Field of Development: A Critical Perspective.* Oxford University Press.

Rockey, J. and Temple, J. (2016). Growth econometrics for agnostics and true believers. *European Economic Review, 81,* 86-102.

Simson R. (2018). *Mapping recent inequality trends in developing countries.* International Inequalities Institute at the London School of Economics and Political Science. http://eprints.lse.ac.uk/101863/1/Simson_mapping_recent_inequality_trends_wp24.pdf

Temple, J. R. (2010). Aid and conditionality. In Chenery, H. and Srinivasan, T. N. (eds) *Handbook of Development Economics* (Vol. 5, 4415-4523). Elsevier.

UNU -WIDER (2012). 'Is There A Micro-Macro Paradox In Aid?'. Helsinki: UNU-WIDER.

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