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Version 3

The zero-correlation result

The univariate relation between aid and growth

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1. Introduction

One of the most intriguing empirical regularities in economic development is the lack of correlation between development aid and growth.

The large multivariate AEL (Aid Effectiveness Literature) finds an amazing variety of results. Chris Doucouliagos and I have studied the first 141 papers of the AEL; see Part 2 of References. When the 1,779 aid effects are made comparable as partial correlations and they are submitted to meta-analysis the PET meta-average is only 0.03, with no simultaneity bias. Most of the large dispersion is achieved by adding control variables to the estimating equation; see Paldam (2021b). This note reconsiders the univariate evidence.[2]

The paper studies the connection between aid and growth with the powerful univariate technique of kernel regression on large datasets.[3] It covers 125 countries that received aid by the OECD registration between 1960 and 2018/9, where pairs of the aid and growth data exists. To make everything transparent and easy to replicate, I use data that can be downloaded from two open sources that are commonly used.[4]

ODA. The Official Development Aid received as a share of GNI. The data are from the World Development Indicators.

Growth. The real growth of *gdp* that is GDP per capita in comparable PPP prices. The *gdp* data are from the Maddison Project.

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2 The results of the paper are much as in the appendix Paldam (2005).

3 The technique of kernel regression is discussed in Chapter 2.4-5 of Paldam (2021a).

4 The data were downloaded in September 2021. It is possible to find a few hundred additional observations, by patching together data from other sources.

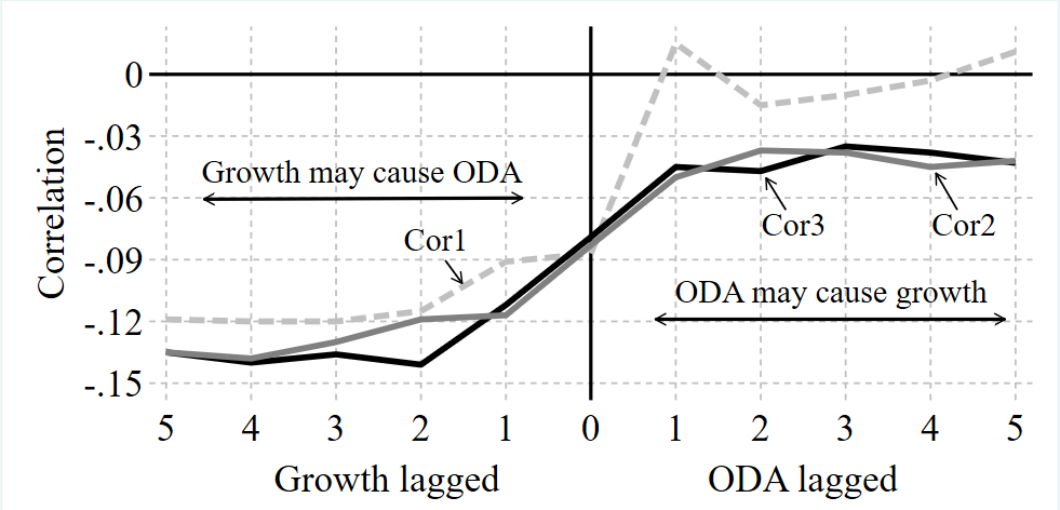
The analysis uses annual data. It gives large datasets and requires lags: Aid programs must be negotiated between two countries, and individual projects need to be prepared. This takes time so economic conditions in the recipient country, such as the growth rate, can only influence aid with a lag. Implementation of aid projects often takes some years, and consequently aid can only influence growth with a lag.[5] Therefore, the analysis uses 11 lag/leads between the two variables as shown in Table 1 and Figure 1.

Table 1. The number of data-pairs available and three correlograms: Cor1, Cor2 and Cor3

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
ODA	5 leads	4 leads	3 leads	2 leads	1 lead	Same	1 lag	2 lags	3 lags	4 lags	5 lags
Growth	5 lags	4 lags	3 lags	2 lags	1 lag	Same	1 lead	2 leads	3 leads	4 leads	5 leads
Part 1. All observations											
N	5,295	5,618	5,618	5,618	5,618	5,512	5,405	5,295	5,184	5,073	4,962
Cor1	-0.119	-0.120	-0.120	-0.115	-0.091	-0.087	0.015	-0.015	-0.010	-0.003	0.011
Part 2. Truncation: aid shares above 50% and growth rates outside the interval ±15%											
N	5.224	5,419	5,425	5,425	5,429	5,334	5,235	5,129	5,026	4,921	4,812
Cor2	-0.135	-0.140	-0.136	-0.141	-0.112	-0.079	-0.045	-0.047	-0.035	-0.038	-0.043
Part 3. The truncated data are further truncated for aid shares above 25%											
N	5,078	5,283	5,291	5,290	5,294	5,196	5,100	4,996	4,893	4,789	4,681
Cor3	-0.135	-0.138	-0.130	-0.119	-0.117	-0.083	-0.050	-0.037	-0.038	-0.045	-0.042

N is the number of observations, and *Cor* is the correlation between aid and growth with the lead/lag of the column.

Figure 1. The three correlograms from Table 1



5 The analysis follows the literature in disregarding activity effects. They are taken to work only the same year and the next, i.e., for ODA with lags 0 and 1.

The three correlograms on Figure 1 are the three rows of correlations in Table 1. The dashed line for all observations is the most volatile, as it should when the data contains extreme observations. When outliers are omitted the two solid lines appears. The solid lines are rather similar, and all correlations are small and negative, so the analysis from now concentrate on Part 3 of the data and hence the Cor3-curve.

The correlations have two levels: To the left the curves are stable around -0.13. This points to the causal effect of growth on aid as discussed in section 3. To the right they are stable around -0.04. This points to the causal effect of aid on growth. It is the zero-correlation result, which is discussed in section 2. For no lags the curves are midways between the two levels, so the unlagged connection is a mixture, with no causal interpretation.

The effect of aid on growth is -0.04. It is even worse than the meta-average in the AEL of 0.03. The numerically larger effect of growth on aid points to some simultaneity in the aid on growth relation. The meta-studies of the AEL found no such bias. Thus, the results do not tally. The next two sections look for a way to resolve the inconsistency.

Figure 2a and b report the same scatter. Even when the data are truncated for outliers, the observations still scatter widely. The bold curve is a kernel regression surrounded by a 95% confidence interval. The kernels are estimated by the stata command lpoly with the defaults and the bandwidth 2.5. The same command and bandwidth are used for the following 18 graphs, but the scatters are suppressed for better visibility.

Figure 2a. Growth explained by aid, same year. Figure 3a is same without scatter

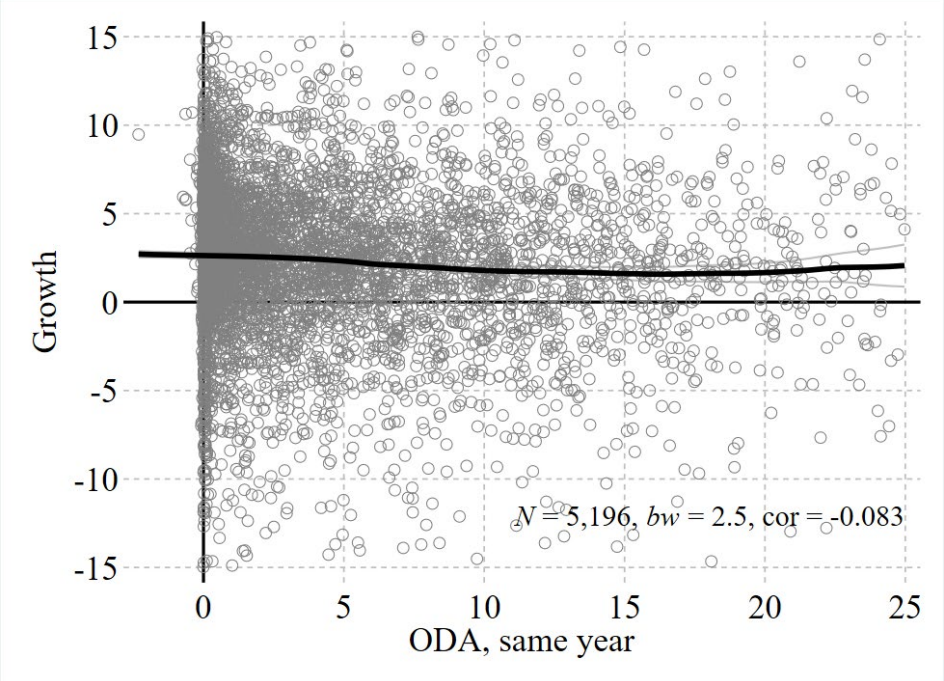
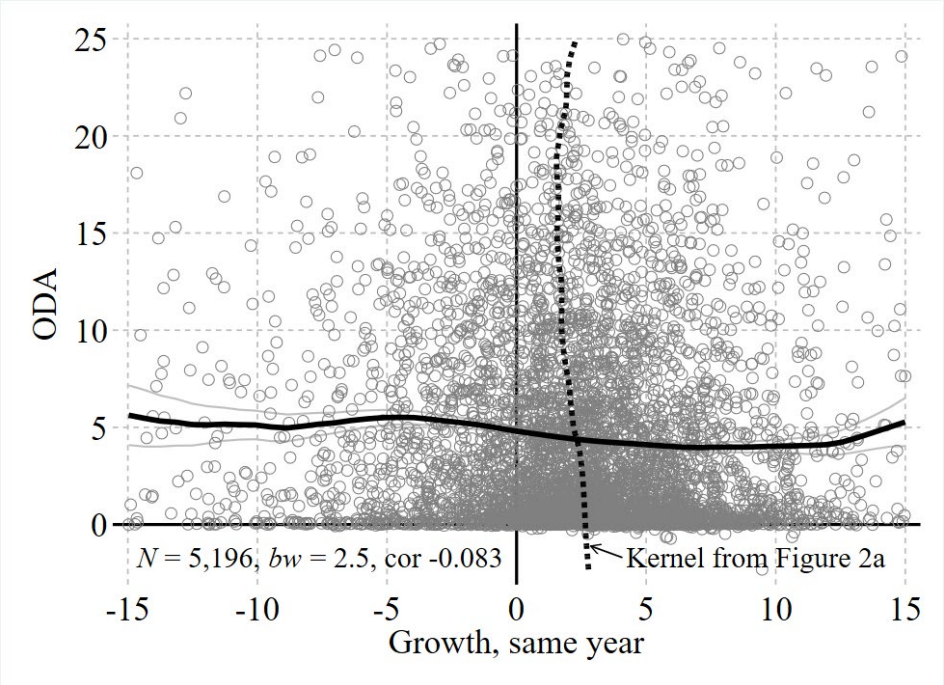


Figure 2b. Aid explained by growth, same year. Figure 5a is same without scatter



Data are from column (5) of Part 3 in Table1. The scatter looks rather similar for the data in the other columns, but the kernel curves are somewhat different as will be shown. Note that the kernel from Figure 2a is included as the dashed curve to illustrate the near-orthogonality of the two 'reverse' kernels

The two kernel-curves on Figure 2 and b are both virtually horizontal, but parallel to either of the two axes, and thus almost orthogonal as seen on Figure 2b. Kernels run both ways are nearly always very different. This has two explanations:

(1) The technique itself: On Figure 2a the data are sorted by ODA before the kernel regression is run, and on Figure 2b the sorting is by growth. (2) The observations on the two graphs scatter very much and the relations explains a tiny part of the variation only. If they explained precisely nothing they would be perfectly orthogonal. This is almost the case.

The two variables of a kernel curve are independent if a horizontal line can be drawn within the confidence intervals on the graph. It is hard to see, so the scatter is suppressed on the following kernel graphs. This allows the vertical axis to be enlarged.

The following 17 kernels are most of the 2 *x* 11 kernels estimated both ways for the eleven cells in Part 3 of Table 1. Five are left out as they showed the same as their two 'neighbors'. Note that all these kernels have a negative slope corresponding to the negative correlations in the table. However, some of the slopes are insignificant. As expected from Table 1 nicely negative slopes does appear on Figure 5 showing how well growth explains the ODA in the next 4 years.

2. Can aid explain growth? Looking at the zero-correlation result

Figures 3 report 5 graphs showing how well ODA with lags of 1 to 5 years can explain growth. Aid generates growth if the slopes on any or all of the five kernels on Figure 3 are positive.

No section of any of the five curves have a significantly positive section. However, there are a section with a negative slope on Figure 3a. It is possible that this is due to reverse causality. Figures 3b and c show nothing at all, as a horizontal line can be drawn within the confidence interval. Figures 3e and f have a strange negative downswing for high aid shares. This is likely to be freak result, and it is of dubious significance anyhow.

Figure 3. Kernel curves for ODA explaining growth

Figure 3a. ODA 1 year before growth (reverse Figure 6b)

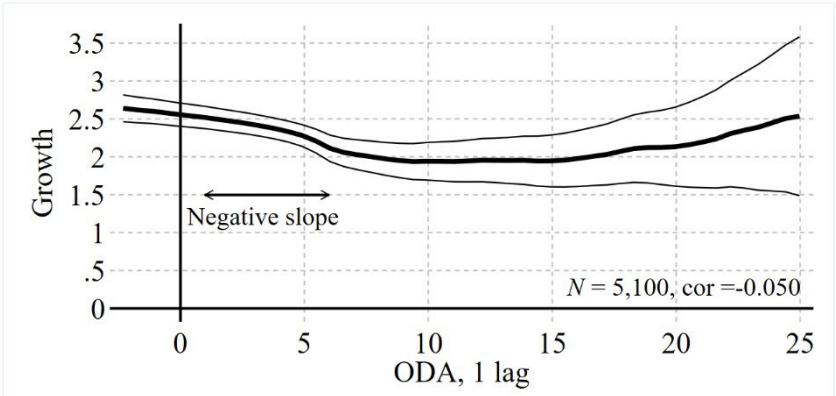


Figure 3b. ODA 2 years before growth (reverse not included)

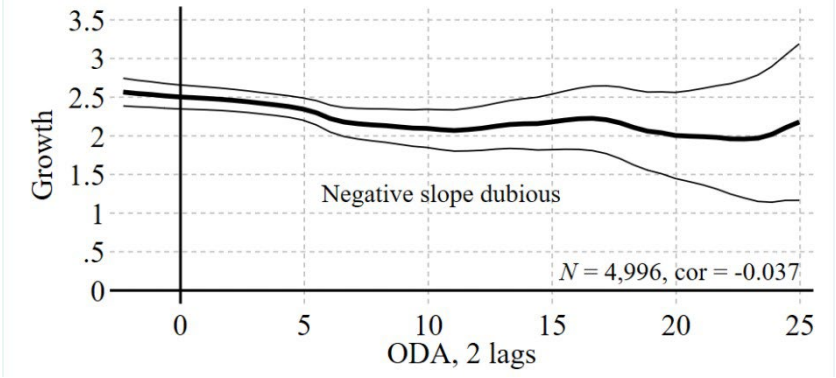


Figure 3c. ODA 3 years before growth (reverse Figure 6c)

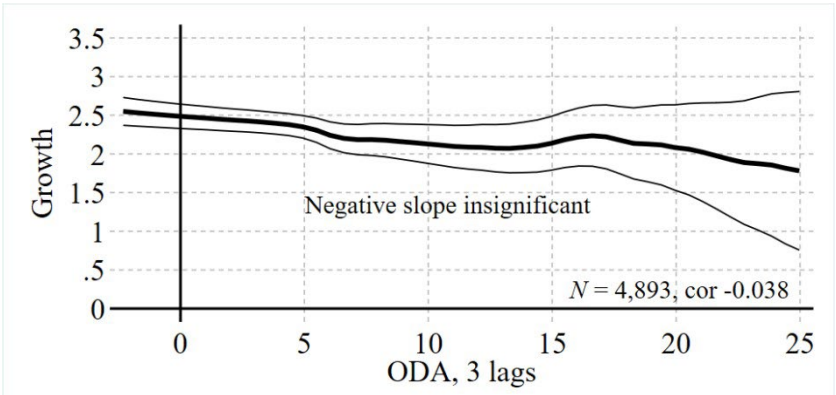


Figure 3d. ODA 4 years before growth (reverse not included)

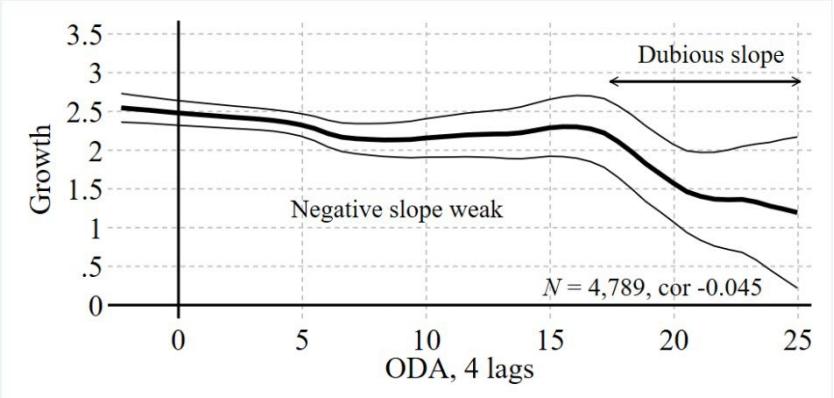


Figure 3e. ODA 5 years before growth (reverse Figure 6d)

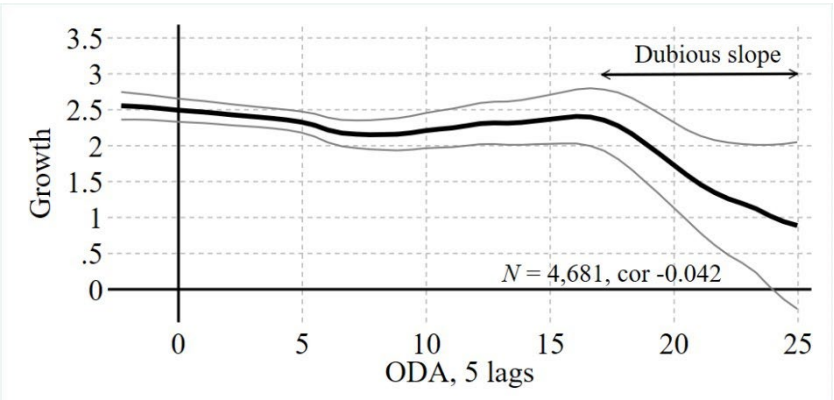


Figure 4 covers the same year, and ODA leaded 1,2 and 4 years.

Figure 4. Figure 3 continued with ODA the same year or later

Figure 4a. ODA and growth same year. Figure 2a without scatter (reverse Figure 6a)

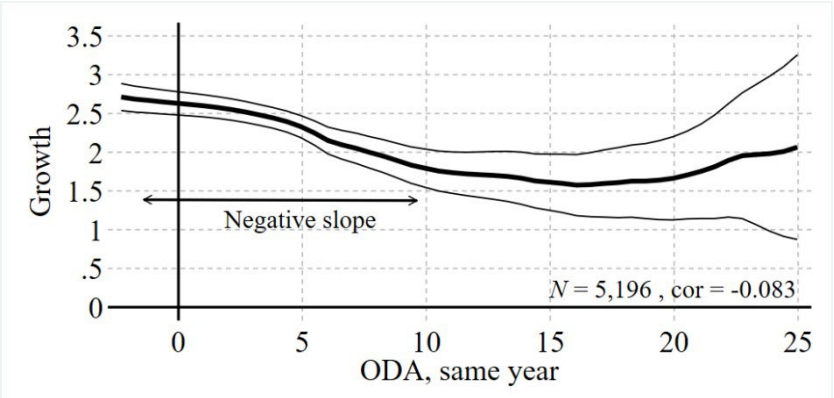


Figure 4b. ODA 1 year before growth (obs.) (reverse Figure 5a)

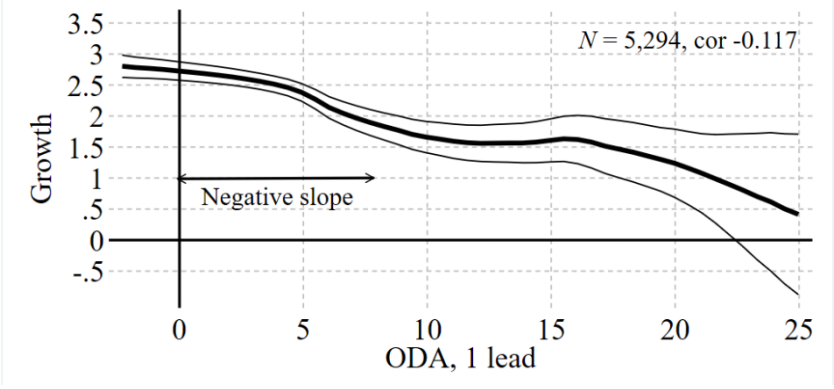


Figure 4c. ODA 2 years before growth (obs.) (reverse Figure 5b

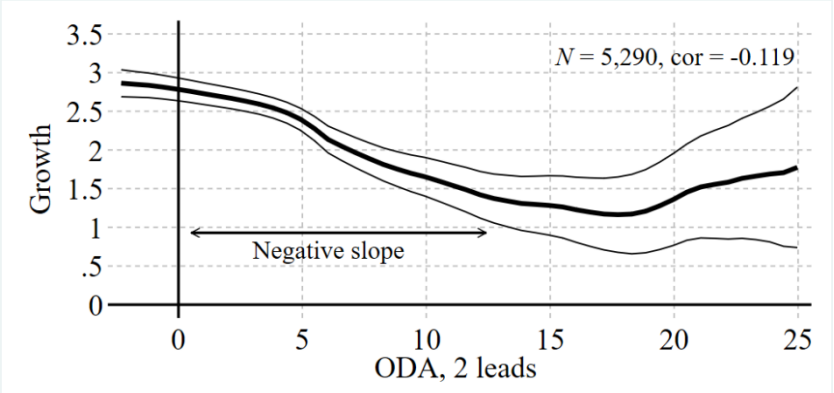
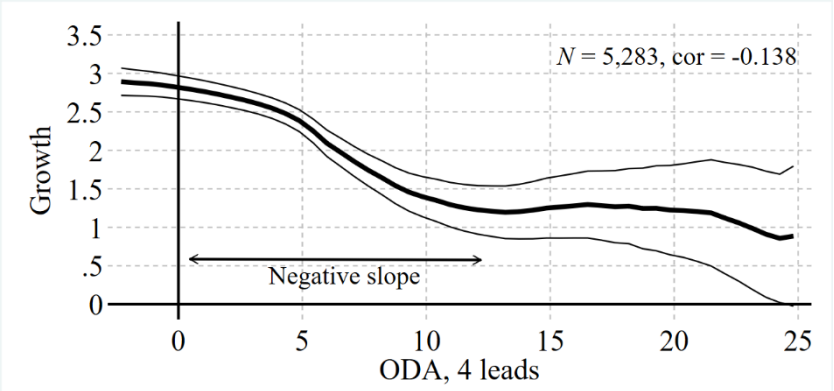


Figure 4d. ODA 4 years before growth (obs.) Reverse Figure 5d)



The curves on all graphs show a clear negative slope that indicate reverse causality. The later three can show no causal relation, but only reverse causality or inertia in the variables

.

3. Can growth explain aid? Looking for simultaneity in the AEL

Figure 1 showed that the largest correlations (numerically) are at the left-hand part of the picture. This suggests that growth can explain aid, though the correlations are at most -0.141. Thus, the analysis looks at the graphs where growth is lagged. In the AAL (Aid Allocation Literature) 30 papers reports 211 estimates of this relation, but a meta study (Doucouliagos and Paldam 2013b) finds very little. In the AEL the relation is the simultaneity bias found by some papers. The meta-studies find that such bias is insignificant.

Figure 5. Kernel curves for growth explaining ODA

Figure 5a. Growth 1 year Before ODA (reverse Figure 4b)

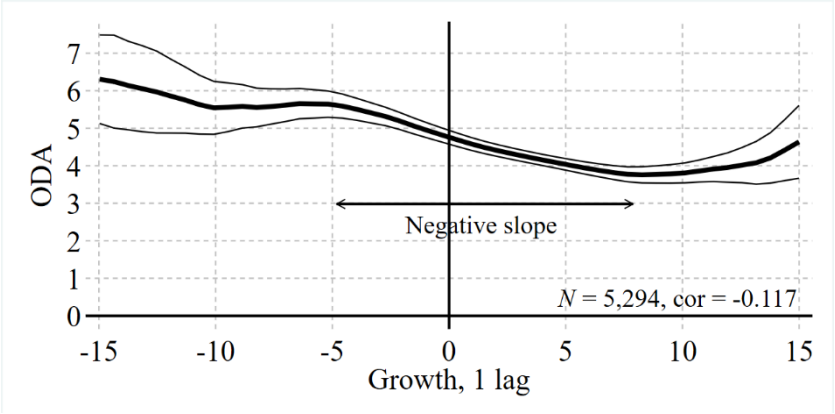


Figure 5b. Growth 2 years Before ODA (reverse Figure 4c)

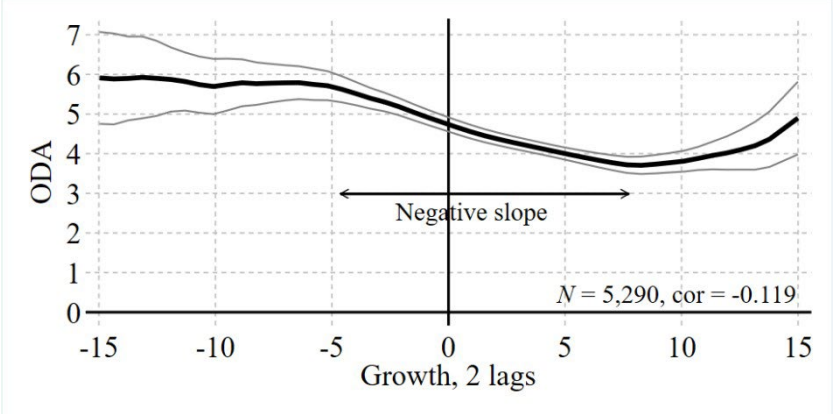


Figure 5c. Growth 3 years before ODA (reverse not included)

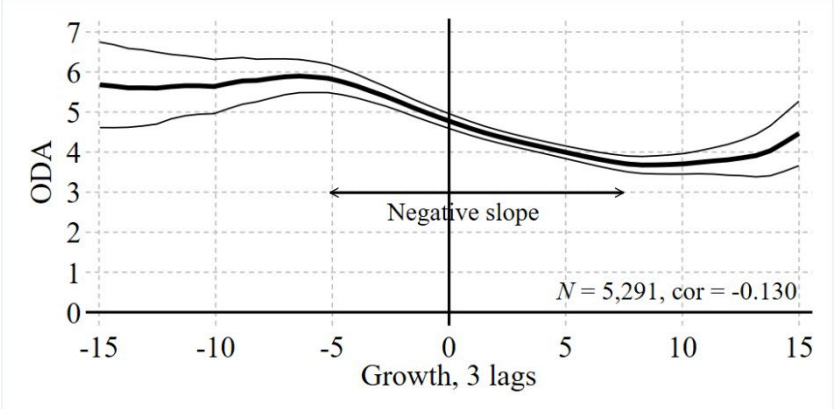


Figure 5d. Growth 4 years before ODA
(reverse Figure 4d)

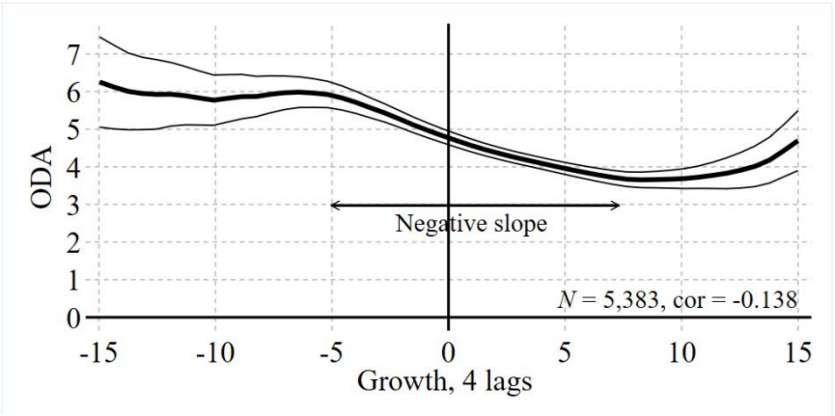


Figure 5 shows that growth with 0 to 4 lags can explain ODA. The four curves are remarkably similar. All five graphs show a *normality interval*, from – 5 to +7% growth, with a narrow confidence interval, where the kernel curve has negative slope. The curves are flat outside that interval.[6] The size of the effect is that while -5% or lower gives an ODA of 6%, growth of +5% or higher gives an ODA of 4%. Countries with economic success loses aid.[7]

Figure 6. Figure 5 continued with growth same year and later

Figure 6a. Growth and ODA same year
Figure 2b without scatter
(reverse of Figure 4a)

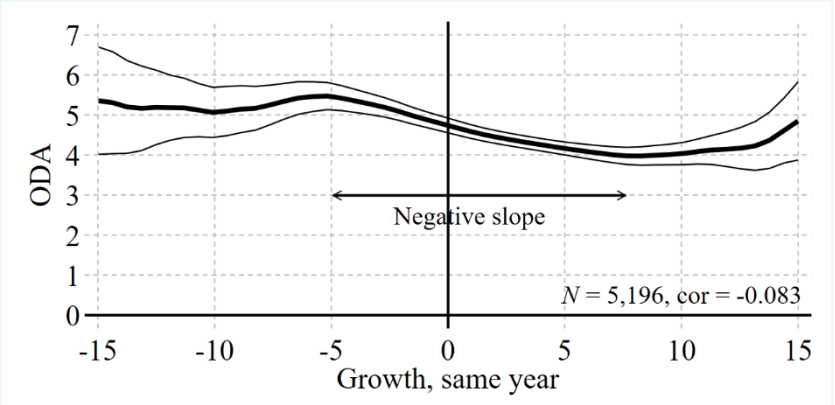
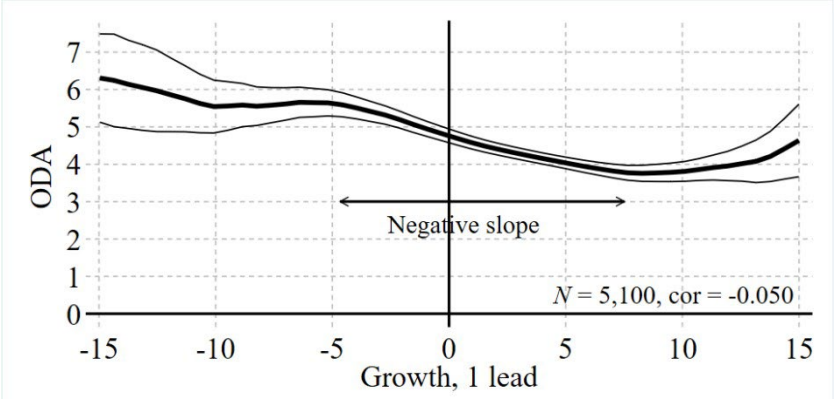


Figure 6b. Growth 1 year after ODA (obs.)
(reverse Figure 3a)



6 The confidence interval widens at the ends. If the same curves are estimated including more outliers (i.e., for Part 2 and Part 1 of the data) the middle section stays the same, and the confidence intervals continue to widen.
7 This is contrary to the recommendations in World Bank (1998).

Figure 6c. Growth 3 years after ODA (obs.) (reverse Figure 3c)

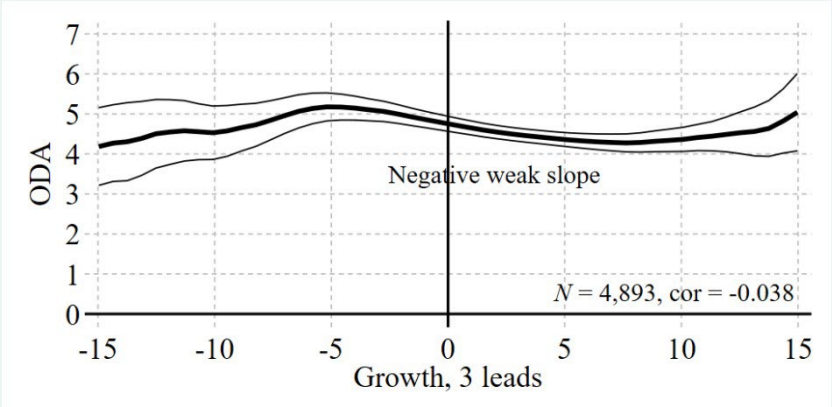


Figure 6d. Growth 5 years after ODA (obs.) (reverse Figure 3e)

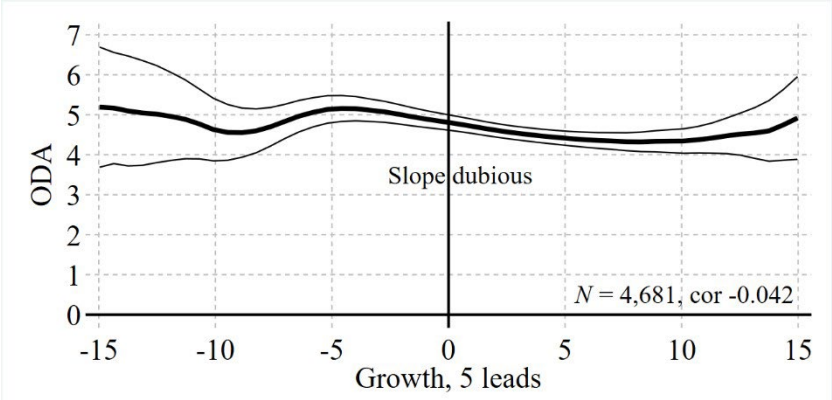


Figure 6 continues the analysis by looking at the same year and growth leaded 1, 3 and 5 years. The kernel curve remains almost the same as before on Figure 6a and 6b though it moves to the right. Predictably, the relation vanishes for 3 and 5 leads, i.e., on the last two figures.

4. Conclusion

The two main conclusions from the analysis are:

The relation from aid lagged to growth is negative at -0.04, but of dubious significance. This is the zero-correlation result.

The relation from growth lagged to aid is significant in the growth interval from −5% to +7%, where higher growth causes less aid.

The results contrast to the findings in the large AEL (aid effectiveness literature), which finds a small positive (partial) correlation of aid and growth of 0.03, and no simultaneity bias.

On a personal note, I want to say that I hoped to find some interval for the aid share where the effect of aid was positive, but the analysis found no such interval.

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