Throwing Good Money After Bad?
The Effects of Foreign Aid on Income Inequality in Developing Countries

Abstract

This paper examines the effect of official development aid (ODA) on income inequality in developing countries. Using data from the World Bank's World Development Indicators, we use a country fixed-effects approach to address endogeneity issues. We find no significant effect of ODA per capita on inequality in developing countries. We therefore conclude that, consistent with previous research in the field, ODA does not significantly contribute to the economic growth and development of developing nations, nor does it appear to decrease income disparity. This analysis adds to the body of literature by using a county fixed-effects approach to analyze the effect of ODA per capita on GINI, something not common in the literature, to obtain our result showing no significant effects.

Keywords: Aid, ODA, Inequality, GINI, development

Section 1: Introduction

The question of the effectiveness of foreign aid is an old and controversial one. On one hand, there are many who claim that foreign aid is critical to economic development, while on the other hand there are others who claim that it increases dependence and creates a kind of aid-related Dutch disease[1]. Oftentimes, however, these arguments are made without an understanding of the strategic interests that are served through official development assistance (ODA). The fact is that although it may seem counterintuitive, foreign aid programs are not typically purely altruistic. Donor countries and aid agencies are driven by political self-interest. Nations seek to use aid as political leverage, while international financial institutions use large-scale programs in order to survive. Recent events, such as the military coup that overthrew former Egyptian president Mohammed Morsi, spurred a heated debate about whether Western interests in Egypt would best be served by a continuation of aid or its suspension. The debate illustrated how foreign aid is fraught with conflicting interests. As Herzer and Nunnenkamp argue, "selfish donor motives are likely to compromise the needs - and merit-based allocation of aid within countries… Likewise, using aid as a means to buy political support by the local elite implies that it favors the rich rather than the poor within a particular country"[2]. Similarly, aid agencies prefer expansive, if ineffective, aid programs because they are driven by the incentive of "[pushing] money out the door".[3] Donor incentives may therefore work against the intended development effects of assistance programs.

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[1] Doucouliagos, H., Paldam, M. The aid effectiveness literature: the sad results of 40 years of research. *Journal of Economic Surveys* 23 (2009): 433–461.

[2] Herzer, D., & Nunnenkamp, P. The effect of foreign aid on income inequality: Evidence from panel cointegration. *Structural Change and Economic Dynamics* (23) (2012): 245-255.

[3] Drazen, A. Discussion of "Are aid agencies improving?" by William Easterly. *Economic Policy* (2007): 668–673

The concern that aid is being used to buy political support of local elites illuminates the possibility that foreign aid might contribute to greater inequality in countries that receive aid. If this turns out to be the case, it may call for a radical rethinking of the need for and usefulness of foreign aid as a development strategy. Increased inequality is a threat to any number of things that are important to economic growth and political stability. For example, Odedokun and Round found that increased levels of inequality hindered economic growth, increased fertility rates, and was strongly linked to political instability.[4] These concerns alone are reason enough to be concerned about preventing further increases in inequality, but they do not even begin to address the moral and ethical implications of implementing a program that places the concerns and needs of the wealthy and powerful over those of the poor and powerless.

If donors continue to use aid to service their interests, then an understanding of its effectiveness and impacts is a necessary step towards developing sound foreign aid programs. And, in fact, the effects of foreign aid on economic growth have been extensively explored. The picture, however, is incomplete without an assessment of the distributional effects of ODA. Simon Kuznets, in his seminal work on the inverted U-shaped relationship between inequality and level of economic development known as the Kuznets Curve, argued that as a country develops, income inequality rises then falls.[5] So, in assessing the effects of aid programs on development and growth, it becomes necessary to gauge how ODA programs have affected the income differential in developing nations. Is the income gap increasing or decreasing over time and what is the effect of foreign aid on income inequality?

This paper will examine the effect of foreign aid on income inequality in developing countries using country-level panel data from 1982-2011. Specifically, we contribute to the

[4] Odedokun, M. O., & Round, J. Determinants of income inequality and its effects on economic growth: Evidence from african countries. *African Development Review 16*(2) (2004): 287 - 327.

[5] Kuznets, S. Economic growth and income inequality. *The American Economic Review 45*(1) (1955): 1-28.

existing literature through an examination of the relationship between income inequality and foreign aid using a country fixed-effects approach, which should address some econometric issues raised by previous research. The paper proceeds in section 2 by first undertaking a review of the existing literature on the impacts of foreign aid, the determinants of inequality, and the interaction between the two. Then follows a discussion in section 3 about the data to be used, our hypothesis (section 4), methods (section 5), results (section 6), and discussion of findings and policy implications (section 7).

Section 2: Related Literature.

In concluding his seminal paper, Kuznets notes that he is "conscious of the meagerness of reliable information presented," and adds that "the paper is perhaps 5 per cent empirical information and 95 per cent speculation, some of it possibly tainted by wishful thinking".[6] He adds that "speculation is an effective way of presenting a broad view of the field; and that so long as it is recognized as a collection of hunches calling for further investigation rather than a set of fully tested conclusions, little harm and much good may result."[7] He also calls for a better understanding of "the secular structure of personal income distribution" and highlights the importance of a deeper understanding of the determinants of income inequality. With this in mind, Kuznets' curve can be understood as a general trend in which income inequality is affected at first negatively and then positively by economic development. According to Kuznets' paper, as a country begins to industrialize urban centers begin to develop and initially causes an urban-rural gap income differential. With time, however, rural populations will decrease as they migrate to urban centers. Inequality then begins to decrease as a certain level of income is

[6] Kuznets, S. Economic growth and income inequality.
[7] Ibid.

reached and benefits begin to trickle down. In Kuznets' hypothesis then, factors contributing to economic development are central determinants of income (in)equality.

For his critics, however, Kuznets' hypothesis falls short. Bahmani-Oskooee et al. acknowledge that Kuznets "draws important distinctions about this process in [least developed countries]".[8] Yet in their study, which applies cointegration to annual time series data from sixteen countries to test the Kuznets hypothesis, they find limited support for it.[9] Their results indicate that only one country of the sixteen included in the sample, Kenya, "demonstrates a pattern that would conform to the Kuznets 'inverted-U' hypothesis." in the short run. In the long-run only Panama "has a positive long-run relationship that corresponds to an 'uninverted U.'"[10] In short, Bahmani-Oskooee et al. argue that the "effect of both [national] income and openness varies by country."[11]

Conceição and Galbraith present an "augmented Kuznets curve" and argue that in developing countries increases in income correspond directly to decreases in inequality while political instability, import-substitution policies, and depreciations in currency tend to increase inequality.[12] Their "augmented Kuznets curve" curves upwards for rich nations in order to explain increased inequality even in the United States and Western Europe.

With an understanding that determinants of income inequality differ between developed and developing countries, Odedokun and Round use OLS regression to test the effects of economic, political, and geographic factors on income distribution in African countries. They

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[8] Bahmani-Oskooee, M., Hegerty, S., & Wilmeth, H. Short-run and long-run determinants of income inequality: Evidence from 16 countries. *Journal of Post Keynesian Economics 30*(3) (2008): 463-484.
[9] Ibid.
[10] Ibid.
[11] Ibid.
[12] Conceição, P., & Galbraith, J. K. Toward a new Kuznets hypothesis: Theory and evidence on growth and inequality. In M. Berner & J. Galbraith (Eds.), *Inequality and Industrial Change: A Global View,* 139-160. New York, NY: Cambridge University Press, 2001.

identify "level of economic development attained, regional factors, size of government budget and the amount of it devoted to subsidies and transfers, phase of economic cycle, share of agricultural sector in total labour force, as well as human and land resources endowment" as factors that have affected income distribution across Africa.[13] They also find some support for the negative effect of high inequality on economic growth and explain that the effect of inequality on growth is channeled through investment in secondary and tertiary education, increased political instability, and a higher fertility rate.[14]

Like Bahmani-Oskooee et al., Odedokun and Round also struggle to detect the Kuznets effect and contend that, "the level of economic development (or per capita income) attained is found to have exerted an inequalizing effect".[15] They concede, however, that the effect of a Kuznets curve may not be measurable in African countries "possibly because most (or probably all) of the countries were yet to attain this latter stage of development during the sampled periods."[16] Theoretically parallel with the Kuznets hypothesis, however, Odedokun and Round find that when a large proportion of the labor force is engaged in the agricultural sector, income distribution tends to be less equal and income inequality tends to be higher in the urban areas of sub-Saharan countries than in rural areas.

Roine et al. also find that economic growth can aggravate income inequality and contend that "periods of high economic growth disproportionately increase the top percentile income share at the expense of the rest of the top decile".[17] This finding is in line with the upward sloping segment of the Kuznets curve where at low levels of economic development, income inequality is increasing as the economy expands. Still, the question of whether higher levels of

[13] Odedokun, M. O., & Round, J. Determinants of income inequality and its effects on economic growth
[14] Ibid.
[15] Ibid.
[16] Ibid.
[17] Roine, J., Vlachos, J., & Waldenström, D. The long-run determinants of inequality: What can we learn from top income data? *Journal of Public Economics* 93 (2009): 974–988.

economic development and growth eventually achieve a more equitable income distribution remains unclear.

Although economic growth appears to have a negative influence on income inequality at low levels of development, the effects of foreign aid on growth are central towards developing an understanding of whether ODA programs harm or help developing nations. Here, too, findings are mixed. McGillivary et al.'s findings suggest that the extent of the effect of aid on growth is that without it, economic growth rates would be lower.[18] Yet others argue that there is no evidence of any effect of aid on economic growth.[192021] Brautigam and Knack further the claim that aid has no effect on growth by adding that it has no effect even when governance institutions are of a high quality, and in fact claim that aid may cause the quality of democratic institutions to deteriorate.[22]

Still others suggest that aid's effect on growth is conditional. Dalgaard and Burnside and Dollar argue that sound conditions and good institutions will affect the effectiveness of aid[23]. Dalgraad asserts the importance of donor policies suggesting that "depending on specific donor policy choices, aid disbursements may lead to faster transitional growth, stagnation or cyclical growth," and argues that donor policies may be the key to understanding why aid is not uniformly effective across recipients.[24] While Dalgraad suggests that donor policies determine an

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[18] McGillivray, M., Feeny, S., Hermes, N., Lensink, R. Controversies over the impact of development aid: it works; it doesn't; it can, but that depends. *Journal of International Development* (18) (2006): 1031–1050.

[19] Easterly, W. Can foreign aid buy growth. *The Journal of Economic Perspectives 17*(3) (2003): 23-48.

[20] Easterly, William. "Can foreign aid buy growth?." *The journal of economic perspectives* 17, no. 3 (2003): 23-48.

[21] Rajan, Raghuram G., and Arvind Subramanian. "Aid and growth: What does the cross-country evidence really show?." *The Review of economics and Statistics*90, no. 4 (2008): 643-665.

[22] Bräutigam, Deborah A., and Stephen Knack. "Foreign Aid, Institutions, and Governance in Sub-Saharan Africa*." *Economic development and cultural change* 52, no. 2 (2004): 255-285.

[23] Dalgaard, C.J. Donor policy rules and aid effectiveness. *Journal of Economic Dynamics and Control* 32 (2008): 1895–1920; and Burnside, C., & Dollar, D. Aid, policies, and growth. *The American Economic Review 90*(4) (2000): 847-868.

[24] Dalgaard, C.J. Donor policy rules and aid effectiveness.

ODA program's level of effectiveness, Burnside and Dollar place this burden on the recipient country. They contend that where there are "good fiscal, monetary, and trade policies," aid has a positive impact on growth, but where good policies are absent, aid has little effect.[25] Angus Deaton, however, supports Brautigam and Knack's conclusion and disputes Burnside and Dollar's argument by identifying a "central dilemma" in ODA programs. Deaton argues that when conditions for development are favorable, there is no need for aid and where these conditions are absent aid is likely to be damaging.[26] Deaton even suggests that aid is inherently anti-democratic because it releases leaders from accountability to their people.

Negative effects of aid on democracy and growth notwithstanding, a number of studies find that aid reduces corruption. Using a quantile regression, Okada and Samreth show that foreign aid reduces corruption but find that this effect is greater in less corrupt countries and varies by donor.[27] Jose Tavares also argues that aid reduces corruption and presents findings that are "statistically and economically significant and robust to different controls."[28] Still, if in fact aid reduces corruption, it remains unclear how reduced corruption affects income inequality. Odedokun and Round find that anti-corruption measures have "no remarkable effect on income distribution," but do find that anti-corruption programs "appear to have reduced the income share of the 'middle class.'"[29] The finding that anti-corruption programs reduce the income share of the middle class indicates that it is mid-level government bureaucrats who are more susceptible to corruption and bribery. If in fact foreign aid programs reduce corruption, then it is middle classes across the developing world that are most likely to suffer a loss of income share.

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[25] Burnside, C., & Dollar, D. Aid, policies, and growth.
[26] Deaton, A. *The great escape: Health, wealth, and the origins of inequality*. Princeton, NJ: Princeton University Press, 2013.
[27] Okada, K., & Samreth, S. The effect of foreign aid on corruption: A quantile regression approach. *Economics Letters* 115 (2012): 240-243.
[28] Tavares, J. Does foreign aid corrupt. *Economics Letters* 79 (2002): 99-106.
[29] Odedokun, M. O., & Round, J. Determinants of income inequality and its effects on economic growth

The wider effects of foreign aid programs on income inequality, however, appear for the most part to be negative or nonexistent. Doucouliagos and Paldam conclude that "after 40 years of development aid, the preponderance of the evidence indicates that aid has not been effective," and argue that ODA programs encourage an aid-related Dutch disease that affects poorer segments of the population more than richer ones.[30] Bjørnskov, who also advances the claim that foreign aid may lead to a "Dutch disease-like" phenomenon, explains that as exchange rates appreciate as a result of aid inflows, a country's competitiveness suffers leading to layoffs and increased unemployment.[31] The resulting inflation also disproportionately affects the poor "since the relatively rich can invest in capital, land and other assets," while wages in the informal sector tend to be unprotected against inflation.[32] Odedokun and Round, however, find that "the inflation rate does not appear to have contributed much to the observed income distribution patterns [in African countries]," and claim that "this finding is not necessarily counter-intuitive… because the major distributional effect of inflation… is believed to be on the distribution of wealth, as opposed to the distribution of income. High inflation is expected to increase wealth inequality, and not income inequality".[33] Nonetheless, Bjørnskov maintains that "foreign aid and democracy in conjunction are associated with a higher share of income held by the upper quintile," indicating that foreign aid may have even more skewed effects in democratic developing countries than autocratic ones where "effects are negligible".[34]

Using panel cointegration, Herzer and Nunnenkamp also find that "aid exerts an inequality increasing effect on the distribution of income," and suggest that even anecdotal

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[30] Doucouliagos, H., Paldam, M. The aid effectiveness literature: the sad results of 40 years of research. *Journal of Economic Surveys* 23 (2009): 433–461.

[31] Bjørnskov, C. Do elites benefit from democracy and foreign aid in developing countries?. *Journal of Development Economics* 92 (2010): 115–124.

[32] Ibid.

[33] Odedokun, M. O., & Round, J. Determinants of income inequality and its effects on economic growth

[34] Bjørnskov, C. Do elites benefit from democracy and foreign aid in developing countries?

evidence indicates that it is political elites who benefit most from foreign aid, indicating that the effect of aid on corruption may be more nuanced than Okada and Samreth and Tavares argue. Chong et al. also find that aid has no robust effect on inequality. Although their findings suggest that in the presence of low corruption foreign aid can reduce income inequality, the outcome "does not appear to be particularly robust".[35]

Bourguignon et al., however, note that although aid has an "extremely small" equality enhancing effect, it is "of some importance for the lowest decile of the [income] distribution."[36] They suggest that the effect of aid is more easily discerned on a decile-by-decile basis and argue that the positive effects of aid on income inequality, though limited, are eclipsed by the negative effects of trade restrictions imposed by high-income countries on the developing world. Finally, Bourguignon et al., suggest that aid when coupled with sound trade policy and investment financed by remittance flows can have a much stronger and more positive effect on growth and income inequality.

This analysis adds to this body of literature by using a county fixed-effects approach which, in concert with using GINI to measure levels of inequality, makes this analysis a unique contribution to research on the topic of the effects of foreign aid on inequality.

Section 3: Data

The source of the data used in this analysis is the World Development Indicators (WDI) published by the World Bank.[37] This is panel data gathered by the World Bank, from which we have compiled all of the data from 1982-2011 for all countries considered by the World Bank to

[35] Chong, A., Gradstein, M., Calderon, C. Can foreign aid reduce income inequality and poverty? *Public Choice* 140 (2009): 59–84.

[36] Bourguignon, F., Levin, V., Rosenblatt, D. International redistribution of income. *World Development* 37 (2009): 1–10.

[37] "World development indicators." *World DataBank*. 2013. http://databank.worldbank.org/data/home.aspx

be low or lower middle income countries, being sure to include as many relevant variables from the literature review as possible.

3.1: Outcome Variable

For the outcome variable of inequality, this study uses the GINI index, which is the most commonly used measurement of income inequality. The GINI index is measured on a scale from 0-1 or as a percentage, where 0 (0%) represents a perfectly equal distribution of income and 1 (100%) represents a perfectly unequal distribution of income. This variable, while useful, is responsible for one of the more significant limitations of this data due to its high levels of missingness. Our approach uses listwise deletion to account for this problem which, although it reduces the size of the sample significantly, allows us to maintain comparability across analyses and does not bias our estimates.

3.2: Independent Variable

The independent variable of interest in this case (foreign aid) will be represented by "Official development assistance and official aid received per capita" which will be created from the World Bank data by dividing the ODA and official aid received (current US$) by the total population for each country.

3.3: Control Variables

The data set also includes variables that, based on research discussed in the literature review, should be controlled for as they have been found to be determinants of income inequality and aid. One of these determinants is the distribution of resources, which we will measure in the same way as Odedokun and Round, using the amount of arable land (measured by hectares of arable land per person) but not using literacy rate as the data on this in the WDI is limited. Another variable related to agriculture that must be controlled for is the share of the agricultural

sector, which we will measure using employment in agriculture as a percentage of total employment. Two of the variables that must be controlled for are best represented using proxies. The first is level of development attained, which Aquino et al have discussed is commonly represented using infant mortality rate as this analysis does.[38] The second is the phase of economic cycle, which Odedokun and Round indicate is often represented by unemployment rate (as we will), because unemployment trends tend to be highly correlated with ups and downs in the economy.[39] Our analysis will also control for regional factors using the region dummies built into the WDI data, which can also be used for clustering of the standard errors as there is likely to be some heterogeneity by region. The amount devoted to subsidies and transfers will be measured by subsidies and transfers as a percentage of expense while the size of government budget will be measured by general government final consumption expenditure as a percentage of GDP.[40] To measure national income, this analysis will parallel Bahmani-Oskooee et al. and use real GDP with a 2005 US$ baseline in the WDI data set.[41] For more on definitions and summary statistics of these variables see Appendices 1 and 2, respectively.

Of the variables which a review of the literature has found to have a significant impact on inequality, the only ones which we are not able to adequately represent using the WDI data are: having democratic institutions, literacy rate (due to missing data), political instability, import-substitutions, and depreciations in currency. The use of the fixed effects method should effectively account for these as they all vary on a country by country basis and are relatively constant over time. The panel data approach and fixed effects model should also help to remove edogeniety from the data.

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[38] Aquino, R., Oliveira, N. F., & Barreto, M. L. Impact of the family health program on infant mortality in Brazilian municipalities. *American Journal of Public Health 99*(1) (2009): 87-93.
[39] Odedokun, M. O., & Round, J. Determinants of income inequality and its effects on economic growth
[40] Ibid.
[41] Bahmani-Oskooee, M., Hegerty, S., & Wilmeth, H. Short-run and long-run determinants of income inequality.

Section 4: Theoretical Model

We begin by estimating the model:

$$Inequality_{it} = \beta_0 + \beta_1 ODA_{it} + \beta_2 \mathbf{x_{it}} + \beta_3 \mathbf{z_i} + + a_i + \theta_t + e_{it} \quad (1)$$

Where $Inequality_{it}$ represents inequality as measured by the GINI index in country i in year t, and ODA_{it} represents official development assistance and official aid received per capita in country i in year t. The coefficient β_1 can be interpreted as the percentage point increase in inequality for each additional dollar off ODA per capita. The vector $\mathbf{x_{it}}$ represents the time variant controls used in estimating the model and vector $\mathbf{z_i}$ represents the time invariant controls used in estimating the model. The composite error term represented by v_{it} can be decomposed into the idiosyncratic error term (e_{it}), the year effect (θ_t), and the time-invariant unobserved country effect (a_i). The unobserved effect, a_i, in this model is treated as a fixed effect, which allows us to control for any omitted country-specific variables that do not vary over time. Using a fixed-effects approach also allows us to control for events across time that have a global impacts, such as global recessions, by including year fixed effects, θ_t, in the model.

Based on the inconsistency of the findings in previous research regarding the effect of aid on inequality, it is likely that our results will indicate little to no effect; this analysis will therefore test a two tailed hypothesis which will allow for us to test whether ODA has a positive, negative or no impact on inequality.

Section 5: Empirical Method

5.1 Fixed-Effects Approach

There is an important econometric issue that is addressed through the use of panel data and the country fixed-effects approach. The issue that this model will remedy is potential heterogeneity in the relationship between income inequality and official development assistance. The fixed

effects model remedies the resulting bias by allowing for arbitrary correlation between the fixed effect, a_i, and the explanatory variables. Allowing for arbitrary correlation insures that time-invariant explanatory variables are cancelled out by the fixed-effects transformation. Applying the fixed-effects approach to panel data will also allow us to control for events across time that have global impact, such as global recessions, by including year fixed-effects in the model in addition to the country fixed-effects.

The model will be estimated using control variables discussed in section 3, including arable land, literacy rate, agricultural employment rate, infant mortality rate, unemployment rate, reliance on subsidies and transfers, GDP, government spending, and regional dummies (which are described in Appendix 3).

5.2: Robustness Checks:

We begin our robustness checks by estimating a standard OLS regression that includes each of the controls discussed in 5.1. By running this regression we can obtain a baseline estimate for the effects of foreign aid using a method that is both simple and easy to interpret. We then use the random effects approach along with a Hausman Test in order to determine whether Fixed or Random Effects is the preferred option for estimating the impacts of foreign aid on inequality. The final robustness check is a fractional probit regression using the Mundlak device to add in the time-invariant country fixed-effects, which enables us to estimate a probit model when the dependent variable is a fractional limited dependent variable, which the GINI index is. The average partial effects of the fractional probit model, while not directly comparable, will provide a point of comparison of the direction and practical importance of the estimated effect of foreign aid on inequality.

Section 6: Results

6.1: *Hausmann Test and Specification*

The decision to use a fixed effects approach instead of a random effects approach was made by running both models for comparison, the results of which can be seen in Appendix 4, and conducting a Hausmann Test using a Mundlak Device, which can be seen in Appendix 5. While the random effects approach's estimate of the coefficient on ODA per capita is somewhat similar to the estimate of the fixed effects approach, most of the other variables had quite different estimates, indicating that random effects is likely to be biased for this analysis. The results of the Hausmann Test support this conclusion, as they found joint significance of the Mundalk Device time averages, which indicates that the random effects approach is indeed biased and we will therefore rely on the fixed effects results for our conclusions.

To ensure correct specification of the model, a RESET specification test was also performed to test if the theoretical model specified in Section 4 is missing any quadratic terms. This test, seen in Appendix 6, found that the model was not missing any quadratic terms as neither $\hat{y}^2$ nor $\hat{y}^3$ were statistically significant and these two variables were also not found to be jointly significant. An additional test was run to provide additional confirmation that ODA per capita should not include a quadratic specification, as the Kuznet's curve hypothesis would suggest is the case. The results of a simple t-test on "ODA per capita squared" find that the estimated coefficient is not statistically significant, providing further evidence that the theoretical model is correctly specified while also indicating that the Kuznet's curve does not hold true for ODA per capita.

6.2: *OLS Robustness Check*

In addition to the random effects model that was run as a part of the Hausmann test described in the previous section, an OLS robustness check was also run. This was standard OLS

regression with Country and Year dummy variables, the results of which can be seen in Appendix 4, which included regional variables that had been automatically dropped in the fixed effects approach. The results of the OLS regression were different statistically from the fixed effects results, although the practical differences were relatively small. The difference on the estimated coefficient of -0.05 on ODA per capita is the most important of these, which OLS found to be statistically significant. This result suggests that an increase of $100 ODA per capita would lead to a 5 percentage point decrease in inequality. The fact that the results are different emphasize the importance of using the fixed effects approach, as it indicates that there is some unobserved heterogeneity that is not captured by the specified variables but can be eliminated by allowing country level variation. It should also be noted that an increase $100 ODA per capita is a very sizable increase, as that is even larger than the mean ODA per capita in this data set (Appendix 2).

6.3: *Fixed Effects Approach*

The results of the country fixed effects regression analysis find there to be no significant impact of ODA per capita on inequality in developing countries. Even if it were statistically significant, the estimated coefficient for ODA per capita of -0.01 is essentially 0 from a substantive standpoint as it would indicate that an increase of $100 ODA per capita would only change the GINI statistic by 1 percentage point (see Appendix 4). The summary statistics in Appendix 2 indicate that not only would this be a vast increase in ODA per capita as the maximum for the whole data set is $199.13, but also that the direction of the change would actually be increasing inequality. It is important to note that this discussion of the direction of the effect is purely hypothetical, however, as the result is not statistically significant and in fact has a confidence interval that ranges from -0.04 to 0.02.

The results of the fixed effects approach found evidence that only the control variable that had a significant impact on inequality was employment in agriculture as a percentage of total employment. All other controls in the fixed-effects approach did not yield statistically significant results, suggesting that the effects of these variables were captured by the year and country effects in the model.

6.4: Fractional Probit Robustness Check

Another robustness check performed in this analysis was an estimation of a fractional probit model, which allows us to examine our data using a more precise estimator that is designed to be used when the outcome variable is measured as a fraction between 0 and 1.[42] The GINI coefficient in our data meets this requirement by dividing its values by 100. This approach will use a Mundlak device, which allows us to control for time-invariant differences between countries similar to the fixed effects approach. The results of the fractional probit approach with a Mundlak device support the results found in the fixed-effects approach as the findings for the effect of ODA per capita were also statistically and practically insignificant. The estimated coefficient on ODA per capita with the fractional probit approach is -0.00025, which would indicate that a $100 increase in ODA per capita would lead to a decrease of inequality of 2.5 percentage points. Again, this result was not statistically significant. Notably, the fractional probit approach also found other controls to be significant, including agricultural employment, infant mortality, unemployment, gdp, and government spending.

Section 7: Conclusion

Consistent with previous research, our findings generally lack both practical and statistical significance. Since our findings for both the fixed effects and fractional probit

[42] Papke, L., &Wooldridge, J. Panel data methods for fractional response variables with an application to test pass rates. *Journal of Econometrics* 145(1-2) (2008): 121-133.

approaches did not yield statistically significant result, we do not have evidence of a "precise zero" either. The effect of official development assistance on income inequality is highly complex and is linked to several factors that were not included in the model, which could explain both income inequality in a given country and levels of ODA to that country. Our inability to control for political stability, ODA conditionality, and a wide array of social and institutional factors that will have an effect on income inequality also limits the model. Additionally, despite the advantages of the fixed effects approach, the problem of simultaneity may be better addressed by a more dynamic model (like an Instrumental Variable approach) that can account for the potential endogeneity of income inequality or a Randomized Control Trial. Similarly, although the country fixed-effects approach allows us to control for country-specific time-invariant characteristics, the effect of ODA per capita may be different for countries at different levels of development. It is reasonable to assume that foreign aid programs will have a more pronounced effect on the poorest and least developed countries and yet the fixed-effects model cannot account of these differences, which suggests that a quantile approach may offer more nuanced results.

Despite the limitations imposed on our model by missing data and simultaneity, our findings are consistent with previous studies in the field, which when taken together seem to suggest that foreign aid does not appear to decrease income inequality. The prevalence of negative and inconclusive findings on the effects of foreign aid programs on income inequality may also suggest that targeted, small-scale aid programs may be more effective at reducing income disparities than large-scale grants at the national-level. As others have suggested, large-scale programs may be poorly managed, lack sufficient oversight, and have goals that are inconsistent with the recipient country's development goals. The political impetus to use foreign

aid as leverage or to implement large-scale programs to ensure the viability of international financial institutions may often result in worsening conditions in developing countries that are in need of targeted programs in distinct policy areas rather than large amounts of aid per capita.

Future areas of research could, in fact, compare the effects of targeted aid programs with the effects of large-scale foreign aid programs on income inequality, and could distinguish between other types of aid programs including different types of donors and specific earmarks. Future studies may also include dummy variables for those aid programs with conditionality to determine whether required benchmarks improve accountability and thereby contribute to closing the income gap. Finally, given recent improvements in data storage and gathering technology, it may behoove researchers to replicate this and other studies as this improvement in data and its availability continues.

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APPENDIX 1. VARIABLE DEFINITIONS

gini	Gini index measures the extent to which the distribution of income among individuals or households within an economy deviates from a perfectly equal distribution. A Gini index of 0 represents perfect equality, while an index of 100 implies perfect inequality.
odapercap	ODA and Official Aid Received (current US$) divided by total population
arable	Hectares of arable land per person
ag_employ	Employment in agriculture as a percentage of total employment
inf_mort	Infant mortality rate (per 1000 live births)
unemp	Total unemployment (% of total labor force)
subs_trans	Subsidies and other transfers (% of expense)
gdp	GDP (constant 2005 US$)
govspend	General government final consumption expenditure (% of GDP)

APPENDIX 2. SAMPLE SUMMARY STATISTICS

Variable	Obs	Mean	Std. Dev	Min	Max
id	112	1219.96	634.09	56	2477
arable	112	0.281	0.211	0.035	0.702
ag_employ	112	39.145	13.851	15.8	85.1
gdp (millions)	112	65100	159000	68800	1250000
govspend	112	12.72	4.23	5.54	23.76
inf_mort	112	33.48	20.7	8.9	105.3
net_oda (millions)	112	654	750	22.4	5410
Totpop (millions)	112	65.5	182	0.616383	1210
subs_trans	112	35.17	16.98	2.04	69.07
unemp	112	7.27	4.17	0.1	28.6
gini	112	42.19	10.17	27.51	61.33
odapercap	112	42.29	38.57	1.66	199.13

APPENDIX 3. REGIONAL DUMMY VARIABLE GROUPINGS

East Asia and Pacific	Cambodia
	Indonesia
	Mongolia
	Philippines
Latin America and Caribbean	Bolivia
	El Salvador
	Guatemala
	Honduras
	Nicaragua
	Paraguay
South Asia	Bangladesh
	Bhutan
	India
	Pakistan
	Sri Lanka
Middle East and North Africa	Egypt, Arab Rep.
Europe and Central Asia	Armenia
	Georgia
	Krygyz Republic
	Moldova
	Ukraine
Sub-Saharan Africa	Burkina Faso
	Ethiopia
	Ghana
	Liberia
	Mauritania
	Uganda
	Zambia

APPENDIX 4. REGRESSION OUTPUTS

EQUATION	VARIABLES	OLS	Fixed Effects	Random Effects	Frac Probit-Coef	Frac Probit-APE
GINI (0-100)	Odapercap	-0.05	-0.01	-0.05		
		(0.02)**	(0.02)	(0.03)*		
	Arable	-5.16	-11.15	-5.16		
		(2.64)*	(8.01)	(4.15)		
	ag_employ	0.28	0.09	0.28		
		(0.06)***	(0.04)**	(0.08)***		
	inf_mort	-0.07	0.10	-0.07		
		(0.04)*	(0.10)	(0.05)		
	unemp	-0.02	-0.03	-0.02		
		(0.13)	(0.19)	(0.16)		
	subs_trans	-0.09	-0.02	-0.09		
		(0.04)**	(0.06)	(0.06)		
	gdp	-0.00	0.00	-0.00		
		(0.00)*	(0.00)	(0.00)*		
	govspend	0.50	0.09	0.50		
		(0.17)***	(0.13)	(0.22)**		
	latinam_carib	20.23		20.23		
		(1.84)***		(2.76)***		
	mideast_nafrica	-0.76		-0.76		
		(1.74)		(2.24)		
	sasia	-2.21		-2.21		
		(1.88)		(2.14)		
	eastasia_pacific	0.62		0.62		
		(2.15)		(3.12)		
	subsaharanafr	0.88		0.88		
		(3.59)		(3.91)		
	Constant	27.30	35.10	27.30		
		(5.14)	(5.97)***	(7.23)***		
pctgini (0-1)	odapercap				-0.00	-0.00
					(0.00)	(0.00)
	arable				-0.29	-0.11
					(0.39)	(0.15)
	ag_employ				0.01	0.00
					(0.00)***	(0.00)***
	inf_mort				0.00	0.00
					(0.00)*	(0.00)*
	unemp				-0.01	-0.00
					(0.00)*	(0.00)*

	subs_trans				-0.00	-0.00
					(0.00)	(0.00)
	gdp				0.00	0.00
					(0.00)**	(0.00)**
	govspend				0.01	0.00
					(0.00)**	(0.00)**
	latinam_carib				0.40	0.15
					(0.05)***	(0.02)***
	mideast_nafrica				0.12	0.05
					(0.07)*	(0.03)*
	sasia				-0.04	-0.01
					(0.06)	(0.02)
	eastasia_pacific				-0.07	-0.03
					(0.06)	(0.02)
	subsaharanafr				0.14	0.05
					(0.05)***	(0.02)***
	Constant				-1.02	
					(0.23)***	
	Observations	112	112	112	112	112
	R-squared	0.88	0.43			
	r2_a	0.83	0.260			
	df_m	27	18	27	35	
	Number of countryid		28	28		
	k_autoCns		6	1	1	
	r2_o		0.0214	0.877		
	rho		0.972	0	0	
	dispers				0.00444	
	deviance				0.337	
	df				76	
	aic				1.513	
	bic				-358.3	
	Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1					

APPENDIX 5. HAUSMAN TEST RESULTS USING MUNDLAK DEVICE

Variables	Coef	Std. Err.	P > (z)
Odapercap	-.1880382	.1256056	0.134
Arable	-77.91722	87.64869	0.374
lit_rate	-1.655017	.3612774	0.000
ag_employ	1.013067	.2764519	0.000
inf_mort	-.3740164	.1947594	0.055
unemp	-1.896535	.9152215	0.038
subs_trans	.0295473	.1115249	0.791
gdp	-4.52e-10	1.27e-10	0.000
govspend	-1.344408	1.737144	0.439
m_arable	59.88949	87.62206	0.494
m_lit_rate	1.797442	.3289905	0.000
m_ag_employ	-1.291868	.2626231	0.000
m_inf_mort	.187675	.1798003	0.297
m_unemp	-2.277795	.812583	0.005
m_subs_trans	.2988888	.3344619	0.372
m_gdp	6.56e-10	2.37e-10	0.006
m_govspend	3.979283	2.255544	0.078
_cons	50.16575	7.713544	0.000

t-test m_arable m_lit_rate m_ag_employ m_inf_mort m_unemp m_subs_trans m_gdp m_govspend

(1) m_arable = 0
(2) m_lit_rate = 0
(3) m_ag_employ = 0
(4) m_inf_mort = 0
(5) m_unemp = 0
(6) m_subs_trans = 0
(7) m_gdp = 0
(8) m_govspend = 0
Constraint 7 dropped

chi2(7) = 153.89
Prob > chi2 = 0.0000

APPENDIX 6. RESET SPECIFICATION/FUNCTIONAL FORM TEST

VARIABLES	OLS
odapercap	0.93098
	(1.1259)
arable	90.71275
	(110.1778)
lit_rate	-3.45513
	(4.1717)
ag_employ	-2.96774
	(3.6371)
inf_mort	-1.8708
	(2.2641)
unemp	-1.67113
	(2.01976)
subs_trans	-0.11418
	(.21895)
gdp	3.55E-10
	(4.24e-10)
govspend	-12.25007
	(14.94689)
latinam_carib	-305.0811
	(367.6681)
mideast_nafrica	-45.3442
	(56.06309)
sasia	-8.063
	(13.15959)
eastasia_pacific	-104.3688
	(125.2495)
subsaharanafr	30.92056
	(42.12385)
y_hat_2	0.32516
	(.344091)
y_hat_3	-0.00255
	(.0025836)
Constant	342.5896
	(413.2387)
observations	26
R squared	0.9576
t-test y_hat_2 y_hat_3	
(1) y_hat_2 = 0	
(2) y_hat_3 = 0	
F(2,9) = 0.79	**Prob>F=0.4816**

APPENDIX 7. QUADRATIC FUNCTIONAL FORM / ROBUSTNESS CHECK OF KUZNET'S HYPOTHESIS

VARIABLES	OLS
odapercap	-0.2078
	(0.13488)
odapercap_2	0.0007
	(0.00063)
arable	-8.1337
	(4.90407)
lit_rate	0.2478
	(.12494)*
ag_employ	0.1997
	(.11466)
inf_mort	0.1422
	(.06434)*
unemp	-.2491
	(.49139)
subs_trans	0.0194
	(.12098)
gdp	-3.77E-11
	(2.21e-11)
govspend	1.2645
	(.42167)**
latinam_carib	25.2264
	(5.2066)***
mideast_nafrica	4.7885
	(5.2097)
sasia	0.2787
	(6.24817)
eastasia_pacific	11.421
	(8.8855)
subsaharanafr	-2.8311
	(7.6048)
Constant	-7.523
	(13.2407)
observations	26
R squared	0.9534