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Policy Analysis

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Foreign Aid and Adolescent Fertility Rate: Cross-Country Evidence

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Abstract: This study examines the role of official development assistance (ODA) in affecting adolescent fertility rates in low- and middle-income countries. Approximately 95% of adolescent births occur in middle- and low-income countries, and the average adolescent fertility rate in low-income countries is five times higher than in high-income countries. Aid donors typically pursue multiple objectives when providing development aid, many of which can go beyond changes in per capita GDP and include human capital factors such as adolescent fertility and infant mortality. Using data over the period from 1995 to 2015, our results suggest that total ODA has a beneficial impact by lowering the adolescent fertility rate either directly or through the channel of income growth. Our results also show that this beneficial effect on the adolescent fertility rate is stronger in low-income countries than in middle-income countries. Findings based on sectoral aid suggest that health aid has a stronger effect than aid in other sectors.

Keywords: adolescent fertility, development aid, development goals, official development assistance

JEL Codes: F35, I15

[a]Deceased on February 11, 2020. This paper is dedicated to the memory of late Dr. Joseph Daniels, who was a dear friend, a devoted professor, a supportive colleague, and an inspiring dean.

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1 Introduction

Development aid is viewed as an important way to stimulate physical capital investment and promote economic growth in low- and middle-income countries. Over the past few decades, the literature on the effectiveness of aid has primarily focused on the broad question related to the impact of aid on aggregate income or economic growth. Findings from the literature, however, are far from being conclusive. Many studies argue that aid plays an essential role in reducing poverty and improving living standards in developing countries (Arndt and Jones 2015; Clemens et al. 2011; Dovern and Nunnenkamp 2007; Hansen and Tarp 2001; Mekasha and Tarp 2013), while others claim that aid has no effect or even a negative effect on the economic growth or income distribution (Doucouliagos and Paldam 2009; Easterly 2003; Herzer and Nunnenkamp 2012; Nowak-Lehmann et al. 2012; Rajan and Subramanian 2008). In addition, some researchers also point out that aid effectiveness depends on "good" economic policies and quality institutions in the recipient countries (Burnside and Dollar 2000; Dalgaard and Hansen 2001; Dalgaard, Hansen, and Tarp 2004; Minasyan, Nunnenkamp, and Richert 2017).

In comparison, little work has been done examining the macroeconomic impacts of aid on other welfare indicators in the recipient countries such as health or gender equity. A few notable exceptions include Azarnert (2008) and Neanidis (2012) on aid and the total fertility rate, Dreher, Nunnenkamp, and Thiele (2008) and Christensen, Homer, and Nielson (2010) on aid and school enrollments, Baliamoune-Lutz (2012) on aid to women's equality organizations, and Mishra and Newhouse (2007) and Chauvet, Gubert, and Mesple-Somps (2013) on aid and infant mortality rates.

Using an overlapping-generations model, Azarnert (2008) shows that aid per child and aid per adult can increase total fertility. This happens when aid lowers the cost of child quantity and thereby shifts household resources from child quality to child quantity. In a later study, Neanidis (2012) postulates theoretically and documents empirically that aid can have both positive and negative effects on total fertility rates – the net effect remaining ambiguous. Focusing on education, Dreher, Nunnenkamp, and Thiele (2008) compare the effects of education aid and domestic government expenditure on school enrollments in 96 countries between 1970 and 2004. The authors find that an increase in per capita aid for education increases primary school enrollment rates in recipient countries, while an increase in recipient countries' domestic government expenditure on education does not. Also looking at primary school enrollment rates, Christensen, Homer, and Nielson (2010) use aid project data to study the effect of foreign aid on

education in some least-income countries. In contrast to the results in Dreher et al., results from Christensen, Homer, and Nielson (2010) suggest that education aid does not have a significant impact on school enrollment in developing countries. Baliamoune-Lutz (2012) examines the effectiveness of aid to women's equality organizations and finds that development assistance to women's equality organizations and institutions helps to improve women's political empowerment in the Middle East and North African region. Mishra and Newhouse (2007) analyze the relationship between health aid and infant mortality. Based on data from 118 countries over the period of 1973 and 2004, the authors show that doubling per capita health aid is associated with a 2% reduction in infant mortality rate. Similarly, Chauvet, Gubert, and Mesple-Somps (2013) look at how aid, remittances and medical brain drain affect child mortality and find that both health aid and remittances reduce child mortality, but the effect of health aid is less robust compared to remittances.

In this study, our goal is to examine the role of official development assistance (ODA) in affecting adolescent fertility rates in low- and middle-income countries. We also differentiate between major aid categories that allows for the possibility of heterogeneous impacts of aid in different sectors. Using data from countries on the Development Assistance Committee (DAC) list over the period of 1995–2015, we find that aggregate ODA significantly reduces the adolescent fertility rate in recipient countries either directly or through its effect on growth. Our results also show that the beneficial impact of ODA is primarily realized through health aid. We measure health aid by multiplying total ODA disbursement and the share of health aid commitment to total ODA commitment (Neanidis 2012). In addition, subsample results based on income levels suggest that the effect of aid is stronger in low-income countries than in middle-income countries.

The contribution of our paper is twofold. First, bilateral donors and multilateral institutions donors often pursue multiple objectives when providing development aid, many of which can go beyond the change in income. Our paper adds to the small literature on the multi-dimensional effects of aid in recipient countries by studying specific outcomes of development aid. Sixteen million women aged 15–19 give birth each year, accounting for 11% of all births worldwide (WHO 2014). Approximately 95% of adolescent births occur in middle- and low-income countries, and the average adolescent fertility rate in low-income countries is five times higher than that in high-income countries (WHO 2014). To the best of our knowledge, this paper is the first empirical study to systematically examine the link between foreign aid and the adolescent fertility rate. Aid may have both direct and indirect effects on adolescent fertility rate, for example, through sponsoring school-based or community-based educational programs and through its effect on reducing poverty and increasing the average income. Our paper makes a novel

contribution to the aid effectiveness literature by offering a closer look at the relationship between aid and an important welfare indicator.

We focus on adolescent fertility rate as there are clearly human capital consequences of teenage childbearing. Teenage childbearing remains a source of primary concern in many developing countries. It has been well established in the medical literature that adolescent pregnancy is linked to high levels of maternal morbidity and mortality as well as high levels of neonatal mortality (Conde-Agudelo, Belizan, and Lammers 2005; Patton et al. 2009). Patton et al. (2009) show that adolescent mothers are twice likely to die due to pregnancy-related complications than mothers who are 20 or older. Health problems, such as anemia, malaria, and HIV, are highly associated with teenage pregnancy (WHO 2014). For example, teen mothers are much more vulnerable to HIV infection than other teens and older women (Ardington, Menendez, and Mutevedzi 2015). Many studies also find teenage pregnancy and childbirth tend to be associated with adverse socioeconomic outcomes for the young mother, including early school dropout or limited opportunities for employment, which can lead to lost productivity (Ardington, Menendez, and Mutevedzi 2015; Chaaban and Cunningham 2011). Chaaban and Cunningham (2011) estimate that young mothers' lifetime foregone income from lost schooling alone due to adolescent childbearing in India can amount to 12% of India's annual GDP, or approximately $400 billion based on the purchasing power parity measure. There is also a significant concern of teenage childbearing due to its potential connection with intergenerational transmission of poverty, which in turn has a negative impact on human capital accumulation - United Nations (2013) points out that early child bearing can lead to a "hard-to-break cycle of poverty" when young mothers "pass on to their children a legacy of poor health, deficient education and meager means of living". Among several reasons, such intergenerational transmission of poverty could be due to that daughters of teenage mothers are more likely to become teenage mothers themselves compared to daughters of adult mothers (Kearney and Levine 2009).

In short, adolescent fertility in developing countries can present a severe impediment to development. A lower adolescent fertility rate may contribute to a higher level of human capital and a healthier and productive workforce, and it can ensure women's participation in the development process, all of which have positive economic growth implications. In this context, our paper is also closely related to and contributes to the broad aid-growth literature.

Second, gender equity, women's empowerment, and lower adolescent fertility rates are among the United Nations' Millennium Development Goals (MDGs) as well as its post-2015 sustainable development goals.[1] With data from 38 developing countries, Eloundou-Enyegue and Stokes (2004) find that reducing adolescent fertility rate in Africa and Latin America can help to shrink the gender gap in educational achievement. As the adolescent fertility rate serves as a progress indicator of some of the MDGs such as achieving universal access to reproductive health, our paper sheds some light on assessing the UN's development goals and adds to the research on post-2015 development goals and MDGs (Pogge and Sengupta 2016). In addition, our results have important policy implications by identifying that development assistance is more effective through the channel of health aid.

The remainder of our paper proceeds as follows. We briefly discuss possible channels through which aid may affect the adolescent fertility rate in recipient countries in Section 2 and present general trends in the adolescent fertility rate and ODA in Section 3. Our data and empirical methodology are described in Section 4. The empirical results are reported in Section 5. Section 6 concludes.

2 ODA and Adolescent Fertility: Conceptual Framework

Fertility among adolescents is influenced by a range of factors, such as existing social norms, access to health services, and the availability of economic opportunities. In this section, we discuss some possible channels through which foreign aid can impact the adolescent fertility rate in recipient countries. Foreign aid may indirectly influence the adolescent fertility rate through its potential effect on aggregate income or government expenditure in developing countries. In addition, foreign aid can also have a more direct effect on the adolescent fertility rate

1 The MDGs include eradicating extreme poverty and hunger, achieving universal primary education, promoting gender equality, reducing child mortality, improving maternal health, combatting HIV/AIDS and other diseases, ensuring environmental sustainability and developing a global partnership for development. The sustainable development goals include the elimination of poverty and hunger, good health and well-being, quality education, gender equality, industry innovation and improved infrastructure, clean water and sanitation, affordable and clean energy, decent work and economic growth, reduced inequality, sustainable cities and communities, responsible consumption and production, climate action, actions to improve life underwater and life on land, peace, justice and strong institutions, and partnerships to achieve these goals.

through support for programs/interventions that change the fertility behaviors of young men and women in aid-recipient countries.

2.1 Indirect Effect: Aid, Income, Government Spending, and Adolescent Fertility

The fertility decisions (by adults) were first modeled as economics behaviors in Becker (1960), the seminal work on the theory of fertility choice. Becker and various coauthors then modified this theory in later studies such as Becker and Lewis (1973), Becker and Tomes (1976), and Becker and Barro (1988). In most of Becker's models, child quantity and child quality are assumed to be normal goods and the cost of child quantity increases with the desired level of child quality. A rise in the family income then has two (opposing) effects on the child quantity and the net impact of a change in income on child quantity is thus a combination of the two effects – the income effect and the substitution effect. Specifically, the income effect indicates that an increase in the family income increases both the child quantity and the child quality. The substitution effect suggests that when child quality rises (following an increase in income), the cost of child quantity rises as well. In turn, parents tend to decrease child quantity (substitute it with child quality).

Focusing on teenage child bearing, income still appears to play a major role in affecting adolescent fertility rate and other health outcomes. In many empirical studies based on macro-level data, it has been well established that there is a negative association between national income and the country's adolescent fertility rate (Dorling, Mitchell, and Pearce 2007; Swift 2011; Torsheim et al. 2004). Torsheim et al. (2004) find that adolescents in lower-income countries tend to have poorer self-reported health. Based on data from 179 countries, Viner et al. (2012) note that higher national income – as measured by per capita GDP – is associated with better adolescent health outcomes, including lower adolescent fertility rates. Similarly, Santelli et al. (2017) use data from 142 countries over the period from 1990 to 2012. The authors find a negative relationship between the adolescent birth rate and the log of per capita GDP and argue that national development itself is an important mechanism for lowering adolescent birth rates. In addition, the level of disparity in the income distribution also seems to affect health outcomes. For example, Kearney and Levine (2014) argue that greater income disparity can cause higher rates of early childbearing, as feelings of economic hopelessness are heightened among individuals at the lower end of the income distribution, which lowers the opportunity cost of early childbearing and in turn leads to a higher adolescent fertility rate. The effectiveness of aid – its impact on economic growth or national income – will likely remain a hotly debated topic. However, to the

extent that ODA can positively (or negatively) affect a recipient country's economic growth and income level, we should expect to see a lower (or higher) adolescent fertility rate associated with more foreign aid.

In addition, (health) aid may change the recipient government's spending decisions possibly due to aid conditionality (Jack 2008), aid fungibility (Chatterjee, Giuliano, and Kaya 2012; van de Walle and Mu 2007), or ODA's impact on the recipient country's tax revenue (Mascagni and Timmis 2017; Morrissey 2015). If government health spending can influence the adolescent fertility rate in a country, then foreign aid can also have an indirect effect on the adolescent fertility rate through the spending channel. Although the literature that specifically addresses the relationship between government health spending and adolescent fertility is minimal, many studies have explored the impact of health spending on other health outcomes with a strong focus on infant and under-five mortality rates. The empirical evidence from these studies, however, remains mixed. For example, drawing on data from India, Kumar, Ram, and Singh (2013) find that the overall public health expenditure has a negative effect on mortality rates, and the effect is stronger on the under-five mortality rate. Farag et al. (2013) look at the impact of government health spending on infant and child mortality in 133 developing countries. The authors find that health spending significantly reduces both infant and under-five mortality rates. In contrast, using data from 117 countries, Kim and Moody (1992) find that health resources do not have a significant impact on the infant mortality rate. McGuire (2006) points out that developing country with higher health spending do not necessarily see a reduction in under-five mortality rates. Similarly, Terrelonge (2014) finds that public health spending has a negative effect, while not statistically significant, on mortality rates with data from 138 countries over 1995–2009.

2.2 Direct Effects of Aid

Aid can have a more direct effect on outcomes related to adolescent pregnancy and fertility by providing assistance for new interventions or existing programs such as school-based or community-wide workshops and cash transfer programs in the recipient country. In addition, foreign aid can also be used to improve the access to reproductive health services for adolescents and youths. These efforts provide adolescents and youths with more knowledge about reproductive and sexual health, which can help them make more informed decisions regarding their fertility behavior. Furthermore, such interventions can to some extent change community beliefs regarding sexual activities and gender roles, which can also lead to changes in adolescent fertility rates.

School-based or community-wide education and service programs and workshops that provide, for example, a reproductive health curriculum or life-skills training can increase participants' knowledge about safe sex (Gulemetova-Swan 2009). Such programs can encourage adolescents' contraceptive use (Bandiera et al. 2012; Erulkar and Muthengi 2009; Lou et al. 2004), delay the age when girls first get married or become pregnant (Duflo, Dupas, and Kremer 2015; Gulemetova-Swan 2009; Rahman 2010), and directly influence teen sexual behaviors (Cabezon et al. 2005).[2] Lou et al. (2004) examine an intervention that attempts to promote safe sex by offering counseling services and free contraception in Shanghai, China. The authors find increased use of contraceptives and condoms in the intervention group relative to the control group. Cabezon et al. (2005) study the impact of TeenSTAR, an abstinence-centered education program in Chile. The results suggest that the program effectively reduces unintended teen pregnancy in the intervention group compared to the control group. Duflo, Dupas, and Kremer (2015) evaluate the effectiveness of programs with regard to fertility-related outcomes in Western Kenya based on 20,000 adolescent boys and girls from more than 300 schools. The authors find that the program that provides free school uniforms to children lowers education costs as well as participants' likelihood of getting married after three, five, and seven years following the implementation of the program. In addition, the authors also find that participating teenage girls are also less likely to become pregnant three and five years following the implementation of the program.

Government-run unconditional cash transfer programs and cash transfer programs conditional on teen school enrollment provide financial incentives to households and increase the opportunity cost of early childbearing; hence, they may also delay the age of marriage and reduce teen pregnancy (Alam, Baez, and Del Carpio 2011; Baird et al., 2010, 2016; Handa et al. 2015). Baird et al. (2010) examine the effect of conditional cash transfers and find that cash transfers significantly reduce the teenage pregnancy rates for girls who dropped out of school. Focusing on the Kenya Cash Transfer for Orphans and Vulnerable Children, Handa et al. (2015) show that the program reduces the likelihood of pregnancy among females aged 12–24 by five percentage points and that the effect is realized through increased female school enrollment, improved financial stability for households receiving the cash transfers, and delayed age of first sex. Examining a conditional cash transfer program targeting young girls' school enrollment in Pakistan, Alam, Baez, and Del Carpio (2011) find that girls who participate in the

2 Interested readers can also refer to McQueston, Silverman, and Glassman (2013) and Hindin et al. (2016) for surveys and discussions of studies that focus on various programs and their impact on the adolescent fertility rate in middle- and low-income countries.

program appear to delay marriage and have fewer births by the time they turn 19 years old.

3 General Trends in ODA and the Adolescent Fertility Rate

3.1 Adolescent Fertility Rate Trend

The adolescent fertility rate is defined as the number of births per 1000 women aged 15–19.[3] Overall, there has been a downward trend in the average adolescent fertility rate globally, which dropped by 43% over four decades from 84.9 births in 1970 to 48.1 births in 2015 (World Bank 2017).

Nevertheless, we observe sharp differences in the adolescent fertility rate across different regions, as shown in Figure 1. Over the period from 1970 to 2015, among all regions, sub-Saharan Africa has the highest average adolescent fertility rate of 134.9 births per 1000 women between the ages of 15 and 19, while East Asia and the Pacific has the lowest average adolescent fertility rate of 27.8 births. With respect to changes in the fertility rate, from 1970 to 2015, the adolescent fertility rate declined sharply by 71% in South Asia, followed by a 67% drop in the Middle East and North Africa, 54% in East Asia and the Pacific, and 47% in Europe and Central Asia. In comparison, the declines in the adolescent fertility rate over the same period in Latin America and the Caribbean (34.8%) and Sub-Saharan Africa (33.7%) were relatively modest.

3 Another often-mentioned fertility rate concept is the total fertility rate in a country, which is measured as the average number of children born per woman throughout her entire reproductive age span. The total fertility rate has declined across various regions, from 6.75 children per woman in 1970 to 4.92 children per woman in 2015 in Sub-Saharan Africa, 5.79–2.49 in South Asia, 6.71–2.81 in the Middle East and North Africa, and 5.31–2.1 in Latin America and the Caribbean. In East Asia and the Pacific and Europe and Central Asia, the total fertility rate has dropped below the replacement fertility rate of 2.1 children per woman since the 1990s. Evidently, declines in the fertility rate are not unequivocally good, given the potential decline in the population of an economically productive age group. However, the focus of our paper is on adolescent child bearing, which often leads to health complications and worse economic outcomes for the both young mothers and their children.

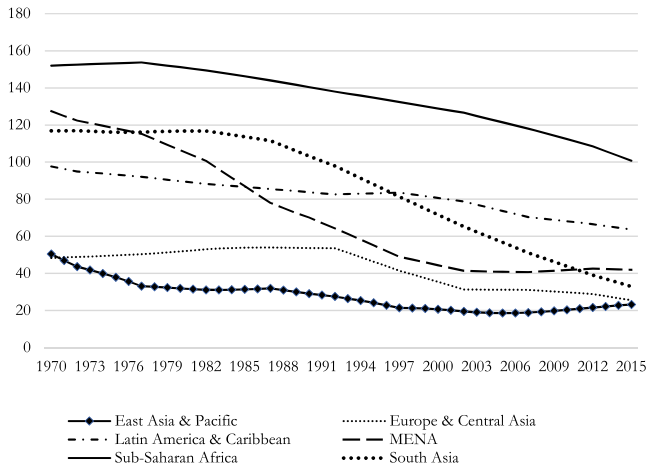

Figure 1: Regional average adolescent fertility rate.

3.2 Official Development Assistance

In Figure 2, we present the net ODA disbursement as a share of recipient country's GDP over 1970–2015. Despite short term fluctuations, the ODA share to GDP rose steadily from 3.7% in 1970 to 10.3% in 1995. After that, there appeared to be a quick decline in ODA share till 2000. This decline in foreign aid between 1995 and 2000 likely resulted from improvements in aid-recipients' domestic economic

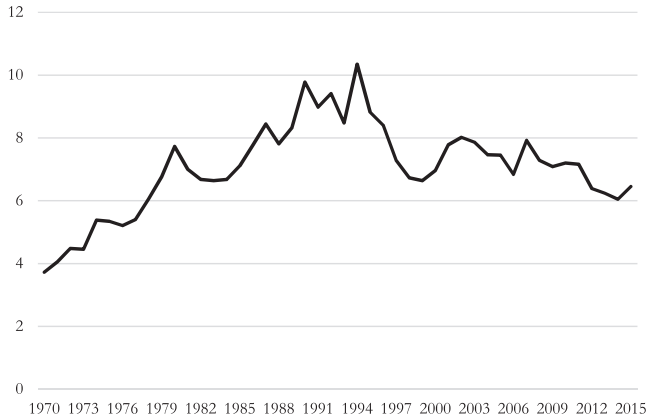

Figure 2: Official development assistance net disbursements as a share of recipient GDP 1970–2015.

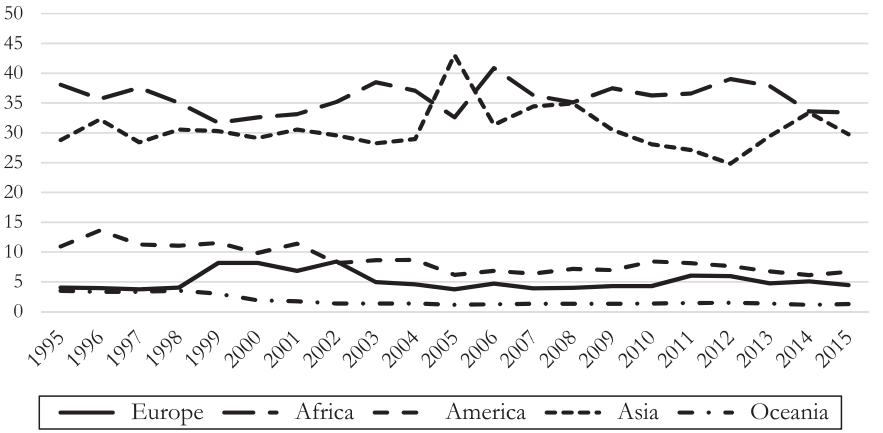

Figure 3: Geographic distribution of ODA (share of total ODA).

conditions as well as a reduction of aid by donors. The Millennium Development Goals (MDGs) established following the United Nations Millennium Summit in 2000 focus on development targets in the areas of poverty reduction, education, gender equity and health. The pursuit of the MDGs together with global anti-terrorism efforts has led to calls for an increase in foreign aid to middle- and low-income countries. To this end, net ODA disbursements almost tripled in value over the past 15 years, rising from $59.6 billion in 2001 to $162.7 billion in 2015. However, the ODA share to recipient GDP actually declined slightly from its highpoint of 8% in 2002 after the UN summit to 6.45% in 2015.

The geographic distribution of ODA has been uneven. Figure 3 shows that Asian and African countries received the largest aid allocation relative to countries in other regions.[4] Over the period from 1995 to 2015, on average, approximately 66.5% of ODA disbursements went to Asia and Africa, varying between 62 and 75% from year to year.

In terms of the sectoral allocation of ODA, the social infrastructure and services sector (e.g., general health, population policy, and education) has recorded the largest share of ODA commitments.[5] In dollar terms, ODA to this sector more than tripled between 1995 and 2015 (OECD 2017). Relative to the ODA in all sectors, 36.5% of the total ODA commitments from all donors targeted the social

4 For example, in 2009, net ODA disbursements to Asia and Africa reached $36.81 billion and $45.23 billion, respectively, while the net ODA disbursements to countries in all other regions were $15.16 billion.

5 We provide information on the sectoral distribution of ODA commitments instead of ODA disbursements due to data limitations.

infrastructure and services sector between 1995 and 2015. Meanwhile, the annual average share of ODA flowing into the economic infrastructure and services sector was 16.9% between 1995 and 2015. One sector that showed a rapid increase in ODA was humanitarian aid, the share of which rose from 4.7 to 11% from 1995 to 2015. In contrast, the share of ODA targeting actions related to debt relief declined significantly from 6.3% in 1995 to a mere 0.3% in 2015, the share of commodity aid dropped from 6.9 to 3.9%, and the share of production aid dropped from 12.1 to 7.4%. The following section provides our empirical methodology and data sources used to consider the impact of ODA on adolescent fertility rates.

4 Empirical Methodology

4.1 Baseline Model and Data

We start with a model presented in Equation (1):

$$\ln(\text{Adofert}_{it}) = \beta_0 + \beta_1 \ln\left(ODAPC_{i,\,(t-1,t-2,t-3)}\right) + \gamma' \boldsymbol{X} + \alpha_i + \varepsilon_{it} \tag{1}$$

where, $\ln(\text{Adofert}_{it})$ is the log value of the adolescent fertility rate in country i in year t, with the adolescent fertility rate measured by the number of births per 1000 women aged 15–19; $\ln(ODAPC_{i,\,(t-1,t-2,t-3)})$ is the log value of the net ODA per capita received by country i in constant 2010 dollars, averaged over year t–1, t–2, and t–3; X is a vector of control variables in country i that could affect the adolescent fertility rate (specifically drawing from Birdsall 1988; Santelli et al. 2017; Viner et al. 2012), including the log of GDP per capita in constant 2010 dollars, the growth rate of real GDP per capita, health expenditures as a share of GDP, rural population as a share of total population, the Gini coefficient, political stability measured by the International Country Risk Guide (ICRG) index, the infant mortality rate, average years of schooling in the female population over the age of 25, the female unemployment rate, and trade openness of a country. To control for unobserved country-specific effects, individual country fixed effects (α_i) are included; ε_{it} is a stochastic error term. We also include year fixed effects in the regressions as well.

We collect adolescent fertility and net ODA disbursement data from the World Development Indicators (WDI) published by the World Bank. The net ODA data consist of disbursements of loans (excluding repayments of principal) and grants by official agencies of the members of the Development Assistance Committee (DAC) countries, by multilateral institutions and by non-DAC countries that aim to foster economic development and improve the welfare in countries and territories on the DAC list of ODA recipients. The original source of the net ODA data is the

Table 1: Summary statistics.

Variable	Obs	Mean	Std. dev.	Min	Max
Adolescent fertility (log)	2221	4.105	0.734	1.799	5.399
Per capita net ODA (log)	2189	3.636	1.377	−1.929	7.349
Real GDP per capita (log)	2216	7.534	1.054	5.231	9.912
Growth rate of real GDP per capita	2216	0.026	0.060	−0.973	0.882
Gini (log)	1714	3.737	0.227	1.275	4.374
Rural population (share of total population, %)	2218	55.678	19.556	8.396	92.588
Infant mortality	2221	45.995	30.261	3.500	152.000
Female schooling	1614	5.327	2.954	0.199	11.812
Health expenditures (share of GDP, %)	2221	5.692	2.130	0.368	14.390
ICRG	1493	60.097	9.294	27.167	81.667
Female unemployment rate	2145	9.455	6.693	0.100	39.300

OECD International Development Statistics database. Note that as our measure of ODA is in per capita term, the value might be high for less populous middle-income countries compared to populous low-income countries holding the total ODA value constant. Female schooling data come from Barro and Lee (2013). Because the schooling data are available every five years (1980, 1985, etc.), we use linear interpolation to fill in the education values for other years. The political stability ICRG index is a composite score based on 12 components published by the Political Risk Service Group, Inc. The index ranges between zero and 100, with zero indicating extreme risk and 100 indicating extreme stability.[6] Data on all other control variables are retrieved from the WDI.

After the panel regressions, we look at empirical results based on specifications including four-year averages of variables that are shown to be significant in Equation (1). This helps better control persistence in economics variables in our model. Our full sample includes 121 DAC-list countries over the period from 1995 to 2015 and is solely determined by data availability.[7] The sample is unbalanced. We provide the list of countries in the Appendix Table A1: and summary statistics in Table 1.

6 The 12 components of the composite political risk index include government stability, socioeconomic conditions, investment profile, internal conflict, external conflict, corruption, military in politics, religious tensions, law and order, ethnic tensions, democratic accountability and bureaucracy quality.

7 We use the DAC list of countries effective as at January 1, 2018 for reporting on 2018–2020. This list is available at http://www.oecd.org/dac/financing-sustainable-development/development-finance-standards/daclist.htm.

4.2 Identification Strategy

One could argue that the relationship between foreign aid and adolescent fertility may be a result of the endogenous determination of aid. If this is the case, the estimated coefficient on aid will be biased and inconsistent. There may be a few different reasons for the endogeneity of aid. First, the omission of time-invariant factors across various recipient countries could lead to endogeneity if the omitted factors are correlated with our foreign aid measure. To address this concern, we estimate Equation (1) with the fixed effects estimator. An additional advantage of a fixed effects regression is that country fixed effects can capture other time-invariant national traits in the aid-recipient country that influence adolescent fertility rates, such as religion and cultural norms. Second, the potential problem of simultaneity between foreign aid and the adolescent fertility rate may result in unreliable estimated coefficients. In other words, we may expect ODA in a recipient country to affect the country's adolescent fertility rate. However, foreign aid might be flowing to a country with a high adolescent fertility rate. As mentioned previously, our aid measure is averaged over three years between t–1 and t–3. This helps dampen the potential simultaneity issue as well as to reduce short-run fluctuations in the annual data. Foreign aid received in the past may influence the adolescent fertility rate today in a country, but the adolescent fertility rate today should not affect the foreign aid a country received in the past at all. Similarly, all other control variables in our model are also averaged over three years between t–1 and t–3.

In addition, we apply instrumental variables (IVs) estimations to further address the potential endogeneity of the aid variable due to other issues such as omitting variables that do vary over time – for example, if adolescent fertility is linked to intergenerational transmission of poverty, then poverty can be the missing control that affects both the aid variable and the adolescent fertility rate. Conceptually, instruments should be correlated with the endogenous variable, or foreign aid, but not with the error term. In practice, finding ideal instruments is a challenging task. We follow Tavares (2003) and Chauvet, Gubert, and Mesple-Somps (2013) and use the national income of large donor countries as potential instruments. The main reason for using income values as instruments is that national income can affect a donor country's ability to provide aid to individual recipient countries, but an individual recipient's adolescent fertility rate should not affect a donor's income. For example, we would expect that the income level in the U.S. influences U.S. aid to Zimbabwe, which in turn can affect the adolescent fertility rate in Zimbabwe. However, the

adolescent fertility rate in Zimbabwe should not have a discernible impact on the U.S. income level.

As our baseline regression model utilizes data on the total ODA received by an individual country, we choose the per capita income of each of the five largest OECD countries, namely, the U.S., Germany, the U.K., France, and Japan, as potential instruments. These five countries are the largest ODA donors among the DAC countries, accounting for, on average, 65% of the ODA from DAC countries over the period from 2000 to 2016 (OECD 2017). Similar to Chauvet, Gubert, and Mesple-Somps (2013), we also include the total ODA values from each of the five largest donors as additional instruments. Further, we construct several weighted sums of per capita real GDP and total ODA from each of the five OECD countries to an individual country in our sample. The different weights include the inverse of the geographic distance between an individual country i and the potential donor country, whether country i was ever a colony of the donor country after 1945, whether country i shares a common official language with the donor country, and whether country i shares a common religion with the donor country (Duenas and Fagiolo 2013).[8] In short, we have 19 potential instruments, including lags of $\ln\left(ODAPC_{i,\,(t-1,t-2,t-3)}\right)$, the real GDP per capita of each of the five OECD countries, total ODA from each of the five OECD countries, the distance-weighted sum of real GDP per capita (and ODA) of the five OECD countries for each individual recipient, the colonial tie-weighted sum of real GDP per capita (and ODA) of the five OECD countries for each individual recipient, the common language-weighted sum of real GDP per capita (and ODA) of the five OECD countries for each individual recipient, and the common religion-weighted sum of real GDP per capita (and ODA) of the five OECD countries for each individual recipient. Our final choice of instruments in the regressions is determined by their quality as indicated by statistical tests on the first-stage results of the IV estimation.

8 The common language, colonial tie, and religion data come from the CEPII. The distance weighted instruments for recipient i are constructed as $\sum_j \frac{1}{\text{dist}_{ij}} x_j$ where dist_{ij} is the geographic distance between country i and country j; x represents total ODA or GDP per capita and $j \in$ {US, Germany, UK, France, Japan}. The language-weighted instruments for recipient i are constructed as $\sum_j D_{ij} x_j$ with $D_{ij} = 1$ if countries i and j share a common official language, zero otherwise. The colonial tie-weighted and religion-weighted instruments are constructed in a similar way as the language-weighted instruments with dummy variables.

5 Empirical Results

5.1 Aggregate ODA and Adolescent Fertility

Regressions 2.1–2.8 in Table 2 present our results using the instrumented fixed effects estimator (IV-FE) and regression 2.9 is a fixed effects regression only including control variables that are significant in previous regressions. All specifications include time fixed effects as well. For regressions 2.1–2.8, we conduct a series of tests to verify the validity of instruments. We are able to reject the null hypothesis of the Kleibergen-Paap under-identification test based on the p-value in Table 2, which provides good evidence supporting that our instruments are correlated with the endogenous variable. However, the weak-instrument issue may arise if the correlation between the endogenous variable and the instruments is low (Baum, Schaffer, and Stillman 2007). To address this potential concern, we report the first-stage regression results in Table A3 in the appendix. The F-statistics in the first-stage regressions are all above 10, with 10 being the rule of thumb cutoff for weak instruments proposed by Staiger and Stock (1997). In addition, we employ the Stock-Yogo weak-instruments test (2005) and report its Wald test statistics. As shown, the Wald statistics are greater than the critical value calculated using Stock and Yogo (2005) for the 10% maximal size of a 5% Wald test in each IV regression. This suggests that the maximal rejection rate of hypothesis testing in our case should not exceed 10% when the true rejection rate is 5%. Finally, the large p value of the Hansen over-identification test indicates that the null hypothesis of instruments being not correlated with the errors cannot be rejected at conventional levels. Overall, we can cautiously conclude that our instruments are valid and not weak.

Regarding the main empirical results, there are three notable points in Table 2. First, the adjusted-R^2 values and the F test of overall significance results suggest that our model fits the data reasonably well. The null hypothesis of all slope coefficients jointly being equal to zero is rejected at the 1% level or better for all regressions.

Second, foreign aid appears to have a negative and statistically significant impact on the adolescent fertility rate. When instrumented, the estimated coefficient on our ODA measure is negative and significant in all regressions, with its magnitude ranging between −0.024 and −0.047. For example, regression 2.6 suggests that for a 10% increase in ODA per capita in the recipient country lowers the adolescent fertility rate by 0.39%, all else constant.

Third, echoing findings from the previous literature, our results show that income per capita and its growth rate tend to decrease the adolescent fertility rate

Table 2: Aid and adolescent fertility rate.

Variables	2.1 IV-FE	2.2 IV-FE	2.3 IV-FE	2.4 IV-FE	2.5 IV-FE	2.6 IV-FE	2.7 IV-FE	2.8 IV-FE	2.9 FE
Ln(per capita	−0.02422**	−0.02739***	−0.02938***	−0.02770***	−0.03910***	−0.03989***	−0.04334***	−0.04724***	−0.01444**
ODA)	[0.010]	[0.010]	[0.011]	[0.011]	[0.011]	[0.012]	[0.011]	[0.012]	[0.007]
Rural population	0.00077	−0.00023	0.00010	−0.00036	−0.00147	−0.00110	−0.00076	0.00078	–
	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	[0.002]	–
Infant mortality	0.00018	0.00013	0.00029	0.00021	−0.00034	−0.00028	−0.00010	0.00012	–
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]	[0.001]	[0.001]	–
Female schooling	0.01322	0.00804	0.00400	0.00534	−0.00878	−0.00811	−0.00983	−0.00815	–
	[0.009]	[0.009]	[0.009]	[0.009]	[0.010]	[0.010]	[0.009]	[0.009]	–
Health	0.00010	−0.00238	−0.00190	−0.00254	−0.00477	−0.00476	−0.00414	−0.00234	–
expenditures	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	–
ICRG	0.00048	0.00054	0.00014	0.00053	−0.00021	−0.00014	−0.00019	−0.00028	–
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	–
Ln(GDP per	–	−0.08663***	–	−0.08495***	−0.03847	−0.03573	−0.03668	–	−0.08302***
capita)	–	[0.030]	–	[0.030]	[0.034]	[0.035]	[0.033]	–	[0.024]
GDP per capita	–	–	−0.15869*	−0.14105*	−0.33016***	−0.32360***	−0.34384***	–	0.11305
growth	–	–	[0.085]	[0.083]	[0.119]	[0.118]	[0.121]	–	[0.074]
Gini	–	–	–	–	−0.02063	−0.02159	−0.02693	−0.02088	–
	–	–	–	–	[0.035]	[0.035]	[0.034]	[0.035]	–
Female	–	–	–	–	–	0.00089	0.00095	0.00205	–
unemployment	–	–	–	–	–	[0.001]	[0.001]	[0.001]	–
Trade openness	–	–	–	–	–	–	0.00099***	0.00097***	0.00068***
	–	–	–	–	–	–	[0.000]	[0.000]	[0.000]
Observations	1,315	1,270	1,268	1,268	1,046	1,046	1,039	1,043	2,446
Adjusted R-squared	0.544	0.537	0.532	0.538	0.561	0.561	0.565	0.563	0.551

Table 2: (continued)

Variables	2.1 IV-FE	2.2 IV-FE	2.3 IV-FE	2.4 IV-FE	2.5 IV-FE	2.6 IV-FE	2.7 IV-FE	2.8 IV-FE	2.9 FE
F-statistics *p* value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Kleibergen-paap test: *p* value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	–
Hansen test: *p* value	0.169	0.100	0.183	0.154	0.172	0.153	0.120	0.220	–
Weak IV test: Wald-F-statistic	165.1	156.9	148.2	154.7	130.2	129	128.6	139.3	–
10% IV bias critical value	19.93	19.93	19.93	19.93	19.93	19.93	19.93	19.93	–

Robust standard errors in brackets ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Instruments for net ODA per capita in regressions 2.1–2.7: sum of total ODA from five largest donors (USA, Japan, France, UK, and Germany) weighted by geographic distance and twice lagged net ODA averaged over t–1–t–3. Instruments for net ODA per capita in regressions 2.8: sum of real GDP per capita of five largest donors (USA, Japan, France, UK, and Germany) weighted by geographic distance and twice lagged net ODA averaged over t–1–t–3. The 10% IV bias critical value for the weak identification test is obtained from Stock and Yogo (2005), based on the number of endogenous variable and the number of excluded instruments.

Table 3: Four-year average aid regression results.

Variables	3.1	3.2	3.3	3.4	3.5	3.6
			Adolescent fertility			Total fertility
	Full sample	Middle-income countries	Low-income countries	Full sample	Middle-income countries	Low-income countries
Ln(per capita ODA)$_{t-1}$	−0.02742**	−0.01396	−0.06030***	−0.00395	0.00964	−0.03325**
	[0.013]	[0.015]	[0.022]	[0.008]	[0.009]	[0.015]
Ln(GDP per capita)$_{t-1}$	−0.27558***	−0.21568**	−0.44882***	−0.14760***	−0.09218**	−0.33519***
	[0.078]	[0.084]	[0.116]	[0.039]	[0.035]	[0.065]
Health expenditure	−0.01719*	−0.02585	−0.00814	−0.01346**	−0.01271	−0.01372**
	[0.010]	[0.017]	[0.011]	[0.006]	[0.009]	[0.006]
Observations	473	300	173	480	307	173
Country FE	YES	YES	YES	YES	YES	YES
F-statistics p value	0.000	0.001	0.000	0.000	0.009	0.000
Adjusted R-squared	0.237	0.208	0.349	0.164	0.094	0.415

Robust standard errors in brackets ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

in a country. We also note that the effects of income and income growth are stronger than that of ODA, which is not surprising. For example, regression 2.2 suggests that a 10% increase in per capita GDP decreases adolescent fertility by approximately 0.8% while a 10% rise in per capita ODA is associated with a 0.27% decline in adolescent fertility rate, all else constant. In addition, government health expenditures also seem to have a negative impact on the adolescent fertility rate, but the effect appears to be sensitive to model specifications and is not estimated precisely.

5.2 Four-Year Average Results

In this subsection, to further reduce short-run fluctuations and account for persistence in economic variables in our model, we look at the effect of aid based on four-year averages of variables. As our sample runs from 1995 to 2015, we take four four-year averages and one five-year average of variables (i.e., 1995–1998, 1999–2002, 2003–2006, 2007–2010, 2011–2015). In addition, we exclude control variables that are not significant in our previous annual data analysis and keep aid, per capita income, and government health spending in our regressions.

Following the fixed effects specifications of Gomanee, Morrissey, and Mosley (2005), in which the authors study the effect of aid and government expenditure on aggregate welfare measures in developing countries, we first look at the effect of aid in our full sample and then in subsamples including middle-income and low-income countries. In addition, we also look at the effect of ODA on the total fertility rate in aid-recipient countries in comparison to its effect on the adolescent fertility rate. The four-year average results are reported in Table 3. In our full sample adolescent fertility rate regression (regression 3.1), ODA is shown to negatively affect the adolescent fertility rate. Such a significant impact of aid seems to be driven by the effect of aid in low-income countries. As shown in regressions 3.2 and 3.3, the coefficient on ODA is negative in both the middle-income subsample and the low-income subsample, but is only statistically significant in the latter. We observe a similar pattern regarding the effect of aid on the total fertility rate. The coefficient on aid is negative in total fertility regression 3.4 (full sample) and positive in regression 3.5 (middle-income countries). But neither is statistically significant. The coefficient on aid is negative and significant at the 5% level in regression 3.6 (low-income countries). Table 3 results also suggest that the effect of aid on the adolescent fertility rate is larger than that on the total fertility rate in low-income countries.[9]

9 We use the Chi-square test to compare the estimated coefficient on aid from adolescent and total fertility rate regressions. In the low-income subsample, the Chi-square test statistic is 8.28, which is significant at the 5% level.

Further, to allow for the indirect effect of aid on adolescent fertility rate through growth, we apply a two-step regression approach as proposed in Gomanee, Morrissey, and Mosley (2005), which is discussed in detail below.

To see whether aid has an indirect effect through growth, we first estimate whether aid is a significant determinant of GDP per capita (the first-step regression). We find that the coefficient on lagged aid is indeed positive and significant in the first-step regression. Second, to take out the aid component of growth, we retrieve the residuals from the first-step regression and name the residual *income_resid*. We then include the variable *income_resid* in our model of adolescent fertility rate (the second step). Such a two-step approach helps us to capture the effect of aid after we control for its potential indirect effect through growth.

We also apply this two-step estimation procedure to allow for the potential interaction between aid and government health spending as inflows of ODA might change government spending decisions. We first estimate whether health aid is a significant determinant of government health spending and then include the residuals from the first-step spending-health aid regression (*health_expenditure_resid*) in the second-step adolescent fertility rate regression.[10] Following Neanidis (2012), we construct net ODA disbursements for health (or health aid) by multiplying net ODA disbursements by the share of health aid commitments in total aid commitments. We recognize that this might introduce some measurement error in the sectoral aid variables as we are assuming aid commitment across sectors is distributed proportionately the same way as aid disbarment across sectors. The aid commitment data by sector and recipient country are collected from the OECD Credit Reporting System (CRS) database based on aid flows for individual projects. We do not use aid disbursements for health and education from the CRS because using such data will significantly reduce our sample size, as the disbursements data are available only between 2002 and 2015. We do not choose to use education and health commitments data directly in the regressions for two main reasons: first, our results on the effect of total aid in previous tables are based on net ODA disbursements data, and second, the CRS data on aid are underreported compared to those of the DAC data (Chauvet, Gubert, and Mesple-Somps 2013).

Figure 4 displays a scatter plot of per capita heath aid (in log) against the adolescent fertility rate (in log) with middle-income countries marked in blue and

10 Health aid includes aid for general health, aid for basic health, and aid for population policy, population programs and reproductive health.

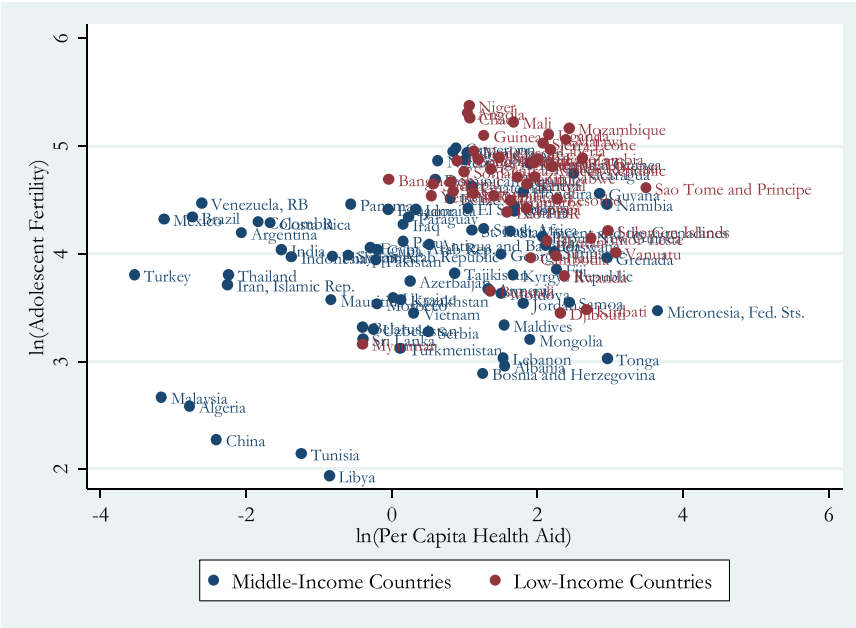

Figure 4: Health aid and adolescent fertility.

low-income countries marked in red. Compared to other countries in our sample, Algeria, China, Tunisia, Malaysia, and Libya (all five are middle-income countries) have both a low level of health aid and a low level of adolescent fertility rate. These observations are located near the origin of the plot. In general, health aid and adolescent fertility rate appear to be negatively correlated with each other in both groups. As expected, middle-income countries on average exhibit lower adolescent fertility rates relative to low-income countries.

For both two-step approach regressions, we report the first-step results in the Appendix Table A2: and the second-step results in Table 4. Regressions 4.1, 4.3, and 4.5 are the second-step regressions with *income_residual* for our full sample, the middle-income subsample, and the low-income subsample, respectively. Regressions 4.2, 4.4, and 4.6 represent the second-step regressions including *health expenditure_resid* for our full sample, the middle-income subsample, and the low-income subsample, respectively. The estimated coefficient on lagged aid is negative and significant in all income residual regressions in Table 4. After we control for the interaction between aid and growth, aid still helps to lower the adolescent fertility rate in the DAC countries. Regarding per capita GDP, the estimated coefficient on the income residual is negative across all samples and significant in our

full sample and the low-income subsample. As aid is shown to be a significant determinant in our first-step growth regressions, these second-step regression results suggest that aid has both a significant direct effect and an indirect effect through growth on the adolescent fertility rate. The indirect effect through growth appears more evident in the low-income group than in the middle-income group given the significant coefficient on the income residual in the low-income subsample. In addition, regressions 4.3 and 4.5 also show that the negative effect of aid on adolescent fertility rate is stronger in low-income countries than in middle-income countries. Specifically, our results suggest that a 10% increase in per capita aid is associated with a decline of adolescent fertility rate by 0.4% in middle-income countries (regression 4.3) and by 1.36% in low-income countries (regression 4.5).[11] These findings are consistent with those in Gomanee, Morrissey, and Mosley (2005), who point out that the effect of aid on aggregate welfare measures is stronger in low-income countries compared to that in middle-income countries.

In contrast, aid does not seem to affect adolescent fertility rate through government health spending. Although our first-step regression results indicate that health aid is a significant determinant of government health spending in both middle- and low-income countries, government health spending is not a significant determinant of adolescent fertility rate. After we take out the health aid component from the health spending, the estimated coefficient on the health expenditure residual in the second-step regressions is −0.013 in the middle-income subsample (regression 4.4) and −0.002 in the low-income subsample (regression 4.6), but neither is statistically significant at conventional levels. The negative (and significant) effect of total aid is larger in low-income countries (−0.069 in regression 4.6) than in middle-income countries (−0.025 in regression 4.4), which are similar to the findings from the regressions with the income residual.[12]

5.3 Sectoral ODA and Adolescent Fertility

In this subsection, we explore the effect of sectoral aid on the adolescent fertility rate, namely health aid, education aid, and other aid. Similar to our empirical

11 A Chi-square test is conducted to compare the estimated coefficients on aid in the middle- and low-income subsamples. The Chi-square test statistic is 14.86 and statistically significant at the 1% level.

12 Similarly, a Chi-square test to compare the estimated coefficients on aid in the middle-income and low-income subsamples yields a statistic of 4.72, which is statistically significant at the 5% level.

Table 4: Four-year average aid two-step regressions (second step).

Variables	Full sample		Middle-income countries		Low-income countries	
	Income residual regression 4.1	Health spending residual regression 4.2	Income residual regression 4.3	Health spending residual regression 4.4	Income residual regression 4.5	Health spending residual regression 4.6
Ln(per capita ODA)$_{t-1}$	−0.0656***	−0.03947***	−0.0406*	−0.02495	−0.1358***	−0.06876***
	[0.022]	[0.014]	[0.022]	[0.017]	[0.025]	[0.019]
Health expenditure_resid	–	−0.00737	–	−0.01345	–	−0.00231
	–	[0.009]	–	[0.015]	–	[0.010]
Income_resid$_{t-1}$	−0.1853**	–	−0.15882	–	−0.2356**	–
	[0.077]	–	[0.111]	–	[0.102]	–
Health expenditure	−0.0157	–	−0.02987	–	0.0104	–
	[0.013]	–	[0.021]	–	[0.010]	–
Ln(GDP per capita)$_{t-1}$	–	−0.28773***	–	−0.24373***	–	−0.42449***
	–	[0.070]	–	[0.077]	–	[0.095]
Observations	261	442	177	276	84	166
Adjusted R-squared	0.1793	0.255	0.1299	0.224	0.4565	0.354
Country FE	YES	YES	YES	YES	YES	YES
F-statistics p value	0.000	0.000	0.0013	0.0025	0.000	0.000

Robust standard errors in brackets ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Table 5: Four-year average sectoral aid two-step regressions (second step).

	Full sample		Middle-income countries		Low-income countries	
	Income residual regression 5.1	Health spending residual regression 5.2	Income residual regression 5.3	Health spending residual regression 5.4	Income residual regression 5.5	Health spending residual regression 5.6
Ln(per capita education aid)$_{t-1}$	−0.00868	−0.01801	0.00534	−0.01148	−0.05617**	−0.05726***
	[0.016]	[0.011]	[0.019]	[0.014]	[0.027]	[0.023]
Ln(per capita health aid)$_{t-1}$	−0.03813***	−0.03613***	−0.02535*	−0.02942*	−0.05681***	−0.04554***
	[0.012]	[0.013]	[0.015]	[0.016]	[0.020]	[0.026]
Ln(per capita other aid)$_{t-1}$	−0.02086	−0.00284	−0.01904	−0.00130	−0.02184	0.00545
	[0.017]	[0.015]	[0.020]	[0.018]	[0.030]	[0.026]
Health expenditure	−0.01189	–	−0.02611**	–	0.00720	–
	[0.009]	–	[0.013]	–	[0.010]	–
Ln(GDP per capita)$_{t-1}$	–	−0.22901***	–	−0.19986***	–	−0.32733***
	–	[0.075]	–	[0.083]	–	[0.117]
Income_resid	−0.14250**	–	−0.14615*	–	−0.14440	–
	[0.066]	–	[0.087]	–	[0.093]	–
Health	–	−0.00608	–	−0.01197	–	−0.00120
expenditure_resid	–	[0.009]	–	[0.015]	–	[0.009]
Observations	260	441	176	275	84	166
Adjusted R-squared	0.194	0.299	0.116	0.258	0.511	0.424
Country FE	YES	YES	YES	YES	YES	YES
F-statistics p value	0.000	0.000	0.004	0.000	0.000	0.000

Robust standard errors in brackets ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

specifications in the previous subsection, we use four-year averages of variables and apply the two-step regression approach.

As mentioned previously, we construct health aid based on net ODA disbursements data and the share of health aid commitments in total aid commitments. Our education aid is constructed in a similar way by multiplying net ODA disbursements and the share of education aid commitments in total aid commitments.

The second-step sectoral aid regression results are reported in Table 5, which generally indicate that the negative effect of aid on the adolescent fertility rate is realized through health aid and education aid. To be more specific, the coefficient on health aid is robustly negative and statistically significant in all regressions. The coefficient on education aid is negative and significant in our full sample and the low-income group. The coefficient on other aid is negative, but is not estimated precisely.[13]

Although it may be impossible to track how each recipient country uses its health aid, some information on the components of health ODA in general may provide insights into our empirical results related to aid for the health sector. Health aid in our sample includes aid for general health, aid for basic health, and aid for population policy, population programs and reproductive health. Aid for general health supports medical education and training, medical research, and medical services. Aid for basic health covers basic nutrition, basic health infrastructure, health education, and infectious disease control, such as malaria and tuberculosis. The largest subcategory of health ODA, however, is aid for population policy and reproductive health, with its value exceeding the combination of basic health aid and general health aid. The annual average of aid for population policy and reproductive health was $4.5 billion between 1997 and 2016 from all DAC countries, which went to areas that can be essential to the adolescent fertility rate such as reproductive health care, family planning, and STD control, including HIV and AIDS.

6 Conclusions

In this paper, we empirically evaluate the effect of foreign aid on the adolescent fertility rate in developing countries. Using data from 121 DAC-list countries

13 There have been studies on the fungibility of health aid (See, for example, Dieleman and Hanlon 2013; Harper 2012). Foreign aid is fungible when the recipient government replaces its own spending in, for example, the health sector by foreign aid, or directs aid to other sectors than originally designated by the donor. Empirical studies have found little evidence for inter-sectoral fungibility of aid (Harper 2012; van de Sijpe 2013; Wagstaff 2011).

over the period from 1995 to 2015, we find that total ODA has a beneficial impact, namely, a negative impact, on the fertility rate among women between the ages of 15–19. Our results suggest to donor countries that ODA helps to reduce adolescent fertility in recipient countries in general, both directly and through the income channel. Regressions focusing on sectoral aid also show that the beneficial effect of aid mainly comes through aid in the health sector. These results are consistent with findings of previous studies that show an association between foreign aid and better health outcomes, such as a lower infant mortality rate in recipient countries (Chauvet, Gubert, and Mesple-Somps 2013; Mishra and Newhouse 2007). Further, we find evidence supporting that the effect of aid is stronger in low-income countries than in middle-income countries, which are consistent with results in Gomanee, Morrissey, and Mosley (2005).

In 2000, the United Nations General Assembly adopted the Millennium Development Goals (MDGs), committing countries to a global partnership to achieve eight development objectives, such as the empowerment of women and reduction of child mortality. Successfully reducing the adolescent fertility rate is closely connected to these MDGs as well as the UN's post-2015 sustainable development goals. Over time, many developing countries have shown significant progress toward achieving some of the goals. Collective actions of all governments and continued support from developed countries to developing countries remain critical to sustainable development in the international community.

Some interesting questions remain. Are there factors that are specific to adolescent fertility decisions compared to adult fertility decisions? What are these factors and what is their relative importance compared to other factors that are common to fertility decisions of both adolescents and adults? Is it desirable to shift donor resources to a specific sector, say the health sector? These questions may serve as directions for future research.

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Appendix

Table A1: List of countries: full sample.

Afghanistan	Congo, rep.	Iraq	Niger	Tonga
Albania	Costa Rica	Jamaica	Nigeria	Tunisia
Algeria	Cote d'Ivoire	Jordan	Pakistan	Turkey
Angola	Cuba	Kazakhstan	Panama	Turkmenistan
Antigua and Barbuda	Djibouti	Kenya	Papua New Guinea	Uganda
Argentina	Dominican Republic	Kiribati	Paraguay	Ukraine
Armenia	Ecuador	Kyrgyz republic	Peru	Uzbekistan
Azerbaijan	Egypt	Lebanon	Philippines	Vanuatu
Bangladesh	El Salvador	Lesotho	Rwanda	Venezuela, RB
Belarus	Equatorial Guinea	Liberia	Samoa	Vietnam
Belize	Eritrea	Libya	Lao PDR	Yemen, rep.
Benin	Ethiopia	Madagascar	Sao Tome and Principe	Zambia
Bhutan	Fiji	Malawi	Senegal	Zimbabwe
Bolivia	Gabon	Malaysia	Serbia	–
Bosnia and Herzegovina	Gambia, the	Maldives	Sierra Leone	–
Botswana	Georgia	Mali	Solomon Islands	–
Brazil	Ghana	Mauritania	South Africa	–
Burkina Faso	Grenada	Mauritius	Sri Lanka	–
Burundi	Guatemala	Mexico	St. Lucia	–
Cambodia	Guinea	Micronesia	St. Vincent and the grenadines	–
Cameroon	Guinea-bissau	Moldova	Sudan	–
Central African Republic	Guyana	Mongolia	Suriname	–
Chad	Haiti	Morocco	Tajikistan	–
China	Honduras	Mozambique	Tanzania	–
Colombia	India	Namibia	Thailand	–
Comoros	Indonesia	Nepal	Timor-Leste	–
Congo, dem. Rep.	Iran	Nicaragua	Togo	–

Table A2: Income, health spending, and aid: four-year average regressions (first step).

Variables	Ln(GDP per capita)			Health expenditure		
	DAC countries	Middle income	Low income	DAC countries	Middle income	Low income
Ln(per capita	0.0489***	0.0343**	0.0929**	–	–	–
ODA)	[0.015]	[0.014]	[0.036]	–	–	–
Ln(per capita	–	–	–	0.3802***	0.3126***	0.6151***
health Aid)$_{t-1}$	–	–	–	[0.069]	[0.063]	[0.198]
Ln(GDP per	–	–	–	0.3770	0.5712	−0.3210
capita)	–	–	–	[0.362]	[0.402]	[0.764]
Rural population	−0.0244***	−0.0252***	−0.0229	–	–	–
	[0.007]	[0.007]	[0.018]	–	–	–
Female	0.09211***	0.09423***	0.07157	–	–	–
schooling	[0.022]	[0.018]	[0.092]	–	–	–
Observations	262	178	84	449	281	168
Adjusted R-squared	0.468	0.519	0.353	0.117	0.134	0.114
Country FE	YES	YES	YES	YES	YES	YES
F-statistics *p* value	0.000	0.000	0.000	0.000	0.000	0.012

Robust standard errors in brackets ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

Table A3: First-stage regression results for Table 2.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
DonorODA_dist	7.460***	8.115***	7.042***	7.557***	8.892***	9.225***	9.661***	–
	(1.961)	(1.917)	(1.942)	(1.950)	(2.005)	(2.027)	(2.060)	–
DonorGDP_dist	–	–	–	–	–	–	–	34.92***
	–	–	–	–	–	–	–	(5.885)
Ln(per capita ODA)$_{t-2}$	0.631***	0.620***	0.618***	0.622***	0.612***	0.601***	0.605***	0.591***
	(0.0353)	(0.0362)	(0.0369)	(0.0366)	(0.0395)	(0.0394)	(0.0399)	(0.0392)
Rural population	0.00624	0.0000443	0.00308	0.000179	−0.00212	0.00355	0.000984	0.0103
	(0.00603)	(0.00566)	(0.00605)	(0.00572)	(0.00622)	(0.00674)	(0.00698)	(0.00728)
Infant mortality	−0.00340*	−0.00409**	−0.00311*	−0.00371**	−0.00259	−0.00181	−0.00245	−0.000385
	(0.00134)	(0.00132)	(0.00137)	(0.00137)	(0.00146)	(0.00150)	(0.00148)	(0.00145)
Female schooling	−0.0140	−0.0303	−0.0449	−0.0374	0.0151	0.0242	0.0276	0.000509
	(0.0359)	(0.0332)	(0.0338)	(0.0330)	(0.0309)	(0.0317)	(0.0326)	(0.0320)
Health expenditures	0.0207	0.0240*	0.0280**	0.0240*	0.0221*	0.0219*	0.0227*	0.0334**
	(0.0112)	(0.00998)	(0.0104)	(0.00996)	(0.0111)	(0.0110)	(0.0109)	(0.0108)
ICRG	0.00189	0.00617*	0.00377	0.00629*	0.00903*	0.00992**	0.00969**	0.00699*
	(0.00327)	(0.00310)	(0.00308)	(0.00313)	(0.00350)	(0.00357)	(0.00360)	(0.00342)
Ln(GDP per capita)	–	−0.569***	–	−0.555***	−0.473***	−0.428***	−0.429***	–
	–	(0.0815)	–	(0.0803)	(0.0963)	(0.0948)	(0.0958)	–
GDP per capita growth	–	–	−0.615	−0.486	−0.174	−0.0489	−0.187	–
	–	–	(0.425)	(0.403)	(0.492)	(0.493)	(0.498)	–
Gini	–	–	–	–	0.359***	0.344***	0.371***	0.370***
	–	–	–	–	(0.101)	(0.101)	(0.104)	(0.104)
Female unemployment	–	–	–	–	–	0.0130*	0.0115*	0.0174**
	–	–	–	–	–	(0.00562)	(0.00563)	(0.00561)
Trade openness	–	–	–	–	–	–	−0.000917	−0.000930
	–	–	–	–	–	–	(0.00131)	(0.00128)

Table A3: (continued)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1315	1270	1268	1268	1046	1046	1039	1043
Adjusted R-squared	0.485	0.504	0.484	0.501	0.494	0.497	0.498	0.495
F-statistic	39.06	48.66	53.98	64.01	60.58	61.43	59.03	44.89

Robust standard errors in parentheses ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$
DonorODA_dist is the weighted sum of total ODA from the five largest donors with the weight being geographical distance between the aid recipient and each donor.
DonorGDP_dist is the weighted sum of real GDP per capita from the five largest donors with the weight being geographical distance between the aid recipient and each donor.

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