Australian National University

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How does foreign aid impact Australian exports in the long-run?

Sabit Amum Otor and Matthew Dornan

Abstract

This study investigates the long-run effects of foreign aid on donor exports to recipient countries, using Australian exports to Asia as a case study. Dynamic panel econometric techniques and the Gravity Model of international trade are used to explore the relationship between official development assistance (ODA) and Australian exports to 17 Asian countries between 1980 and 2013. The modelling results show that Australian ODA is positively associated with exports to recipient countries and that, contrary to the findings of previous studies, ODA from other OECD donors also increases Australian exports. In the long-run on average, our preferred model suggests that one dollar of Australian aid increases Australian exports to the recipient by $7.10. Granger causality analysis suggests that causality runs in both directions, confirming that Australian ODA leads to Australian exports. Interestingly, the Australian government's decision to untie Australian aid from domestic procurement requirements in 2006 does not appear to have reduced the impact of Australian aid on exports. We conclude that calls to 'tie' aid are, at best, a distraction, with aid increasing exports more significantly through other (non-tying) channels.

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1. Introduction

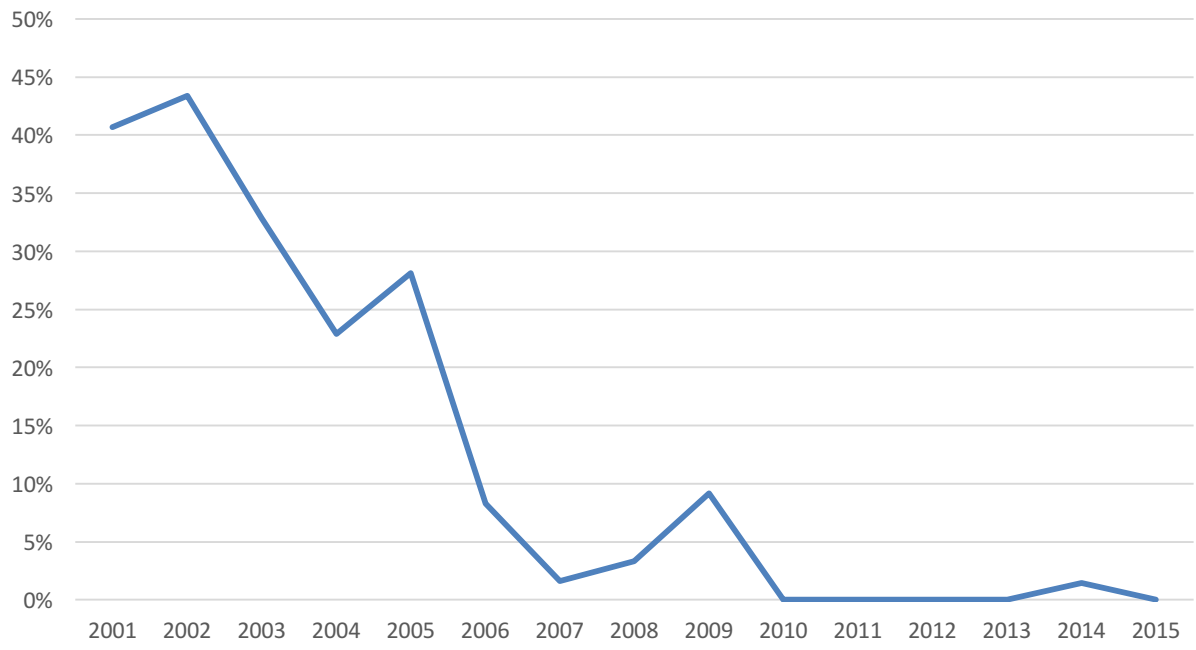
The Australian government provides approximately 4 billion dollars of foreign aid (or Official Development Assistance (ODA)) to developing countries each year. A considerable amount of this assistance goes to Asia, with Asian countries receiving 42% of country allocations in the aid budget in 2014-15. This foreign aid is provided for reasons of both self-interest and poverty alleviation. The Australian government's aid policy states that the purpose of aid is "to promote Australia's national interests by contributing to sustainable economic growth and poverty reduction" (Commonwealth of Australia, 2014). National interest objectives are not defined by the statement, but are commonly understood to include political, strategic and commercial benefits (Alesina and Dollar, 2000; Bourguignon and Sundberg, 2007; Sachs, 2005; Riddell, 2008).

This paper explores the long-run effects of foreign aid on Australian exports to Asia (the last of these 'national interest' objectives). The paper is primarily of an empirical nature. It neither argues that linkages between aid and exports are good nor bad, although we note ongoing contention in relation to the subject, with critics concerned about the adverse impacts of (what is commonly termed) 'boomerang aid' on aid effectiveness. In exploring the historical relationship between aid and Australian exports to Asia, the paper ties into a broader literature that examines the relationship between foreign aid and trade. The paper considers the impact of foreign aid from both Australia and other OECD Development Assistance Committee (DAC) donors, filling a gap in the literature on Australian aid, and challenging the results of previous studies in relation to aid from other donors. Dynamic panel econometric techniques and the Gravity Model of international trade are employed in the paper.

In examining a dataset that spans 1980 to 2013, the paper also assesses the impact on Australian exports of 'untying' the Australian aid program. This is an issue that continues to be topical a decade after the Australian aid program was 'untied' and which, to the best of our knowledge, has not previously been the subject of academic study. The practice of 'tying' has been widely criticised internationally due to concerns about its detrimental impact on effectiveness, including as part of the 2005 Paris Declaration. As a result, the Australian government 'untied' its aid program in 2006, discontinuing the practice of tying aid to purchase of goods from Australian businesses (though in practice some forms of tying continued). It had previously untied aid to LDCs in 2001. This shift saw a significant

reduction in the percentage of aid tied to Australian suppliers (figure 1 presents data from the OECD, though we would argue that this is likely to underestimate the effective rate of tying). The results presented below are used to assess whether the change has corresponded with an increase or decrease in the long-run impact of aid on Australian exports to recipient countries, presenting clear lessons for policy makers.[1]

Figure 1 — Tied aid as a percentage of total Australian aid commitments, 2001-2015



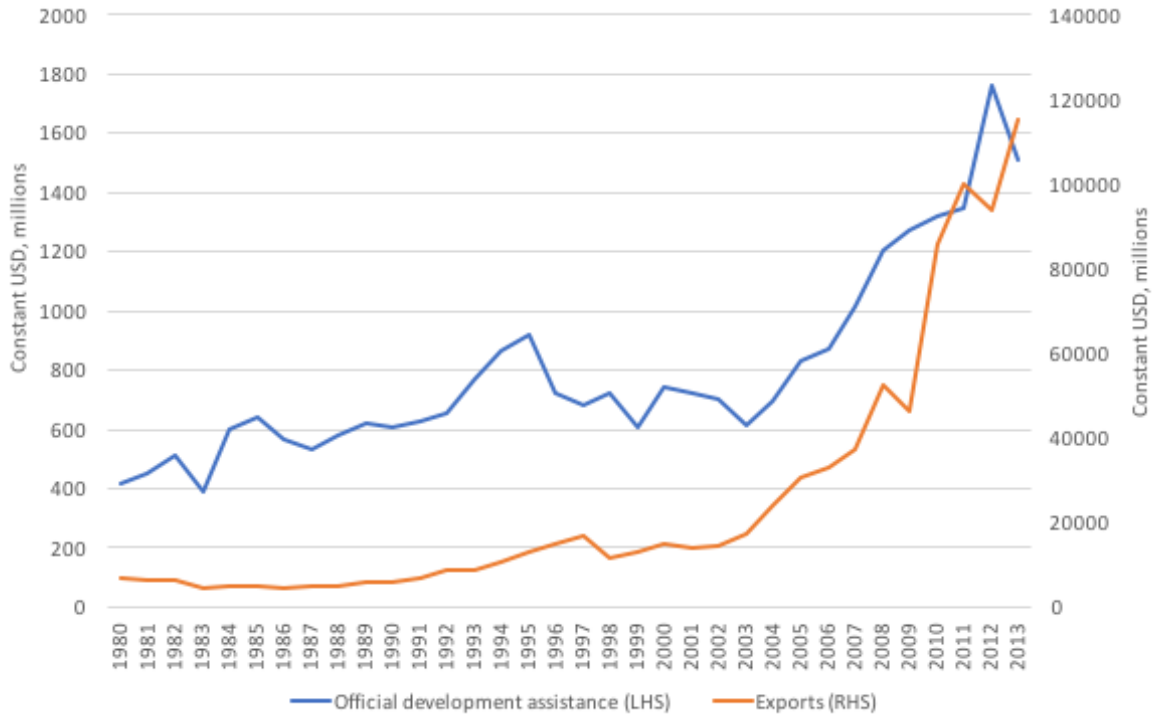
Source: OECD data, available at: http://stats.oecd.org/

For reasons relating to data availability, the paper only examines foreign aid and exports to Asian countries. Data on Australian aid and/or exports to other regions — the Pacific, Africa, and Latin America — did not provide an adequate sample size (i.e. an appropriate time series and cross-section dimensions) for the econometric techniques that are employed. This is a limitation of our study, as the extent to which our findings are applicable to aid in other

[1] The shift to a completely untied aid program occurred in 2006, although as noted, there had been a change previously in 2001, when Australia untied aid to LDCs. As LDCs receive a negligible share of Australian aid (less than 10%), and as our focus is on Asia, we have taken 2006 as the year in which the aid program was untied.

regions is unclear; however, it is an unavoidable one given our focus on impacts in the long-run. The benefit of concentrating on Asia is that a considerable portion of Australian aid goes to Asian countries, while at the same time, these countries are important trading partners. Australian trade to the Pacific Islands, Africa and Latin America is limited, as is foreign aid to the latter two regions. The relationship between Australian exports and aid to Asia is shown in figure 2.

Figure 2 — Australian exports and aid to Asia



The rest of the paper is organised as following: Section 2 discusses the relationship between foreign aid and exports and reviews existing literature on the subject; Section 3 outlines our estimation approach and details the data used in our analysis; Section 4 presents the econometric methodology and estimations; Section 5 discusses our results; and Section 6 concludes.

2. Framework and Literature Review

2.1 Theoretical framework

The relationship between foreign aid and exports from the donor is complex, with causality potentially running in either (or in both) directions. Trade links have been shown to be a strong explanatory variable for the allocation of aid, with donors allocating more aid to countries with which they trade (Alesina and Dollar, 2000; Berthélemy, 2006). This can be explained by national interest drivers of aid allocation, which in turn are influenced by the activities of domestic lobby groups (Lloyd *et al.*, 2000; McGillivray and Morrissey, 1998).

But causality has also been shown to run in the opposite direction, with foreign aid affecting donor exports (Martinez-Zarzoso e*t at*., 2009; Nowak-Lehmann, e*t al*., 2009; Zarin-Nejadan, 2008). There are a number of direct and indirect mechanisms through which this might occur. Direct mechanisms involve the use of foreign aid to purchase imports (Martinez-Zarzoso e*t at*., 2009; Nowak-Lehmann, e*t al*., 2009; Zarin-Nejadan, 2008). This can occur as a result of aid 'tying', whereby donors require that aid funds be used to purchase goods and services that are sourced from the donor country. However, the mechanism can also be less overt. For example, donors can adopt a variety of trade promotion activities linked to aid, such as allocating foreign aid toward projects that require imported goods and services (i.e. supplies) from firms in which the donor has strong competitive advantage, subsidising export-credit schemes, or using aid to lower the cost of donor-country firms that bid for the tender (McGillivray and Morrissey, 1998).

Indirect mechanisms through which aid may increase exports are various. One is macroeconomic. To the extent that foreign aid facilitates economic development that increases incomes, this enhances the ability of the recipient country to purchase exports (including those of the donor) (McGillivray and Morrissey, 1998). Disentangling these effects from broader economic trends is difficult, as evident in the mixed record of studies seeking to ascertain the economic impact of foreign aid on growth (Riddell, 2003). Other indirect mechanisms include (i) goodwill effects (aid may generate goodwill in the recipient country, leading to purchase of products from the donor), (ii) the creation of networks and linkages between the two countries; and (iii) demonstration effects, or the promotion of donor products by aid programs (whether implicit and explicit) (Lloyd *et al.*, 2000; Nowak and Lehmann 2009). These mechanisms can have both an aggregate and substitution effect on

exports to the recipient, with aid from one donor potentially leading the recipient country to purchase a greater share of exports from that donor (thereby reducing its purchase of goods from other donors).

The direct mechanism, through which aid is used to purchase products from the donor, is the most obvious way through which aid could increase exports from the donor to the recipient. However, international evidence suggests it is not the most important mechanism. Many of the empirical studies that have identified a relationship between aid and trade conclude that aid increases exports by a magnitude of more than one (or that $1 of aid causes more than $1 of exports). This suggests that other factors must also be at work. Indirect mechanisms, including goodwill effects, network and linkage effects, and demonstration effects, therefore appear to be important (Arvin and Baum, 1997).

It should be noted that many of these mechanisms have the potential to impact exports negatively as well as positively. The relationship between foreign aid and economic growth continues to be debated; where aid undermines growth for whatever reason (the impact on rent seeking and institutions is often cited in the literature), this has potential to reduce exports from the donor. The nature of aid is also important. In cases where foreign aid helps to build domestic production capacity in a sector, there is potential for this to adversely affect exports from a donor. The tying of foreign aid can also affect exports in different ways. Although it may increase returns to the donor in the short-run, it is not unreasonable to expect that tying of aid undermines long-term goodwill effects of foreign aid on exports. There is also considerable evidence that aid is less effective when tied to exports from donor countries, suggesting that tying of aid may reduce the positive macroeconomic impacts of aid on growth (and, it follows, on exports from the donor) (Jepma 1991). All of this points to the complexity of the relationship between aid and exports, and suggests that the relationship is likely to vary considerably in different contexts.

2.2 Literature review

There is an extensive economic literature that studies the welfare implications of foreign aid. Theoretical literature has in many cases considered transfer implications in static settings, with a focus on terms of trade effects (Suwa-Eisenmann and Verdier 2007). Djajić *et al.* (2004) and Shimomura (2007) extend their analysis to a dynamic setting. Djajić *et al.* (2004) develop a model that shows, under certain conditions, that both donor and the recipient

country can materially benefit from foreign aid, with the recipient country benefitting in the first period, and the donor country benefitting in the second period. Shimomura (2007) extends the Djajić *et al* model into an infinite time horizon, demonstrating that aid benefits both donor and recipient in the long-run — a finding contingent on the positive impact of aid on exports from the donor country.

Empirical research on the relationship between aid and trade is very extensive. Much of this research has focused solely on whether trade influences the allocation of aid (Alesina and Dollar, 2000; Berthélemy, 2006). Other empirical work has examined the extent to which aid influences exports, with the gravity model commonly used as an empirical framework.

The first empirical studies of the extent to which aid influences exports were undertaken by Arvin *et al.* (1997) and Arvin and Baum (1997). The former investigated the lingering effects of untied aid on donor's exports using data on Canadian exports to 54 recipient countries. The latter study investigated the effects of tied and untied aid on the exports of 17 OECD countries. In both studies, the authors argued that although untied aid does not obligate the recipient to purchase goods and services from the donor, there are benefits that accrue to the donor through other mechanisms, though these take time to materialise.

Two subsequent studies cast doubt on the whether aid impacts exports. Lloyd *et al.* (2000) and Osei *et al.* (2004) concluded that aid had no impact on trade between donors and recipients, and that correlations between the two could be explained by trade influencing aid allocations. In contrast, Wagner's 2003 study of 20 donors and 109 recipients concluded that aid does increase exports from the donor to the recipient. Wagner (2003) further found that the indirect effects of aid on exports — which he largely attributes to goodwill and demonstration effects — were more than twice as large as the direct effects (in which aid is used to purchase exports from the donor).

In recent years, the long-run (dynamic) effects of aid have attracted interest among researchers who have available to them improved econometric techniques and better data. Some of these studies have also considered the effects on exports of tying of aid. Nowak-Lehmann *et al.* (2009) and Zarin-Nejadan *et al.* (2009) applied dynamic cointegration techniques to investigate the effect of foreign aid on donor exports for Germany and Switzerland, respectively. Both studies reach the same conclusion: the full effects of aid on exports take time to materialise, with the effects of aid on exports higher in the long-run than

the short-run. In the case of Germany, each dollar spent on aid was led to exports of between $1.04 and $1.50 value in the long-run, and $0.69 in the short-run. Martinez-Zarzoso *et al.* (2009) used a different approach to reach the same conclusion. They found that while tying of aid has declined as percentage of the German aid program since the 1960s (it dropped from 72% of all aid in 1979 to 6% in 2010), the estimated impact on exports has increased over the same period (from $0.60 for every dollar of aid provided in the 1970s, to $1.50 in the 2000s).

The three aforementioned studies also consider the impact of aid from other donors on German and (in the case of Zarin-Nejadan *et al.* (2009)) Swiss exports. All find evidence of a substitution effect: aid from other donors, appears to reduce exports from Germany/Switzerland. In contrast, Otor (2014) concludes that aid from the other donors has positive and statistically significant impacts on Japanese exports. This is explained by the contribution of such aid to foreign currency holdings (both directly and indirectly through impacts on growth) in the recipient country.

2.3 Summary

There is a significant gap in the literature on Australian aid and its impact on exports. We are aware of only one such empirical study that includes Australia (Wagner 2003), and this was as part of a sample of 20 donors using data from before 1992. It found that Australian foreign aid increased exports significantly (with $1 of foreign aid resulting in exports of $3.92) — more than in the case of most other donors — and that this was despite lower levels of aid tying than used by other donors.

This paper builds on the existing body of literature in a number of ways. First, we analyse data not previously examined in order to add to evidence on the effects of aid on exports. Our focus on Australian aid addresses a gap in the literature, which is made more important by the increase in Australian aid in recent years (notwithstanding subsequent budget cuts), and by the Coalition Government's emphasis on 'national interest' as an objective of Australia's foreign aid program.

Second, as the only study to focus on Australian aid in recent years, we are able to analyse two distinct periods in the history of the Australian aid program: one in which aid was tied to Australian contractors, and the other in which it was untied. This allows us to provide a fresh perspective on the debate about the impact on exports of tied and untied aid.

Third, we use methodologies that specifically investigate the long-run (i.e. dynamic) relationship between aid and Australian exports to Asia. These include the following dynamic panel econometric techniques: Dynamic Fixed-Effects (DFE), Mean Group (MG), Pool Mean Group (PMG), and Dynamic Ordinary Least Squares (DOLS). These methodologies, which are described in detail below, have a number of advantages over those used in previous literature, including their robustness to estimation issues associated with endogeneity, omitted variables and measurement error (Banerjee, 1999; Pillips and Moon, 2000; Batagi and Koa, 2000), unit root (Granger and Newbold, 1974), and cointegration (Engle and Granger, 1987). Granger causality tests allow us to establish the direction of causality, thereby confirming that our results are not simply the product of the donor rewarding higher exports with increased aid allocations.

3. Estimation Approach

3.1 Modelling the impact of aid on exports

The estimation model we use to analyse the impact of Australian ODA on Australian exports to its recipients is the gravity model of international trade (gravity model afterwards), which can be written in the following form:

$$y_{ij,t} = \beta_0 + \omega_{ij} + \pi_t + \nu_{ij}t + \psi'_{ij} z_{ij,t} + \mu_{ij,t} \qquad (1)$$

Where the dependent variable (y_{ijt}) is the logarithm (log) of exports (at constant 2012 US$) from Australia (denoted by *i*) to the recipient country *j* in period *t*. ψ'_{ij} is 1 x 6 row vectors of coefficients. z is a vector of explanatory variables that includes log of total GDP ($TGDP_t$) and log of total population ($TPOP_t$) of both Australia and the recipient country, log of the bilateral exchange rate (EX_{ijt}) between the two countries, log of Australian aid ($AIDAUS_{ijt}$) to the recipient country, and log of aid from other OECD DAC donors ($AIDDAC_{ijt}$) to the recipient country. The constant term β_0 captures factors that are common to all years and all trade partners. ω_{ij} is a time-invariant fixed effect, which captures all unobserved country-pair specific factors, including the distance between the two economic centres, the existence of

trade agreements, common language, common border, and colonial history.[2] π_t is a year-specific effect which captures unobserved factors specific to the period *t*, but common to all country pairs (such as a trade shock that affects all countries in a particular year). ν_{ij} is the coefficient of time trends and *t* is a time trend that captures unobserved trending factors. $\mu_{ij,t}$ is a random error term.

The first two explanatory variables represent proxies for the overall economic mass (or size) of the trading partners. Consistent with previous applications of the gravity model, we expect a positive relationship between total GDP and Australian exports, as higher GDP in Australia suggests that more goods are produced and available for export, while higher GDP in the recipient country suggests an enhanced ability to purchase imports (Serlenga and Shin 2007). We expect a negative relationship between total population (POP) and Australian exports, on the basis that a larger population implies greater resource endowment and self-sufficiency, meaning that countries are less likely to rely on international trade. The third explanatory variable is the log of the bilateral exchange rate between Australia and the recipient country, which controls for price effects in the gravity equation (Sologa and Winders, 2001). An appreciation of the exchange rate can be expected to decrease a country's exports to its trading partners; however, there are countervailing effects, such as the positive exchange rate effects of rising export levels. We therefore hypothesize the exchange rate effect to be ambiguous (consistent with Abeysinghe and Yeok, 1998; among others).

Foreign aid-related explanatory variables include the log of Australian aid to the recipient country, and the log of aid from other OECD donors. As discussed in the introduction, in the long-run we expect Australian aid to increase the purchase of Australian goods and services in the recipient country, due toboth direct and indirect effects. We therefore expect a positive relationship between Australian aid and Australian exports to recipient countries. Aid from other donors increases the recipient's foreign exchange holdings, enabling them to purchase goods (and particularly capital goods) from other economies (Chenery and Strout, 1966). However, the same goodwill, demonstration and network effect that promote Australian exports to a recipient of Australian aid could result in aid from other OECD donors crowding

[2] Also captured are multilateral resistance factors which was introduced into the gravity equation by Anderson and van Wincoop (2003).

out (or reducing) Australian exports (F. Nowak-Lehmann D. *et al*., 2009, among others). The effect of aid from other donors on Australian exports could therefore be either negative or positive.

3.2. Data and sources

The data on official development assistance (ODA) disbursements are measured in constant 2012 US Dollars (millions), and are sourced from the OECD Development Assistance Database. The data on Australian exports (in US Dollars) are from the UN COMTRADE database (http://comtrade.un.org/db/) and are deflated using implicit export index prices (2012=100) from Australian Bureau of Statistics. The nominal figures of GDP and total population are from World Development Indicators database, and are deflated using the US GDP deflator (2012=100). The exchange rates used are from UNCTAD (http://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx).

Table 1: Summary Statistics

Variable	Obs	Mean	Std Dev.	Min	Max
Export	578	1.46E+09	6.39E+09	0	8.84E+10
Australian aid	578	4.69E+07	7.18E+07	0	6.06E+08
DAC's aid	578	9.92E+08	1.04E+09	3150000	7.60E+09
Total GDP	578	2.75E+23	1.76E+24	6.34E+17	2.69E+25
Total Pop	578	3.31E+15	6.67E+15	2.27E+12	3.14E+16
Exchange rate	578	0.682342	3.819824	4.64E-05	29.56486
Log of Export	578	8.071199	1.641756	0	11.2473
Log of Australian aid	578	7.471028	1.04951	0	9.083797
Log of DAC's aid	578	8.646781	0.683959	6.498311	9.880721
Log of Total GDP	578	21.95762	1.150382	19.20464	25.1491
Log of Total Pop	578	14.77412	0.949883	12.35549	16.49686
Log Exchange rate	578	1.648427	1.125485	-1.47078	4.33376
Trend	578	17.5	9.819206	1	34
Dummy variable (D) (from 2006, untying)	578	0.235294	0.42455	0	1

4. Econometric Methodology and Estimation Results

4.1 Unit root test

The starting point of our panel cointegration analysis is to conduct unit root tests of the variables in equation (1). We apply two different tests: the first test was introduced by Breitung (2000), and the second was introduced by Choi (2001). The Breitung (2000) test is a member of the group of tests that assume a common unit root process. Breitung (2000) and Westerlund and Breitung (2009) demonstrate that the test has the greatest power and lowest distortion of first generation unit root tests. The Choi (2001) test, which is one of the Fisher-type tests, is a member of the group of tests that assume individual unit root process. The test is nonparametric, less restrictive, and easier to use relative to other tests in its group. Choi (2001) shows that the test outperforms many unit root tests that assume individual unit root process, including another Fisher-type test which was proposed by Maddala and Wu (1999). These tests suit panel data with small number cross-sectional units with large time-series for each cross-sectional unit.

Table (2) reports the statistics of both unit root tests for all variables. An intercept and trend were assumed after examining the graphs. The first-differenced of the series are found to be stationary for all variables, with the exception of log of population, which is stationary when using the Breitung test but non-stationary when using the ADB-Choi test. For the series in level, four variables exhibit unit root (or are non-stationary). Results for log of exports are mixed (the Breitung test statistic indicates unit root, the Choi test statistic does not), while for log of GDP, both tests indicate the series is stationary.

Table 2: Panel unit root test results of the Breitung and ADF - Choi Z-stat

	Breitung		ADF-Choi	
Level	Statistic	Prob	Statistic	Prob
LEXP	0.017	0.51	-3.12***	0.00
LTGDP	-4.11***	0.00	-2.54**	0.01
LTPOP	-1.03	0.85	-0.015	0.49
LEXCH	1.78	0.96	2.10	0.98
LAIDAU	0.38	0.65	-0.20	0.58
LAIDDAC	2.14	0.98	0.84	0.80
First-difference				
ΔLEXP	-12.44	0.00	-18.42***	0.00
ΔLTGDP	-14.72***	0.00	-10.93***	0.00
ΔLTPOP	-2.62***	0.00	2.21	0.99
ΔLEXCH	-7.35***	0.00	-8.24***	0.00
ΔLAIDAU	- -4.29***	0.00	-16.13***	0.00
ΔLAIDDAC	-5.99***	0.00	-16.50***	0.00

*All variables are in logarithms. Breitung and ADF - Choi Z-stat represent the panel unit root tests of Breitung (2000) and Choi (2001) respectively. ***, ** indicates statistical significant at 1%, 5% level respectively. Statistics of the tests are asymptotically distributed as standard normal.*

There are some important caveats that apply in the case of variables found to be stationary in levels. Panel unit root test sometimes generate incorrect results due to the presence of cross-country cointegration or/and cross-country dependence in the error terms (Banerjee, Marcellino and Osbat, 2001; Verbeek, 2004 among others). The rejection of the null hypothesis could also result from the rejection of only one individual country's series in the

panel, while other series in the panel are non-stationary (see Maddala and Wu, 1999; Choi, 2001 among others). Therefore, to clarify these ambiguities, we follow Pesaran (2011) in estimating the proportion of cross-section countries in the panel for which the unit root is rejected. We perform individual unit tests for each country in the panel data for Australian exports, total population and total GDP variables, applying augmented the Dickey-Fuller (ADF) test for both export and GDP variables, while applying the Kwiatkowski, Phillips, Schmidt and Shin (1992) test (usually referred to as KPSS test) for the total population variable.[3] The individual unit root tests statistics are not reported here, but for Australian exports, 14 out of 17 individual countries series exhibit unit root in levels according to the ADF tests (all first-differenced variables are stationary). For GDP, the ADF test statistics indicated that all series of individual countries in levels contain unit root, while first-differences of all series are stationary. For population, 16 out of 17 individual countries series exhibit unit root in levels according to the KPSS test, first-differences of 12 out of 17 individual countries series are stationary.

As a result, we can conclude that all variables in the model are nonstationary in levels, and integrated of order one I(1) in first-differences.

4.2 Panel co-integration test

We adopt the Pedroni (1999, 2004) panel cointegration for the present study, as this is found to be the best performing test by Wagner and Hlouskova (2010). Pedroni (1999, 2004) allows for cross-section heterogeneity in intercepts, coefficients of repressors and deterministic trends. Pedroni (1999, 2004) proposes two sets of statistics for cointegration. The first is called "within-dimension-based statistic or panel cointegration statistic". These are constructed by pooling the autoregressive estimated coefficients of the second-stage regression across cross-sections. The within-dimension statistic are, in turn, divided into two sets of statistics, unweighted and weighted. Each of these statistics (weighted and unweighted) has four test statistics: (i) Panel ν – statistic; (ii) Panel Phillips-Perron type ρ –

[3] The reason for choosing the KPSS test instead of the ADF test is that we found that each series of individual country of the total population variable is stable autoregressive process of order one AR(1) with root near unity, and as demonstrated by DeJong *et al* (1989) and argued by Kwiatkowski, Phillips, Schmidt and Shin (1992), the ADF test do not perform well and often fail to reject the null hypothesis in such autoregressive process even when the series do not in fact contain unit root.

statistic; (iii) Panel Phillips-Perron type $t-$statistic; and (iv) Panel augmented Dickey-Fuller (ADF) type $t-$statistic. The second of the sets of statistics are called "between-dimension or between-group". These are constructed by taking the average of all cross-sections autoregressive estimated coefficients in the panel in the second stage. This set has three test statistics: (i) Group Phillips-Perron type $\rho-$statistic; (ii) Group Phillips-Perron type $t-$statistic; (iii) Group augmented Dickey-Fuller (ADF) type $t-$statistic[4].

Table 3: Results of Pedroni (1999, 2004) panel cointegration test

	Unweighted		Weighted	
Within dimension	Statistic	Prob.	Statistic	Prob.
Panel v-Statistic	-4.79	1.00	-4.15	1.00
Panel rho-Statistic	0.84	0.80	0.56	0.71
Panel PP-Statistic	-17.26***	0.00	-9.189***	0.00
Panel ADF-Statistic	-16.19***	0.00	-9.03***	0.00
Between dimension	Statistic	Prob.		
Group rho-Statistic	1.93	0.97		
Group PP-Statistic	-11.76***	0.00		
Group ADF-Statistic	-9.3***	0.00		

*Note: *** indicates statistical significant at 1% level. Probabilities Panel $v-$statistic is one-sided test, where large positive values indicate rejection of the null hypothesis of no cointegration, whereas large negative values of other remaining statistics indicate rejection of the null hypothesis of no cointegration.*

After a close inspection of the graphs of cross-sections data, we decided to include individual fixed and time trends effects when we applied Pedroni tests to the model. Table (3) shows the empirical results of the Pedroni (1999, 2004) tests. Out of eleven statistics six of them indicate the existence of the long-run relationships between the variables at the 1 percent

[4] Pedroni (1999) demonstrates that the panel-ADF and Group-ADF tests have better sample properties than other test, therefore, there are more reliable.

level of the significance. Overall, we may conclude that there is convincing evidence of cointegration relationships among the variables in the model.

4.3 Estimating the long-run relationship using the Pooled Mean Group (PMG), the Mean Group (MG) and the Dynamic Fixed Effects (DFE)

Since our purpose is to examine the long-run effects of Australian aid and other OECD donor aid on Australian exports we, alternatively, estimate a dynamic version of equation (1) using dynamic panel econometric techniques. The advantage of this approach is that it mitigates endogeneity problems, capturing the effects of both current and past aid disbursements and other explanatory variables on the current volume of exports; as well as incorporating the effects of past export volumes on current export volumes. The approach takes into account heterogeneity across the countries by allowing us to control individual country-and bilateral country pair-specific effects. Thus, our dynamic specification can be written in the following form:

$$y_{ijt} = \alpha_0 + \varphi_{ij} + \eta_t + \kappa t + \sum_{s=1}^{p} \delta_{ijs} y_{ij,t-s} + \sum_{s=0}^{q} \lambda'_{ijs} z_{ij,t-s} + \varepsilon_{ijt} \qquad (2)$$

Where the dependent variable and the explanatory variables (variables included in the vector Z) are described above in equation (1). We add lagged of dependent variables to the right hand side of the equation to take into account persistence of export volumes. By re-parameterization, Equation (2) can be re-written in the following form:

$$\Delta y_{ij,t} = \alpha_0 + \varphi_{ij} + \eta_t + \sum_{s=1}^{p-1} \chi_{ijs} \Delta y_{ij,t-s} + \sum_{s=1}^{q-1} \gamma'_{ijs} \Delta z_{ij,t-s} + \rho_{ij} y_{ij,t-1} + \xi t + \zeta'_{ij} z_{ij,t} + \varepsilon_{1ij,t} \qquad (3)$$

Where

$$\rho_{ij} = -(1 - \sum_{s=1}^{p} \delta_{ijs}) \text{ , } \zeta_{ij} = \sum_{s=0}^{q} \lambda_{ijs} \text{ , } \chi_{ij} = -\sum_{n=s+1}^{p} \delta_{ijn}, s = 1, 2, 3, \ldots\ldots, p-1, \text{ and}$$

$$\gamma_{ij} = -\sum_{n=s+1}^{q} \lambda_{ijn}, s = 1, 2, 3, \ldots\ldots, q-1.$$

By factorisation of the explanatory variables in level, Equation (3) above can be rewritten as a dynamic error correction model. The model, introduced by Stock (1987), is of the form:

$$\Delta y_{ij,t} = \alpha_0 + \varphi_{ij} + \eta_t + \sum_{s=1}^{p-1} \chi_{ijs} \Delta y_{ij,t-s} + \sum_{s=1}^{q-1} \gamma'_{ijs} \Delta z_{ij,t-s} + \rho_{ij} (y_{ij,t-1} - \theta t - \psi'_{ij} z_{ij,t}) + \varepsilon_{1ij,t} \quad (4)$$

Where $\psi' and_{ij} \gamma'_{ij}$ are 1 x 6 row vectors of long-and short-run coefficients, and χ_{ijs} are scalars. $\Delta y_{ij,t}$ is the first difference of the log of Australian exports to the recipient at time *t*; $\Delta z_{ij,t-s}$ is 6 x 1 column vector of the first difference of the log of explanatory variables; and $z_{ij,t-1}$ is 6 x 1 column vector of the log level of explanatory variables. Explanatory variables include: log of total GDP ($TGDP_t$), log of total population ($TPOP_t$), log of bilateral exchange rate (EX_{ijt}), log of Australian aid ($AIDAUS_{ijt}$) and log of OECD DAC aid ($AIDDAC_{ijt}$). The row vector of long-run coefficients, ψ'_{ij}, defines the equilibrium relationships among exports series, $y_{ij,t}$, and repressors series, $z_{ij,t}$. The row vector of short-run coefficients, γ'_{ijs}, relates exports series, $\Delta y_{ij,t}$ to their past and present values of repressors, $\Delta z_{ij,t}$. ρ_{ij} is the error-correction coefficient which measures the speed of adjustment of the exports series, $y_{ij,t}$ toward its long-run equilibrium following a change in repressors series, $z_{ij,t}$. ρ_{ij}<0 points towards the existence of a long-run relationship. As a result, where ρ_i takes a significant and negative value, it is treated as evidence of cointegration between $y_{ij,t}$ and $z_{ij,t}$.

We apply three techniques to estimate equation (4). The first is the dynamic fixed-effects (DFE) model, which assumes that the intercepts differ across the groups (i.e. countries series) but restricts all other slope parameters so that they are equal across groups. This technique removes fixed factors that could impede or facilitate trade between trading partners, which are often difficult to measure and if correlated with the explanatory variables, could result in bias and inconsistent estimates. The downside of the dynamic fixed-effects model is that it could produce misleading estimates if in fact the slope parameters are not identical.

The second technique, the Mean Group (MG) model, was proposed by Pesaran and Smith (1995). This technique imposes no restriction on intercepts and slope parameters. The procedure estimates each group separately using the ARDL framework (Autoregressive Distributed Lag model), and then obtains a simple average of all individual groups estimated

intercepts and slope parameters. Pesaran and Smith (1995) show that the MG technique produces consistent estimates compared to the DFE when intercepts and other slope parameters are not identical across groups.

The third and the final technique is the Pooled Mean Group (PMG) which was introduced by Pesaran *et al.* (1999). The technique assumes that the intercepts, short-run slope parameters and error variances differ across groups, but that the long-run slope parameters are identical. Thus, the technique is an intermediate estimator between the DFE and the MG. To test the hypothesis of long-run slope homogeneity, the Hausman test is used.

4.4 Estimated results of Pooled Mean Group (PMG), Mean Group (MG) and Dynamic Fixed Effect (DFE)

Table 4 reports the results of using PMG, MG and DFE techniques to estimate model (2) using data on Australian exports (the dependent variable), GDP, population, the exchange rate, and aid to recipient countries from Australia and other OECD donors.[5] The Hausman test statistic casts doubt on the MG technique; the error-correction estimate is outside the circle (below -1) which implies no cointegration among the variables of equation (2) in the long-run. We therefore discard the results of this technique as it contradicts the cointegration test results (see subsection 5.2), and rely instead on PMG and DFE estimates. That is to say, we rely on the assumption of homogeneous long-run coefficients.

[5] With exception of DFE that applies fixed-effect estimator, PMG and MG techniques are applied to time-demeaned data (within-transformations of the data were done before applying these techniques). For the sake of comparison, we also applied the techniques on the data before undertaking within-transformation, with the results being similar.

Table 4: Long-run estimates

Technique	PMG	MG	DFE
Log of total GDP	0.16 ***	-1.31	0.10
	(0.05)	(0.78)	(0.16)
Log of total population	-2.79***	58.70	-1.96
	(0.79)	(59.72)	(2.17)
Log of bilateral exchange rate	0.06	-1.59	0.01
	(0.07)	(3.28)	(0.17)
Log of Australian aid	0.27***	2.81**	0.29**
	(0.05)	(1.37)	(0.13)
TREND	0.06***	-1.05	0.05
	(0.01)	(1.07)	(0.03)
Error correction term	-0.64***	-1.58***	-0.61***
	(0.01)	(0.22)	(0.06)
Long-run return on Australian aid	**US$8.4**	**US$8.8**	**US$9.0**
Long-run return on aid from other OECD DAC donors	**US$0.3**	**US$0.8**	**US$0.9**
Hausman test	1.00		1.00
Obs	510	510	510

Notes: The dependent variable is log Australian exports to Asian countries. Robust standard errors are parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% respectively.

We estimate PMG, MG and DFE techniques with three lags. The long-runs average returns on Australian ODA and other donors are calculated according to the following formula: $\frac{\partial X}{\partial Y} = \beta_i x \frac{X}{Y}$; β_i denote the coefficients for the variables log Australian aid log ODA's aid; X denotes the average of exports series; Y denotes the averages of Australian aid series and of OECD DAC aid series. These coefficients are taken from Table (4) and averages from the Table (1). Endogeneity is not considered an issue when estimating long-run coefficients, as shown by Pesaran (1997).

Results from the PMG and DFE estimates are statistically significant and positive for aid from both Australia and other OECD donors. In dollar terms, $1 of Australian aid increases Australian exports by $8.4 according to the PMG estimates, and by $9.0 according to the DFE estimates. In the case of aid from other OECD donors, $1 of aid increases Australian exports of $0.3 according to the PMG model, and $0.9 according to the DFE model. This suggests that aid money from other OECD donors has a positive effect on Australian exports to these countries. Other remaining variables have expected signs, although results are not always statistically significant. The relationship between exchange rates and exports is positive but not statistically significant.

4.5 Estimating the long-run relationship using Dynamic Ordinary Least Squares (DOLS)

Another technique we use to estimate the long-run relationship between Australian aid, aid from other donors, and Australian exports to Asian countries, is called fixed-effects panel Dynamic Ordinary Least Squares (DOLS) — a technique first developed by Stock and Watson (1993). This model is especially suited to variables that cointegrate (by selecting appropriate lags and leads, endogeneity and serial correlation biases can be reduced substantially). The fixed-effect panel DOLS estimator used below is shown by Kao and Chiang (2000) to outperform both ordinary least squares (OLS) and fully modified OLS (FMOLS). An added advantage of using DOLS is that it can be used with Driscoll and Kraay's (1998) estimator, which produces heteroskedastic- and autocorrelation-consistent standard errors that are robust to general forms of cross-sectional dependence and autocorrelation. In the previous section, we had assumed cross-sectional independence across countries — an assumption that may be inappropriate. DOLS used with Driscoll and Kraay's (1998) estimator is our preferred model as a result.

The fixed-effects panel DOLS estimator is in the following form:

$$y_{ij,t} = \beta_0 + \omega_{ij} + \pi_t + \psi'_{ij} z_{ij,t} + \sum_{s=-q}^{q} \gamma'_{ij,|s|} \Delta z_{ij,t-s} + \varepsilon_{ij,t} \qquad (5)$$

Where Δ denotes the first difference, y denote the dependent variable and is the logarithm (log) of exports (at constant 2012 US$) from Australia (denoted by i) to the recipient country (j) in period t. Δz_{ij} is the vector of the first difference of explanatory variables that includes the log of total GDP ($TGDP_t$), the log of total population ($TPOP_t$), the log of bilateral exchange rate (EX_{ijt}), the log of Australian aid ($AIDAUS_{ijt}$), the log of aid from other OECD DAC donors ($AIDDAC_{ijt}$), the log of Australian aid*post2006 (a dummy variable that = 0 if year < 2006 and =1 if year => 2006) and time trend. ω_{ij} is a time-invariant fixed effect, π_t is a year-specific effect, and ε_{ijt} is a random error term.

4.6 Estimated results of Dynamic Ordinary Least Squares (DOLS)

Table (5) presents the estimates using DOLS with two leads and four lags. In columns (1) and (2) we used data from the entire period (1980 to 2013), whereas in columns (3) and (4) we divided 1980-2013 period into two periods: one before 2006, and one from 2006. This is done in order to test the impact of the Australian government's decision to untie Australian aid from the purchase of Australian exports of goods and services. The DOLS fixed-effects estimates in column (1) and (3) do not take into account cross-sectional dependence issues; however, the Breusch-Pagan LM test for cross-sectional independence indicates that errors in equations (1) and (3) exhibit substantial cross-sectional correlation. We therefore reproduced the estimates using the Driscoll-Kraay technique in columns (2) and (4) in order to address the issue (again, this is our preferred model).

The estimates for the whole period (1980 to 2013) presented in columns (1) and (2) point to a statistically significant and positive relationship between Australian aid and Australian exports. Results in these columns indicate that in the long-run $1 of Australian aid on average increases exports by $6.0 (for column (1)) when using fixed effects DOLS, and by $7.1 (for column (2)) when applying the Driscoll-Kraay technique to DOLS.

By estimating an interaction term (log of Australian aid*post 2006) — the year in which the Australian government abolished the longstanding practice of tying its aid to Australian exports of goods and services —we were able to check for any differences in the relationship between aid and exports over these two periods. We found none. The interaction term is

statistically insignificant, which suggests that the long-run relationship between Australian aid and Australian exports is not different as a result of the untying of the aid program. Another way to examine the effect of the untying of the Australian aid program is to compare the pre-2006 and 2006-onwards periods in order to see if there was a significant change in the relationship between Australian aid and exports. This would generally be considered unnecessary, given the failure to establish statistical significance for the interaction term (log of Australian aid*post2006); however, we undertook the analysis in any case.

Our findings when examining the pre-2006 and 2006-onwards period strengthen our confidence in the hypothesis that untying of the Australian aid program has not changed the relationship between Australian aid and Australian exports to Asia. Using our preferred method, which involves applying the Driscoll-Kraay technique to DOLS in order to addresses cross-sectional dependence issues, there is almost no difference between the pre-2006 and 2006-onwards period. Table (5) shows that there is a positive and statistically significant relationship between Australian aid and exports in both periods. In dollar terms, $1 of Australian aid led to an increase in exports on average over the long-run of $6.8 pre-2006, and $6.5 thereafter. Given the minimal difference, and the statistically insignificance of the interaction term, we can conclude that the relationship between Australian aid and exports was unaffected by untying of the Australian aid program.

Table 5: The long-run estimates of DOLS

	(1) DOLS (with FE)	(2) DOLS (with) D-K	(3) DOLS (with FE)	(4) DOLS (with) D-K
Log of total GDP	0.366	0.701***	0.221	0.783**
	(0.414)	(0.128)	(0.416)	(0.312)
Log of total population	-2.604**	-1.950	-3.083**	-2.059
	(1.292)	(1.510)	(1.300)	(1.850)
Log of bilateral exchange rate	-0.045	-0.017	-0.036	-0.036
	(0.151)	(0.135)	(0.151)	(0.141)
Log of Australian aid (1980-2013)	0.193**	0.228**		
	(0.090)	(0.085)		
Log of Australian aid*post2006 (= 0 if year < 2006 and =1 if year => 2006)			-0.261	-0.048
			(0.185)	(0.042)
Log of Australian aid (if year <2006)			0.264***	0.219**
			(0.094)	(0.082)
Log of Australian aid (if year =>2006)			0.003	0.171**
			(0.196)	(0.076)
Log of aid from other OECD donors (Australia excluded)	1.117***	1.004***	1.156***	1.087**
	(0.203)	(0.309)	(0.203)	(0.396)
Trend	0.059	0.005	0.156**	0.010
	(0.053)	(0.025)	(0.077)	(0.057)

Long-run return on Australian aid				
For the whole period	**US$6.0**	**US$7.1**		
Long-run return on Australian aid				
for pre-2006			**US$8.2**	**US$6.8**
Long-run return on Australian aid				
for 2006+			**US$6.3**	**US$6.5**
Long-run return on other OECD				
bilateral aid (Australia excluded)	US$1.6	US$1.5	US$1.7	US$1.6
Country fixed effects	yes	yes	yes	yes
Year fixed effects	yes		yes	
Modified Wald test for groupwise heteroskedasticity	1818***		2118***	
Breusch-Pagan LM test of independence	582.4***		549.3***	
R^2 (within)	0.62	0.59	0.63	0.61
Obs	459	459	459	459

Notes: The dependent variable is log of Australian exports to Asian countries. Models (1) and (3) were regressed using DOLS with Fixed-effects technique; while Models (2) and (4) were regressed using Driscoll-Kraay (D-K) with Fixed-effects technique. DOLS estimations were conducted using 2 leads and 4 lags. ***, ** and * indicate statistical significance at the 1% %5 and 10% respectively. Standard errors are reported in parentheses. The long-run average returns on Australian aid and other OECD DAC donors' aid are calculated according to formula:

$$\frac{\partial X}{\partial Y} = \beta_i x \frac{X}{Y} \ for\ the\ whole\ period;\ and\ = \beta_j \frac{X}{Y} + \beta_k x\, D\ x \frac{X}{Y}\ ,\ D = 0\ if\ year < 2006\ and$$
$$D = 1\ if\ year = > 2006;$$

β_i denote the coefficients for the variables log of Australian aid and log of OECD DAC aid (for the whole period); β_j denotes the coefficient for Log of Australian aid (if year < 2006) and β_k denotes the coefficient for Log of Australian aid*post2006. X denotes average Australian exports to recipients; Y denotes average Australian aid and OECD DAC aid to recipients; D is the average of the dummy variable. These coefficients are taken from Table (5) and averages from Table (1).

Table 5 also presents results on the impact of foreign aid from other (non-Australian) OECD donors on Australian exports to recipient countries. In columns (1) and (2), the elasticities of aid from other OECD donors on Australian exports are positive and statistically significant at the 1% level in both models. In dollar terms, $1 of aid led to an increase in Australian exports of $1.6 in column (1), and $1.5 in column (2). The estimates presented in columns (3) and (4) produce similar results. These results support the hypothesis that aid money from other OECD countries increases the foreign exchange holdings of recipient countries (both directly and indirectly), thereby enabling them to purchase goods and services from Australia. Furthermore, this effect must outweigh any substitution effect that re-directs recipient country purchases from Australian export to those of other OECD donors.

With regards the estimated coefficients of the remaining explanatory variables, all have the signs we would expect. The total GDP of both Australia and the recipient is positively related to Australian exports, and at a statistically significant level in columns (2) and (4) (these results use the preferred Driscoll-Kraay (D-K) technique). This supports our hypothesis that higher GDP in recipient countries increases demand for Australian exports, while higher GDP in Australia implies higher level of production of goods and services (which in turn may be available for export). Total population of both Australia and each recipient country has a negative relationship with Australian exports, which is again, what we would expect. This indicates increased self-sufficiency and less dependence on international trade where populations are higher. These results are statistically significant (at the 10 percent level) in the first and third column, but not statistically significant in the second and fourth column. The estimated coefficients of bilateral exchange rates are positive. However, the result is not statistically significant so cannot be used with any confidence to support the hypothesis that a lower Australian dollar increases exports.

4.7 Testing the causality of the relationship between aid and exports

The mechanisms through which foreign aid can result in higher exports from the donor to the recipient country were outlined in section one. It is also conceivable that causality runs in the opposite direction, with exports causing the level of foreign aid. This might occur as a result of lobbying by exporters, and could involve the donor rewarding a country for the purchase of its exports, or alternatively, using aid to cement a pre-existing relationship (McGillivray and Morrissey, 1998). Testing the direction of causality is therefore important if we are to be confident in our conclusions that foreign aid leads to higher exports.

The analysis presented so far has confirmed a positive relationship exists between Australian aid and Australian exports to recipient countries in Asia, and between aid from other OECD donors and Australian exports in the same countries. The analysis presented below suggests that causality is likely to run from foreign aid to exports, or that foreign aid results in higher exports from Australia (although we also find causality runs in the opposite direction as well). We use a Granger causality test to confirm this hypothesis for Australian aid.[6]

The Granger causality test is used as is standard in the literature in order to explore the causality of the aid-export relationship. Having established that there is evidence of long-run equilibrium relationship among series of the model (1), we implement the Granger causality test using a panel-based error correction model to examine the long-run causality between Australian aid and Australian exports to Asian countries. We apply the two-step procedure of the Engle and Granger (1987). First, we estimate the long-run model (i.e. Equation (1)) in order to obtain the estimated residuals, $\mu_{ij,t} = y_{ij,t} - \beta_0 - \omega_{ij} - \pi_t - \nu_{ij}t - \psi'_{ij}z_{ij,t}$ (error correction term ECT henceforth). Second, we estimate Granger causality model (i.e. models (6) and model (7).

$$\Delta y_{ij,t} = \alpha_1 + \nu_{ij1} + \varphi_{ij1}t + \sum_{s=1}^{q}\gamma'_{1s}\Delta y_{ij,t-s} + \sum_{s=1}^{q}\gamma'_{1s}\Delta z_{ij,t-s} + \rho_{1ij}\, ECT_{ij,t-1} + \varepsilon_{1ij,t} \quad (6)$$

$$\Delta x_{ij,t} = \alpha_2 + \nu_{ij2} + \varphi_{ij2}t + \sum_{s=1}^{q}\gamma'_{1s}\Delta y_{ij,t-s} + \sum_{s=1}^{q}\gamma'_{2s}\Delta z_{ij,t-s} + \rho_{2ij}\, ECT_{ij,t-1} + \varepsilon_{1ij,t} \quad (7)$$

For the long-run Granger causality test, we perform standard t-tests on the estimated coefficients of the error correction terms in eq (6) and eq (7): we test $H_0 : \rho_{1ij} = 0$ against $H_0 : \rho_{1ij} \neq 0$ in Eq (6) and $H_0 : \rho_{2ij} = 0$ against $H_0 : \rho_{2ij} \neq 0$ in Eq (7).

Table (6) presents the results of Granger causality test. For equation (6), t-statistic of the test for the error correction term indicates that there is strong evidence of long-run causality that is positive and which runs from Australian ODA to Australian exports. For equation (7), the

[6] We do not employ Granger causality test to analyse the relationship between foreign aid from other donors and Australian exports, as we can think of no reason why Australian exports would result in higher levels of foreign aid from other OECD donors.

t-statistic of the test for the error correction term suggests that there is evidence of long-run Granger causality that runs from Australian exports to Australian ODA.

Table 6: Panel causality test results

	Dependent variable: Δy		Dependent variable: Δx	
	Coefficient	t-statistic	Coefficient	t-statistic
ECT_{t-1}	-0.51***	-4.56	-0.17**	-2.10

*Note: *** and ** indicates statistical confidence at the 1% and 5% level respectively. Three lag are assumed in both model (5) and (6).*

We can therefore conclude that causality runs in both directions. There is strong evidence that Australian aid Granger-causes Australian exports, while at the same time, there is evidence that Australian exports Granger-cause Australian aid.

5. Discussion

5.1 Australian aid

The findings presented in the previous section show that in the long-run, Australian aid has positive and significant impacts on Australian exports to Asian countries. In our preferred model, estimates suggest that $1 of Australian aid led to an average increase in Australian exports of $7.1 to Asian countries over the long-run in the period in question (i.e. 1980 to 2013). Subsequent Granger causality analysis confirms that causality runs in both directions, meaning that foreign aid does Granger-cause exports, and that the relationship does not only exist due to Australia allocating more aid to countries that purchase Australian exports.

The extent of the effect that aid has on exports in our models is significant, and greater than studies of aid and exports from other countries that use similar methods (Nowak-Lehmann *et al.* 2009 and Zarin-Nejadan *et al.* 2009). The strong link between aid and exports for Australia is consistent with the findings of Wagner (2003), who concluded that Australian aid and exports were more closely linked than in the case of any other OECD donor country, with the sole exception of New Zealand. At the same time, our results suggest that aid leads to an even higher level of exports than estimated by Wagner. This can be explained due to

our use of dynamic panel econometric techniques, which allows us to focus on the long-run, whereas Wagner's analysis considers only short-run effects. The long-run effects that we estimate are cumulative, meaning our results should provide a better measure of the total effect of aid on exports, while also being higher than those of a short-run analysis (Greene 2003). In addition, we hypothesize that our result is partly explained by the sample we use; Australia is an open economy and has deep trade links with Asian countries to which it also provides aid — a point of difference with European donors that largely provide aid to sub-Saharan African countries.

The scale of the effect that we estimate also highlights the importance of the indirect mechanisms discussed in section 2.1. The use of Australian aid to purchase exports from Australia cannot explain the extent to which aid is estimated to Granger-cause exports. Other indirect mechanisms, including impacts on economic growth (and income), goodwill effects, network and linkage effects, and demonstration effects, must be responsible for the bulk of the aid-trade relationship.

5.2 Untying of Australia's aid program

Indirect mechanisms explain another important finding. The modelling results presented in section 4 suggest that the Australian government's 2006 decision to untie its aid program from domestic procurement requirements has not affected the impact of Australian aid on Australian exports to Asia. This result is likely to come as a surprise to some: a recurring discussion in Australia has seen arguments made in favour of re-tying Australian aid to Australian products. Our findings demonstrate for out sample that there are no additional benefits to Australian exporters from tying aid.

There are a number of explanations for why the decision to untie Australian aid has not adversely affected Australian exports to those countries. One is that untying of the aid program has had no impact on the award of contracts, with Australian companies (and NGOs) continuing to receive the bulk of contracts. There is some evidence to support this. OECD data shows that in 2007, just after the untying of the aid program, 95.82% of Australian aid contracts by value were awarded to companies based in Australia. In 2014 after 8 years of the policy being in effect, that figure had declined, but only very modestly, to 89.69%. The modest decline in this figure is likely due to advantages enjoyed by existing

(Australian-based) contractors, which we expect would include better information and knowledge of the aid program, established networks and relationships, and track record.

That said, this can only be a small part of the explanation for why the decision to untie Australian aid has not adversely affected Australian exports to those countries. As already discussed, the more important explanation is the fact that indirect mechanisms linking aid and trade — including long-run macroeconomic impacts, goodwill effects, network and linkage effects, and demonstration effects — are more important than direct mechanisms (through which aid is used to directly purchase exports). The latter can only explain a very small part of the $7.1 export 'return' that Australian aid generates. We can therefore conclude that the focus on tying aid to exports is not only harmful to aid effectiveness (as has been firmly established in the literature), but is also a distraction. Aid's impact on exports is much more significant than the use of aid funds to directly purchase exports; tying of aid appears to have no impact on exports from Australia to Asia.

5.3 Aid from other OECD donors

The paper also examined the impact of aid from other OECD DAC donors on Australian exports to Asia. Contrary to the findings of a number of other studies (Martinez-Zarzoso e*t at*. 2009; Nowak-Lehmann D e*t al*. 2009; Zarin-Nejadan 2008), but consistent with Otor (2014), we found that aid from the other donors has positive and statistically significant impacts on Australian exports. An explanation for this is macroeconomic: aid money from other OECD DAC countries increases economic growth and foreign exchange holdings in the recipient country, thereby facilitating the purchase of goods from Australia. This effect would appear to outweigh any 'substitution' effect associated with aid from other donors. We are of the view that our sample may explain why our result differs to the study above. Australia (and in the case of Otor's 2014 study, Japan) is deeply integrated into Asian markets, to an extent far greater than that of European donors in Sub-Saharan Africa. Further research is needed to confirm this hypothesis.

6. Conclusion

This paper has examined the long-run effects of foreign aid on donor exports to recipient countries, using Australian exports to Asia as a case study. In doing so, it addresses clear gaps in the literature. There has only been one previous study on the relationship between foreign aid and Australian exports that used econometric techniques, and that uses data from before 1992. There has also been no study to date of the effects on Australian exports of the 'untying' of the Australian aid program from domestic procurement requirements — an issue that remains topical and will be of particular interest to policy makers in Australia.

The relationship between official development assistance (ODA) and Australian exports to 17 Asian countries between 1980 and 2013 was explored using dynamic panel econometric techniques and the Gravity Model of international trade. The focus on aid and exports to Asia limits the scope of the study, but was unavoidable given data constraints and our focus on long-run impacts. Use of these sophisticated econometric techniques had a number of benefits over those used in previous studies, including robustness to estimation issues such as endogeneity, omitted variable bias, and measurement error. The use of Granger causality tests allowed us to establish the direction of causality, confirming that our results are not simply the product of the donor rewarding higher exports with increased aid allocations.

Our estimates lead us to a number of conclusions. First, Australian aid to Asian countries results in higher levels of Australian exports in the long-run. In our preferred model, $1 of Australian aid leads to an average long-run increase in Australian exports of $7.1 to recipient countries. We present strong evidence that this relationship is based on aid leading to higher levels of exports; or in other words, that Australian aid Granger-causes Australian exports. Furthermore, the scale of the impact of Australian aid on exports points to the importance of indirect mechanisms in explaining this effect, given that direct mechanisms (such as use of Australian aid to purchase exports from Australia) can only explain a small part of the effect. Indirect mechanisms include (i) macroeconomic impacts (and their effect on foreign exchange holdings), (ii) goodwill effects (aid may generate goodwill in the recipient country, leading to purchase of products from the donor), (iii) the creation of networks and linkages between the two countries; and (iv) demonstration effects, or the promotion of donor products by aid programs (whether implicit and explicit).

Second, aid from other OECD DAC donors also increases Australian exports to recipient countries. In our preferred model, estimates suggest that in the long-run, $1 of OECD aid increased Australian exports to Asian countries by $1.5 on average over the 1980 to 2013 period. This finding runs counter to those of both Martinez-Zarzoso *et at.* (2009) and Nowak-Lehmann D *et al.* (2009) for Germany, and Zarin-Nejadan (2008) for Switzerland, but is consistent with the findings of Otor (2014) for Japan. We suspect that this is the result of our sample, given Australia's (and in the case of Otor (2014), Japan's) deep integration into Asian markets. Our results can be explained with reference to both this and to macroeconomic impacts of aid in recipient countries.

Third, (and related to our first conclusion, above), there is no evidence that untying of the Australian aid program has (a) adversely affected Australian exports, or (b) reduced the impact of Australian aid on Australian exports. Our sample period (1980-2013) covers both a period (pre-2006) in which the Australian aid program was tied to use of Australian contractors, and a period (from 2006) in which it was not. Our results hold across both periods, with no reduction in impact in the 2006-onwards period. This can partly be explained by the limited impact untying has had on aid contracting (most contracts continue to be awarded to firms based in Australia in the post-tying period). A more important explanation, however, is that in the long-run the indirect mechanisms through which aid affects exports (listed above) are more significant than the direct effects (use of aid to purchase exports).

This final conclusion calls into question periodic discussion in political circles of the benefits to Australia of tying Australian aid to Australian contractors. Even in a context where the national interest has been given greater emphasis by the Australian government, our results show that the 'tying' debate is, at best, a distraction. At worst, we wouild argue that it is the result of rent-seeking behaviour that is of no benefit to Australian exporters as a group, while at the same time being detrimental to the effectiveness of aid's poverty-alleviation objectives. Simply put: aid increases exports more significantly through other (non-tying) channels.

Our analysis further demonstrates that Australia's aid program is already serving Australia's commercial interest through its impact on exports. This should come as good news to a government intent on showing the national benefit of Australia's foreign aid program.

7. References

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