Aid and Trade: How Does Canadian Official Development Assistance Affect Canadian Exports? An Empirical Analysis[⊥]

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Ottawa, July 27, 2026

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The authors would like to thank Paul Farran, Director of Policy and Advocacy at Cooperation Canada, for providing comments on earlier drafts of the study.

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1. Introduction

Canada's international engagement reflects a longstanding commitment to advance its values and interests through diplomatic engagement, expansion of commercial relationships and international development programming. Supported by Official Development Assistance (ODA), international development programming can serve as a highly effective tool of Canada's soft power. Given growing interest in a trade-development nexus (TDN) in Canada and other donor countries (Tomlinson, 2026), this paper updates the analysis in Bhushan and Siauw-Soegiarto (2017) and examines the empirical relationship between Canada's bilateral ODA and Canadian exports.

ODA's main objective is to support poverty reduction in developing countries. Canada's ODA Accountability Act (ODAAA), which came into force in 2008[1], ensures that aid "is provided with a central focus on poverty reduction and in a manner that is consistent with Canadian values, Canadian foreign policy, the principles of the Paris Declaration on Aid Effectiveness on March 2, 2005, sustainable development and democracy promotion and that promotes human rights standards."[2] The Act further mentions that ODA must contribute to poverty reduction, take into account the perspectives of the poor and be consistent with international human rights standards. Former Liberal Member of Parliament, John McKay, who was the architect of this law, has recently warned that Canada's new approach to tie foreign aid to trade goals carries the long-term risk of deviating aid from its core objective of poverty reduction despite yielding short-term benefits. He further described the government's new approach as a more sophisticated version of tied aid.[3]

Both international development and international trade are at major inflection points. With 2030 approaching, a widening financing gap has put Agenda 2030 and the Sustainable Development Goals (SDGs) out of reach. The 'billions to trillions' agenda – the leveraging of limited public funds to attract large-scale private investments – to close the SDG financing gap has not materialized (World Bank Group, 2015). Canada, like many other major donors recently, announced in its November 4, 2025, budget that it will reduce aid spending by CAD $2.7 billion over 4 years. Preliminary data from the Development Assistance Committee (DAC) of the OECD indicates a decline of 23.1% in ODA in 2025 from DAC members and associates, the largest decline on record.[4]

[1] The ODAAA has been amended to address reporting requirements and to align Canada's aid reporting with the OECD definition of ODA (see https://cooperation.ca/odaaa-guide/) but the core objective of ODA remains poverty reduction.

[2] See https://laws-lois.justice.gc.ca/PDF/O-2.8.pdf (Accessed on May 15, 2026).

[3] See https://www.canadianaffairs.news/2026/03/29/canadas-shift-toward-linking-aid-and-trade/. (Accessed on May 18, 2026).

[4] See https://www.oecd.org/en/data/insights/data-explainers/2026/04/a-historic-decline-in-foreign-aid-preliminary-2025-oda-data.html (Accessed on May 18, 2026).

From a trade perspective, the post-World War II rules-based trade system that allowed countries to integrate into global value chains (GVCs) and benefit from export-led growth is fracturing under the weight of geopolitical fragmentation and rising protectionism. Geopolitics, technology and policy (protectionism and economic nationalism) are reshaping the patterns of trade and testing the resilience of GVCs (Samy, 2026a). As argued by Rodrik (2015), this makes it more difficult for developing countries to participate in GVCs, diversify their economies and benefit from international economic integration.

From Canada's perspective, its trade dependence on the United States means that it must expand trade with other countries, especially emerging and developing countries, to shield itself from United States protectionism, tariffs and an unpredictable United States trade policy. Over the period 2016 to 2024, the share of Canadian merchandise exports to the United States varied from about 73 to 77 percent. It declined by nearly 4 percentage points in 2025 as a result of United States tariffs and a switch to other markets, but remains over 70 percent. At the same time, trade is a key component of Canada's economic performance, representing two-thirds of GDP and supporting roughly one in five jobs (Government of Canada, 2025a). The current Canadian government has set a goal of doubling its non-US exports by 2035 (Government of Canada, 2025b).

Understanding how these two domains—international development (supported by ODA) and international trade—interact is therefore of significant analytical and policy relevance. Thus, this paper examines the empirical relationship between Canadian ODA and Canadian exports to developing countries.[5] This issue is important for a few reasons.

First, much of the existing literature has tended to focus on the impact of aid on recipient countries, using various methodological approaches that include macroeconomic studies of aid on growth and development outcomes using econometric analysis; micro-level evaluations; and country-case studies. Existing research has long recognized the tension between the altruism and strategic self-interest of donors (Morgenthau, 1962; Alesina and Dollar, 2000) while making the case for ODA on moral, humanitarian and development grounds. Comparatively, however, and since the main objective of ODA is poverty reduction in recipient countries, fewer studies (e.g. Bhushan and Siauw-Soegiarto, 2017, for Canada; Nowak-Lehmann et al., 2009, for Germany) consider the impact on donor countries. This paper thus fills an important knowledge gap, especially in the Canadian context.[6]

[5] Our focus in this paper is on donor exports, but aid can generate other economic, political and security benefits for donors, such as access to natural resources, investment opportunities, and soft power and influence in international forums.

[6] Other than the paper by Bhushan and Siauw-Soegiarto (2017), we are not aware of other empirical studies for the Canadian case.

Second, interest in a TDN is growing in Canada and other donor countries (Tomlinson, 2026), and current political leadership is pushing an agenda for promoting Canadian exports through international assistance. This is also directly connected to aid for trade, whose objective is "to help developing economies, including least developed countries, tackle trade-related obstacles, strengthen their capacity to trade and build the infrastructure they need to integrate into the international trading system." [7]

If aid indeed contributes to poverty reduction and development in recipient countries through their own exports and other channels, while also increasing exports from donor countries, it creates a win-win situation. At a time when the Canadian aid budget is being significantly reduced, this would provide evidence to Canadian taxpayers and policymakers that ODA is a good investment that can contribute to Canada's goal of trade diversification. Aid spending can thus contribute to a TDN to the extent that trade and investment are seen as effective and strategic tools for promoting development and poverty reduction. While pushing for a poverty aligned TDN, there is room to also support non-TDN ODA expenditures.

Examining the relationship between aid and exports can also help us reflect on tied aid, a practice that Canada has largely moved away from, and in alignment with international development norms by organizations such as the Organization for Economic Co-operation and Development (OECD) DAC. Informally, there are some indications that Canada is moving back into this direction.

Finally, this issue carries significant implications for public policy. If Canadian ODA is shown to stimulate export growth, it could justify a more integrated approach to trade and development policy, one that prioritizes mutually beneficial economic growth alongside core development and humanitarian goals. Conversely, a weak or inconsistent relationship would indicate that Canadian aid operates independently of commercial interests, driven strictly by altruistic and moral objectives. Current modalities for delivering Canadian aid, especially through the multilateral system (that is, the UN system) and civil society organisations would reinforce the latter.

At a time of heightened fiscal scrutiny, understanding this relationship can help policymakers make more informed decisions about both aid allocation and Canada's broader international economic strategy. By providing empirical clarity on the Canadian case, this paper provides critical insights into the country's evolving approach to ODA and its ongoing pursuit of trade diversification.

[7] See https://www.oecd.org/en/data/dashboards/aid-for-trade.html. (Accessed on May 20, 2026).

2. Methodology and Estimation Strategy

This paper uses statistical inference as the sole methodology due to the complexity and data requirements of direct approaches such as process tracing or forensic accounting. The latter are highly effective empirical methods for mapping discrete institutional decisions and establishing a decision-by-decision causal mechanism, akin to observing a game of billiards. However, evaluating the aggregate commercial elasticity of official development assistance necessitates statistical inference. The inherent fungibility of foreign aid flows, combined with the multi-tiered complexity of international supply chains, render direct "billiard-ball" causality tracking structurally infeasible.[8] This is because, beyond merely tracing the flow of capital, an investigator would also need to prove intentional reciprocity – a near-impossible task given the complex, and often competing, incentive structures governing principals and agents.

Consequently, this analysis employs lagged econometric models to capture systemic, macro-level shifts in bilateral trade that emerge following bilateral ODA disbursements. The design allows us to bypass multiple layers of missing and opaque data, immeasurable micro-level behaviours, and potentially competing interests; thus, focusing on the starting (ODA disbursement) and end (Canadian exports) points of the research question, testing whether ODA does flow through the unmeasurable intermediate steps and into the capturable/measurable downstream variable – Canadian exports. Thus, it allows us to evaluate whether ODA is correlated with donor exports, and the additional lag mechanism enables us to systematically address endogeneity and reverse causality. Together, this allows us to state "Mathematically, a change in A causes B to change" in a predictive manner rather than in the "billiard ball" sense of causality.

2.1 Estimation Strategy

Several mechanisms may underpin a positive relationship between ODA and exports, which is our main interest in the current paper. Aid can relax supply-side constraints in recipient countries by improving infrastructure, strengthening institutions, and fostering human capital development, thereby increasing their capacity to import. By helping build relationships and understanding of how to operate in foreign markets, aid may also reduce informational and transaction barriers faced by Canadian firms or deepen diplomatic and commercial ties that facilitate market access.

We use a gravity model of trade estimated on panel data from 1989 to 2024 to examine this relationship. The gravity framework, which relates bilateral trade flows to economic mass and

[8] "Fungibility" merely reflects the macroeconomic reality that a sovereign country may divert scarce domestic fiscal resources to other priorities if it receives targeted aid for originally intended projects. For instance, if a government originally budgets $1,000 for a new irrigation network but receives $200 in aid for that specific project, it may reallocate $200 of its domestic revenue to build new schools. That newly freed $200 may or may not be spent in a way that benefits the donor state's commercial interests.

trade costs, provides a well-established foundation for analyzing trade determinants and for incorporating policy variables such as aid flows. By exploiting variation across country pairs and over time, we identify whether, and to what extent, Canadian aid is associated with subsequent export performance, controlling for standard factors such as GDP, distance, and other bilateral characteristics. At the same time, concerns about reverse causality and omitted variable bias underscore the need for a careful empirical strategy, which the gravity model and panel structure help address by including fixed effects and time-varying controls.

In standard economic terms, a gravity model assumes that the volume of trade between two nations is driven by their economic "mass" (Gross Domestic Product [GDP]) and hindered by the physical distance between them. By adding Canadian ODA to this equation, we can isolate how aid flows alter baseline trade expectations. This is expressed as the following equation, which mimics the equation of interest presented by Bhushan and Siauw-Soegiarto (2017):

$$\ln X_j = \beta_0 + \beta_1 \ln GDP_{CA} + \beta_2 \ln GDP_j + \beta_3 \ln Pop_j + \beta_4 \ln Dist_{CAj} + \beta_5 FTA\_TWO_{CAj} + \beta_6 ComLeg_{CAj} + +\beta_8 ODA_j + \varepsilon$$

X_j denotes Canada's exports to country j. [9]
GDP_{CA} denotes the GDP of Canada.
GDP_j denotes the GDP of country j.
Pop_j denotes the size of the population of country j.
$Dist_{CAj}$ denotes the population-weighted distance between Canada and country j.
FTA_WTO denotes whether country j is a signatory FTA partner (1 = yes).
$ComLeg_{CAj}$ denotes whether Canada and country j share the same legal system (1 = yes).
ODA_j denotes the ODA disbursement to country j.

3. Empirical Analysis

We began our empirical analysis by attempting to replicate and update findings presented by Bhushan and Siauw-Soegiarto (2017), specifically the positive association between Canadian bilateral ODA and Canadian exports, which they found for the period 1989 to 2015. Aside from updating the dataset from 2015 to 2024[10, 11], restricted by CEPII's Gravity Model dataset, the OECD updated its ODA definition and calculation in 2018 (OECD, 2026; Zuhr & Garret, 2019). Our

[9] This is log-transformed by the estimation package R. The raw data must not be log-transformed for Pseudo-Poisson maximum likelihood estimation in R.
[10] Due to CEPII's Trade Gravity Model being only available up to 2021 (Conte et al., 2022), this is achieved by assuming slow over-time changes in population-weighted distance between two economies; therefore, carrying over the 2021 values to 2022 and up until 2024.
[11] We also extracted GDP and population data from the World Development Indicators (WDI) database to bridge the CEPII data gap between 2022 and 2024 (World Bank, 2026a, b).

analysis is unaffected, as we continue to use the Net ODA and Gross ODA, which have been updated across the entire sample period and published by the OECD (OECD, 2026).

Table 1 replicates the specifications from Bhushan and Siauw-Soegiarto (2017) and directly compares the historical data (1989-2015) with the results in Table 2, based on the updated dataset (1989-2024). The entire period of analysis includes Canadian ODA to up to 155 partners annually. These baseline models in Table 1 examine the contemporaneous relationship, measuring the impact of ODA deployed on exports in the same year. We use the Pseudo Poisson Maximum Likelihood (PPML) estimator since it produces robust standard errors in the presence of both heteroscedasticity and autocorrelation, and handles 'zero' trade observations.

The baseline estimation in Table 1 for the period 1989-2015 shows a positive and statistically significant contemporaneous relationship between ODA and exports. This indicates that Canadian ODA increased Canadian exports in the same year. Although these results mirror those of Bhushan and Siauw-Soegiarto (2017), they reflect data-scaling and transformation problems, thus creating a spurious correlation between ODA and exports that we observe in Table 1. When we updated the dataset to include the 2016-2024 period, corrected data scaling and transformation errors, and corrected the estimation-strategy error, the contemporaneous relationship became statistically significant and negative (see Table 2), which is contrary to our expectations and to the results presented in Table 1.

For Gross ODA, the coefficient of -0.144 (Table 2, column 3) correlates with an expected decrease of $3.32 in Canadian exports for every $1.00 of Gross ODA. For Net ODA, the coefficient of -0.033 correlates with an expected decrease of $0.76 in Canadian exports for every $1.00 of Net ODA (Table 2, column 4). The addition of the last nine years introduced high volatility, reflecting a period when global trade faced severe disruptions, including those caused by the Covid-19 pandemic, alongside a notable shift in the types of environments receiving Canadian aid.

Specifically, to the extent that more aid was directed to low-income and fragile contexts in recent years, specifically during the 2020~2022 pandemic (see Figure 1), weak purchasing power and limited demand for Canadian imports in these countries may partially explain the negative relationship. Indeed, our calculations indicate that the percentage of gross or net bilateral ODA from Canada to fragile countries peaked over the period 2016-2022, and ranged from 69 to 74 percent.[12]

Additionally, the relationship could reflect reverse causality or underlying conditions rather than a direct causal effect of aid on exports. It should also be noted that the additional data for recent years includes the period when Canada's Feminist International Assistance Policy (FIAP) – which included a target of 50% of bilateral development assistance to sub-Saharan Africa – began to be

[12] We used the list of fragile countries from Cisneros Rosado and Samy (2023). Ukraine was excluded from the calculations because it is an outlier in terms of bilateral aid received in recent years.

implemented. Post-FIAP, there was an increase in the share of bilateral aid allocated to low-income countries around the 2020-2022 pandemic period. This was followed by a sharp drop, and a corresponding increase in the share allocated to upper middle-income countries (see Figure 1).

Despite the problems related to the above estimates (data-scaling, transformation and reverse causality), we argue that there are two possible reasons for the different results between the pre-2015 and the post-2015 periods:

The Decoupling of Growth: In the pre-2015 model, a partner country's GDP was a major driver of Canadian exports (the coefficient ranged from 0.962 to 1.000; see Table 1, columns 3 and 4). In the 1989-2024 model, this economic link decreases to a range 0.453 to 0.552 (see Table 2, columns 3 and 4). This reveals that as developing countries grow wealthier, their new purchasing power is no longer translating into increased Canadian exports. This decoupling is mathematically confirmed by the models' Within R-Squared values. Historically, the dynamic variables in our model (like partner GDP) could explain roughly 21% of the year-to-year variation in Canadian exports. In the post-2015 period, that explanatory power plunges to just 6%. Ultimately, this could suggest that Canadian export growth is increasingly being crowded out by competing interests or cheaper alternatives (e.g., China for infrastructure and consumer goods), rather than growing naturally alongside our partners' economies.

Aid to Fragile States: As discussed earlier, post-2015, bilateral Canadian ODA went increasingly to some of the globe's most fragile and conflict-affected states. While this is a good thing, given that the main objective of ODA is poverty reduction, these environments possess fragmented private sectors that cannot immediately sustain reciprocal trade, leading to a natural divergence between aid distribution and export growth. This pivot was further compounded by a recent series of severe global crises: the deployment of pandemic-era public health aid, the subsequent spike in developing-world public-sector debt, and Russia's invasion of Ukraine. While our structural model explicitly filters out the broad macroeconomic damage from these global shocks, the fundamental decoupling remains clear: when aid is deployed to increasingly difficult contexts, it ceases to function as a driver of Canadian exports.

Table 1: Canadian ODA's Impacts on Canadian Exports, Static PPML Estimations, 1989-2015, No FE								
	(1)		(2)		(3)		(4)	
	World		Non-USA		Gross ODA		Net ODA	
Log Gross ODA					0.064	*		
					(0.037)			
Log Net ODA							0.074	**
							(0.034)	
Log Canadian GDP	0.082	*	0.185	*	- 0.037		- 0.072	
	(0.047)		(0.101)		(0.201)		(0.204)	
Log Partner GDP	1.039	***	0.976	***	1.000	***	0.962	***
	(0.067)		(0.058)		(0.100)		(0.102)	
Log Distance (Pop Weighted)	- 0.689	***	- 0.327		- 0.372	**	- 0.411	**
	(0.190)		(0.247)		(0.188)		(0.182)	
FTA / WTO Dummy	0.747	***	0.413	*	0.296		0.328	*
	(0.231)		(0.212)		(0.191)		(0.186)	
Common Legal System	0.828	***	0.579	***	0.073		0.102	
	(0.155)		(0.187)		(0.207)		(0.214)	
Log Partner Pop	0.008		- 0.013		- 0.041		- 0.034	
	(0.094)		(0.086)		(0.123)		(0.121)	
Constant	- 3.828	*	- 7.742	***	- 2.066		- 0.040	
	(2.046)		(2.410)		(5.002)		(5.087)	
Num. Obs.	4734		4707		3125		3062	
R^2 Adj.	0.989		0.902		0.933		0.914	
Significance level	'***' 0.01; '**' 0.05; '*' 0.10							

Figure 1: Canadian Gross ODA Allocation (in %) by the World Bank Income Classification

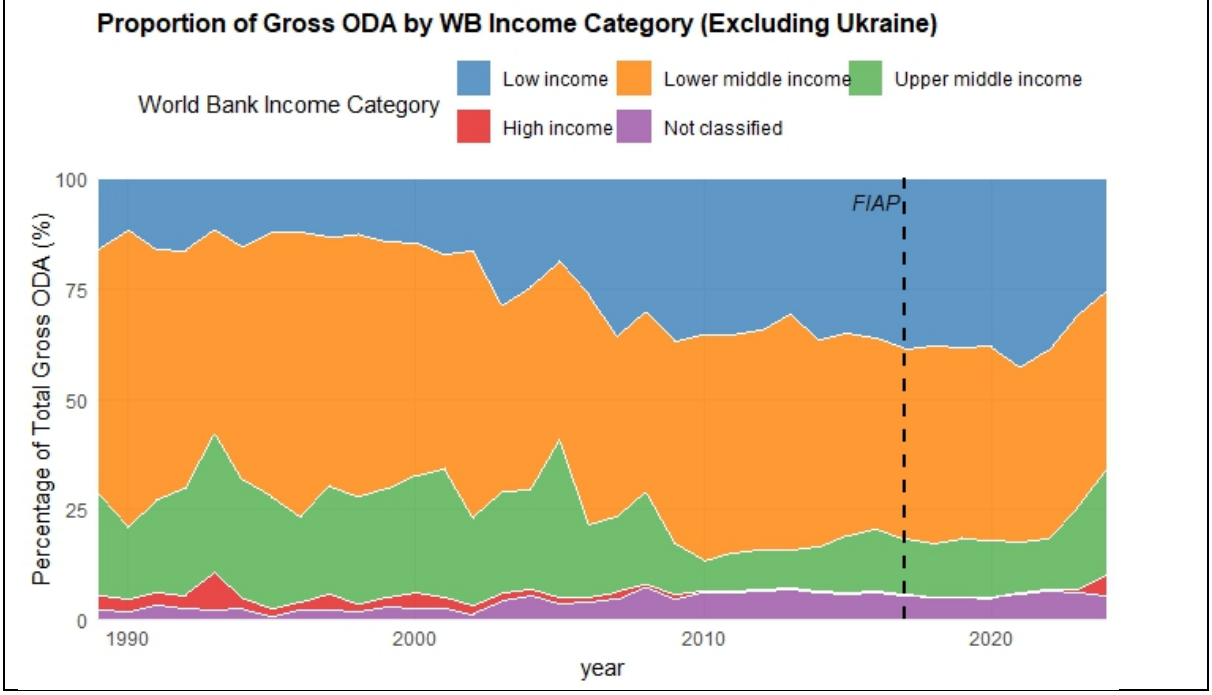

Table 2: Canadian ODA's Impacts on Canadian Exports, Static PPML Estimations, 1989-2024, No FE						
	(1)	(2)	(3)	(4)	(5)	(6)
	World	Non-USA	Gross ODA	Net ODA	Gross, Filtered	Net, Filtered
Log Gross ODA			- 0.144 ** (0.059)		- 0.034 (0.046)	
Log Net ODA				- 0.033 *** (0.004)		- 0.016 (0.038)
Log Canadian GDP	- 0.603 *** (0.128)	- 0.741 *** (0.043)	- 0.508 *** (0.047)	- 0.581 *** (0.080)	- 0.561 *** (0.077)	- 0.565 *** (0.074)
Log Partner GDP	0.528 *** (0.127)	0.727 *** (0.050)	0.453 *** (0.054)	0.552 *** (0.089)	0.538 *** (0.087)	0.541 *** (0.085)
Log Distance (Pop Weighted)	- 1.527 *** (0.206)	- 0.544 ** (0.269)	- 0.514 *** (0.188)	- 0.555 *** (0.176)	- 0.556 ** (0.276)	- 0.558 ** (0.274)
FTA / WTO Dummy	0.296 (0.189)	0.497 *** (0.147)	0.766 *** (0.174)	0.828 *** (0.143)	0.754 *** (0.160)	0.755 *** (0.163)
Common Legal System	0.773 *** (0.250)	0.490 (0.317)	- 0.361 (0.288)	- 0.019 (0.198)	0.059 (0.233)	0.049 (0.229)
Log Partner Pop	0.606 *** (0.109)	0.319 *** (0.080)	0.705 *** (0.104)	0.454 *** (0.082)	0.423 *** (0.085)	0.420 *** (0.084)
Constant	25.780 *** (2.420)	20.765 *** (2.292)	16.242 *** (1.708)	18.802 *** (1.569)	19.180 *** (2.405)	18.968 *** (2.405)
Num. Obs.	6423	6387	4220	4132	4034	3964
R^2 Adj.	0.956	0.791	0.884	0.845	0.773	0.775
Significance level	'***' 0.01; '**' 0.05; '*' 0.10					
Note of Filtered Models (Models 5 and 6)	The data filtration criteria: 1) Remove all observations with $0.00 in Gross and Net ODA 2) Remove both upper and lower outliers based on Canadian Exports and ODAs: China, Hong Kong, Mexico, the Republic of Korea, and Ukraine 3) Remove small island countries: Cook Islands, Kiribati, Montserrat, New Caledonia, Niue, Nauru, Saint Helena, Solomon Islands, Sint Maarten, Tokelau, Tonga, British Virgin Islands, Wallis and Futuna Islands, and Samoa					

3.1 Improved Structural Estimates

While Table 1 provides a good foundation for understanding the relationship between bilateral aid disbursement and donor exports in the same year, it does not capture how development projects and ODA operate alongside ODA's moral and normative objectives. Excluding tied aid, ODA's economic impact on trade may take time to materialize and is not expected to immediately increase Canadian exports to the partner country. Furthermore, standard models often fail to account for the unique, unchangeable historical characteristics of individual countries (such as colonial legacies or deep-rooted institutional structures) and their structural features.

Additionally, the brute-force approach to rescaling large variables relies on log-transforming them; therefore, it converts zero to "undefined" and causes statistical software to delete those observations. That creates severe selection bias, leading to inaccurate results. However, the brute-force fix of introducing log (x + 1) introduces another significant problem. In the case of ODA, since it is measured in millions of current USD, a "+ 1" to otherwise "0" ODA observations creates a significant data skew. Even when a country receives 2 million in ODA, it would result in a 50% artificial inflation of ODA under such treatment.[13] Thus, we instead use the Inverse Hyperbolic Sine (IHS) transformation for our variable of interest – ODA, which can have natural zeros in various years.[14] Additionally, all non-binary variables are converted to per-dollar and per-individual measurement units for consistency and to preserve the IHS transformation's mathematical property regarding the log-transformation at large numbers.

Variables that underwent the IHS transformation can be evaluated using standard elasticity calculations to assess their effects on the dependent variable.[15] In our case, the IHS-transformed ODA's impact on the log-transformed Canadian export. To provide a more accurate and actionable policy metric highlighted above, Table 3 introduces our improved methodology. We apply Country and Year Fixed-Effects (FEs) separately and jointly under a Two-Way Fixed-Effects (TWFE) architecture for properly specified PPML models.[16] The TWFE strictly controls for both unique country histories (the purpose of the Country FE) and global time shocks (such as the 2008 financial crisis or the COVID-19 pandemic; the purpose of the Year FE). Most importantly, we introduce lags to the ODA variables, allowing the data to measure the delayed structural impact of assistance.

[13] [(2 + 1) – 2] / 2 = 1/2 = 0.50. See Appendix A for further discussion.
[14] See Burbidge, Magee, and Robb (1988) for further discussion.
[15] Arcsinh() denotes the IHS transformation. As arcsinh(x) = log(x +(x^2+1)$^{0.5}$); therefore, $\delta \boldsymbol{E}[y]/\delta x = \boldsymbol{E}[y] * \beta_x * 1/[x^2 + 1]^{0.5}$. As we can see, when *x* increases in value, $\text{Lim}_{x\to\infty} = [x^2 + 1]^{0.5} \approx [x^2]^{0.5} = x$; therefore, consistent with the standard log-transformed calculation. See Appendix A for further information and Bellemare and Wichman (2020) for further discussion.
[16] See Silva and Tenreyro (2006) for further discussion.

The 3- to 5-year lags are chosen because they remained robust to multiple competing specifications that evaluated various lagged intervals of Net and Gross ODA to identify the variable that consistently retained statistical significance. Concretely, these lags would indicate the time it takes for ODA to a country to have a significant impact on Canadian exports, which seems reasonable, since projects tend to be completed over a few years, and it may also take a few years for increased trade to follow. Additionally, we filtered for upper- and lower-bound outliers on both bilateral ODA and exports to avoid them from distorting the results. Additionally, we excluded country-year observations with $0 bilateral ODA to focus our analysis on those that received bilateral ODA from Canada and on how that translates into Canadian exports. Thus, the models presented in Table 3 strictly analyze the above mechanisms, not the overall statistical comparison of trends between years with Canadian bilateral ODA and years without them among Canada's development partners.

The improved estimates in Table 3 show that timing indeed matters. While the 3-year lags for ODA do not have a significant impact on exports, **net ODA has a positive and significant impact on exports (+0.004 for the 4- and 5-year lags), which translates to an expected increase of Canadian exports of $0.04 for every $1.00 of net ODA.** These improved estimates, which yield lower impacts on exports than previously reported (Bhushan and Siauw-Soegiarto, 2017) once again confirm the decoupling of the growth phenomenon that we discussed earlier, since partner GDP is not significant.

Appendix B presents the regression outputs for the aggregate, non-segregated bilateral ODA datasets (that is, without excluding outliers as we did in Table 3 above) for comparison with Tables 2 and 3. The models employ the same strict temporal lag structure, predicting export variations three to five years following disbursement. Tables B1 (1989~2015) and B2 (1989~2024) utilize data without excluding statistical outliers, highlighting the persistent underlying overall correlation between Canadian ODA and export growth. Tables B3 and B4 mirror the timeframes of Tables B1 and B2 but model the impact of ODA on existing commercial relations, establishing a baseline for sustained market engagement by measuring year-over-year marginal export growth rather than absolute export volumes. By retaining these critical observations, our models capture the true breadth of Canada's global trade footprint, rather than artificially filtering the data to reflect only successful partnerships.

We find that Canadian net ODA has a significant and positive impact on Canadian exports after 3- and 4- years for the period 1989-2015, but the effect is negative over the entire period (1989-2024). This again confirms the unusual post-2015 period characterized by several endogenous shocks.

We also segregated the datasets by the World Bank's classification of countries to investigate the impact of a country's wealth on the amount of Canadian goods and services imported (results not reported in this paper). We found that Low-Income Countries (LICs) and Upper-Middle-

Income Countries (UMICs) have an inconsistent and insignificant relationship between Canadian ODA and Exports from 1989 to 2015. For these two groups of countries, it is either negative and insignificant for LICs or negative and significant for UMICs. **However, for Lower-Middle-Income Countries (LMICs), during 1989-2015, $1 of Net ODA is correlated with a $0.02 increase in Canadian exports. During the full period (1989-2024), $1 of Net ODA to LMICs correlates with a $0.07 to $0.09 increase in Canadian exports**.

Ultimately, the data demonstrate that bilateral ODA is not commercially sterile; when deployed strategically, particularly with LMICs, it may foster the development of robust, long-term trade relationships.

Table 3: Canadian ODA's Impacts on Canadian Exports, Filtered Data [1]						
	1989-2024 Static PPML Two-Way FE					
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
Gross ODA 3-yr lag	- 0.016 (0.029)					
Net ODA 3-yr lag		0.001 (0.002)				
Gross ODA 4-yr lag			0.005 (0.023)			
Net ODA 4-yr lag				0.004 ** (0.002)		
Gross ODA 5-yr lag					0.007 (0.018)	
Net ODA 5-yr lag						0.004 ** (0.002)
Log Partner GDP	0.077 (0.049)	0.074 (0.049)	0.073 (0.048)	0.733 (0.048)	0.070 (0.048)	0.071 (0.048)
Log Distance [2]	- 33.582 * (17.335)	- 34.937 ** (17.519)	- 35.404 ** (17.046)	- 35.241 ** (17.344)	- 35.058 ** (16.696)	- 34.890 ** (16.870)
FTA / WTO Dummy	0.110 (0.130)	0.097 (0.129)	0.092 (0.128)	0.086 (0.129)	0.091 (0.125)	0.085 (0.127)
Log Partner Pop	0.410 (0.426)	0.390 (0.415)	0.386 (0.427)	0.380 (0.420)	0.376 (0.432)	0.366 (0.425)
Num. Obs.	3676	3676	3556	3556	3435	3435
R^2	0.953	0.953	0.953	0.953	0.953	0.954
R^2 Adj.	0.953	0.953	0.953	0.953	0.953	0.954
R^2 Within	0.055	0.052	0.051	0.054	0.050	0.053
R^2 Within Adj.	0.055	0.052	0.051	0.054	0.050	0.053
Std. Errors	Partner Country					
FE: Country	X					
FE: Year	X					
Signif. Code	'***' 0.01; '**' 0.05; '*' 0.10					
Note 1:	The data filtration criteria: 1) Remove all observations with $0.00 in Gross and Net ODA 2) Remove both upper and lower outliers based on Canadian Exports and ODAs: China, Hong Kong, Mexico, the Republic of Korea, and Ukraine 3) Remove small island countries: Cook Islands, Kiribati, Montserrat, New Caledonia, Niue, Nauru, Saint Helena, Solomon Islands, Sint Maarten, Tokelau, Tonga, British Virgin Islands, Wallis and Futuna Islands, and Samoa					
Note 2:	The ***Log Distance*** is weighted by population; therefore, it is not a pure physical distance.					

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Tables 4 and 5 utilize a Markov Chain analysis to track the real-world trajectories of Canada's trading partners. Rather than just taking a static snapshot, this method allows us to see how countries migrate among four distinct states over time (e.g., moving from "High Aid / Low Trade" dependency to "High Aid / High Trade" or "Low Aid / High Trade" reciprocity).[17] By tracking these movements, the matrices map the momentum of our bilateral relationships, revealing whether countries are actively graduating from aid dependency to self-sustaining trade or becoming structurally trapped in aid dependency.

Table 4: Markov Matrix, Period 1 (1989-1993) to Period 6 (2014-2018) [18]

Probabilities of migrating between states between the two periods

Original State (P1, 1989 -1993)	Destination State (P6, 2014-2018)			
	Low Aid / High Trade	**High Aid / High Trade**	**Low Aid / Low Trade**	**High Aid / Low Trade**
Low Aid / High Trade	46%	46%	0%	8%
High Aid / High Trade	32%	64%	0%	4%
Low Aid / Low Trade	22%	8%	50%	20%
High Aid / Low Trade	15%	58%	8%	19%

Countries Transitioned from the P1 State to a Different State by P6	
Low Aid / High Trade to High Aid / High Trade	Cuba, Guatemala, Kenya, Lebanon, Nigeria, Türkiye
Low Aid / High Trade to High Aid / Low Trade	Democratic People's Republic of Korea
High Aid / High Trade to Low Aid / High Trade	Argentina, Brazil, Chile, Costa Rica, Algeria, Ecuador, Malaysia, Thailand, Tunisia
High Aid / High Trade to High Aid / Low Trade	Zimbabwe
Low Aid / Low Trade to Low Aid / High Trade	Albania, Republic of the Congo, Georgia, Kazakhstan, Maldives, Papua New Guinea, Paraguay, Suriname, Togo
Low Aid / Low Trade to High Aid / High Trade	Bénin, Côte d'Ivoire, Myanmar
Low Aid / Low Trade to High Aid / Low Trade	Burundi, Central African Republic, Liberia, Madagascar, Sierra Leone, Syria, Chad, Yemen

[17] "High" and "Low" are defined relative to the median.

[18] Only countries that migrated from their starting position to a new one are shown in Tables 4 and 5. Countries that remained in their original positions (the majority of the sample) are excluded to avoid a long list.

High Aid / Low Trade to Low Aid / High Trade	Angola, Gabon, Guyana, El Salvador
High Aid / Low Trade to High Aid / High Trade	Afghanistan, Burkina Faso, Bolivia, Democratic Republic of the Congo, Honduras, Haiti, Iraq, Jordan, Cambodia, Mali, Nicaragua, Nepal, Sudan, Uganda, Viet Nam
High Aid / Low Trade to Low Aid / Low Trade	Dominica, Saint Lucia

Table 4 shows the likelihood that Canadian ODA partners will transition out of their original Aid-Trade status between Period 1 (1989-1993) and Period 6 (2014-2018).[19] Although many ODA partners are stuck in their Aid-Trade state, numerous countries have made their transitions. For instance, 22% of countries (such as Albania, Republic of the Congo, Georgia, Kazakhstan, Maldives, Papua New Guinea, Paraguay, Suriname, and Togo) in the "Low Aid / Low Trade" state transitioned to the favourable "Low Aid / High Trade" state, achieving above-median Canadian export levels without requiring massive aid inflows.

Additionally, 58% of countries (for example, Afghanistan, Burkina Faso, Bolivia, Democratic Republic of the Congo, Honduras, Haiti, Iraq, Jordan, Cambodia, Mali, Nicaragua, Nepal, Sudan, Uganda, and Viet Nam) moved from the "High Aid / Low Trade" group, up into the "High Aid / High Trade" group, This does not mean Canadian ODA is the sole contributor to their transitions, as local institutions, resource mobilization, and (individual and collective) agency play crucial, if not determinative, roles. However, ODA does provide much-needed resource injections to developing countries that have fallen behind in the race for development, as many East Asian countries once were.[20, 21]

Table 5 mirrors this analysis for the transition from Period 6 (2014-2018) to Period 7 (2019-2024). This table captures the evolving dynamics since the original 2017 working paper, tracking countries' transitions through the Aid-Trade matrix amid the global pandemic, its associated economic shock, and Russia's invasion of Ukraine. The most critical metric is the consolidation within the "High Aid / Low Trade" state: countries caught in this state now face an 81% probability of remaining there. In comparison, 15% of "Low Aid / Low Trade" countries (Dominica, Gambia, Saint Lucia, the Republic of Moldova, and North Macedonia) actively regressed into this high-dependency bracket (High Aid / Low Trade).

[19] Period 1: 1989 ~ 1993 | Period 2: 1994~1998 | Period 3: 1999~2003 | Period 4: 2004~2008 | Period 5: 2009~2013 | Period 6: 2014~2018 | Period 7: 2019~2024.

[20] See Amsden (1989), Johnson (1982), and Wade (1990) for discussion on Japan, South Korea, and Taiwan's post-WWII development.

[21] See Cole and Lyman (1971), Haggard (1990), Jacoby (1966), Krueger (1979), and Nakamura (1981) for the roles of American economic and military aid in the post-WWII development of Japan, South Korea, and Taiwan.

The severe "stickiness" observed in Tables 4 and 5 illustrates a convergence of three factors: the structural challenges faced by Canada's ODA partners, the devastating impact of the global polycrisis, and Canada's shift toward the FIAP. Furthermore, by prioritizing assistance to highly fragile states – where baseline infrastructure cannot sustain reciprocal trade – and responding to post-2020 global shocks, Canadian ODA has increasingly flowed into rigid, non-reciprocal environments. This supports the negative structural returns captured in our regressions from Table 2 (1989-2024) and Table B1 (see Appendix B).[22]

Table 5: Markov Matrix: Period 6 (2014-2018) to Period 7 (2019-2024)					
Probabilities of migrating between states between the two periods					
Original State (P6, 2014 ~ 2018)	**Low Aid / High Trade**	**64%**	**29%**	**7%**	**0%**
	High Aid / High Trade	**0%**	**98%**	**0%**	**2%**
	Low Aid / Low Trade	**18%**	**0%**	**67%**	**15%**
	High Aid / Low Trade	**0%**	**19%**	**0%**	**81%**
		Low Aid / High Trade	**High Aid / High Trade**	**Low Aid / Low Trade**	**High Aid / Low Trade**
		Destination State (P7, 2019~2024)			

Countries Transitioned from the P6 State to a Different State by P7	
Low Aid / High Trade to High Aid / High Trade	Brazil, Dominican Republic, Ecuador, Guyana, El Salvador, Togo, Tunisia, Venezuela
Low Aid / High Trade to Low Aid / Low Trade	Azerbaijan, Papua New Guinea
High Aid / High Trade to High Aid / Low Trade	Afghanistan
Low Aid / Low Trade to High Aid / Low Trade	Dominica, Gambia, Saint Lucia, the Republic of Moldova, North Macedonia
Low Aid / Low Trade to Low Aid / High Trade	Antigua and Barbuda, Belize, Fiji, Grenada, Mauritania, Turkmenistan

[22] To verify this structural break, we applied the same specifications exclusively to the 2016–2024 sub-sample. Unlike the strongly positive and significant Net ODA coefficients found in the 1989–2015 period (see Table 2, models 2 and 4), the relationship in the post-2015 period is statistically insignificant (yielding coefficients of 0.0018 for the 3-year lag and 0.0030 for the 4-year lag). While the limited timeframe and extreme volatility of the post-2015 era yield insignificant coefficients in isolation, the high volumes of bilateral aid to low-income and fragile countries, coupled with severely contracted reciprocal trade during this period, create a massive downward anchor. When this modern data is pooled with the historical baseline, it severely skews the overall 35-year trajectory, driving the full-era 1989–2024 coefficients into negative and significant territory (see Table 2, models 6 and 8).

High Aid / Low Trade to High Aid / High Trade	Guinea, Mongolia, Syria

It is important to note that the condensed timeframe of the post-2015 period (that is, 2016-2024) may artificially inflate this observed rigidity, as late disbursements (2021-2024) may not have yet materialized. However, the sheer magnitude of the reversal—from historically positive to deeply negative coefficients—confirms a fundamental structural break driven by the reorientation of Canadian international assistance. For example, if we focus purely on bilateral aid for specific Aid for Trade sectors, the average country-year aid-for-trade spending increased more than 7-fold from the Chretien/Martin eras to the Harper era, then declined by more than 2-fold during the Trudeau era.[23] In the case of exports, there was a general decline in average exports (per country-year) to ODA recipients over the time period of analysis.

This break was heavily compounded by global economic shocks, specifically COVID-19 supply chain disruptions and the staple food crisis triggered by Russia's invasion of Ukraine. When ODA is deployed to states reeling from these overlapping crises, the recipient nations simply lack the fiscal capacity to import Canadian goods and services en masse. Consequently, even when Canadian assistance successfully stabilizes local social and economic conditions, the resulting purchasing power could be largely absorbed by cheaper consumer goods and regional alternatives that fall outside Canada's competitive price point.

4. Conclusion and Key Messages

Our analysis establishes a newly rigorous econometric baseline for evaluating the structural impacts of Canadian ODA on Canadian exports. Compared to Bhushan and Siauw-Soegiarto (2017)[24], we deployed a correctly specified Poisson Pseudo-Maximum Likelihood (PPML) estimator with standard country and year fixed effects and the stringent Two-Way Fixed Effects (TWFE) estimator. The TWFE specification accounts for statistical noise from global economic shocks and country-specific differences. This methodology successfully resolves the row-wise deletion errors associated with log-transforming zero-trade values. Furthermore, by including lags, we successfully isolated the causal direction of aid, neutralizing the endogeneity problems that persistently plague contemporaneous models.

[23] The included sectors are Economic Infrastructures (Transport and storage, communications, and energy), and Production Sectors (Agriculture, Forestry, Fishing, Industry, Mineral Resources and Mining, and Construction). The "Trade Policies and Regulations" category is also included.

[24] Net ODA and Gross ODA were unadjusted; therefore, when performing regression analysis in Stata, the zero-value ODA rows were automatically deleted. This led to substantial differences in observation counts (see Table 2 in Bhushan & Siauw-Soegiarto, 2017) and the corrected replication portion of this paper (see Table 1).

Viewed through this stratified analytical lens, the historical panel data (1989–2015) demonstrates that Canadian bilateral ODA was once positively and significantly correlated with reciprocal growth in Canadian bilateral exports (Tables 1, 3, and Appendix B, Table B1). Given the inherent identification boundaries of this research design, we do not impute direct, deterministic causality to this historical baseline. This correlation, however, should not be interpreted as an isolated driver of developmental success. As historical precedent dictates – most notably the post-WWII East Asian development experience – external aid injections operate not in a vacuum, but as a secondary complement to robust domestic industrial policies and grassroots collective action.

Consequently, shifting macroeconomic conditions within host economies consistently co-move with expansions in Canadian export volumes (see Table 3 and Appendix B, Table B1). Furthermore, the transitional matrices from this era capture a fluid, upward structural momentum, in which several recipient nations transitioned away from systemic dependence on aid toward self-sustaining, trade-driven trajectories of resource accumulation and domestic development (see Table 4).

However, the post-2015 data reveal a structural break, characterized by a decoupling between aid distribution and trade generation, as shown in Tables B2 and B4 in Appendix B. While this decoupling was not uniform across all bilateral partners, the aggregate shift was sufficient to invert the previously positive correlation, rendering the post-2015 aid-trade coefficient negative and statistically significant. During this period, the historical fluidity of these bilateral matrices was replaced by a more rigid structural reality: an increasing concentration of developing countries now occupies or stagnates within high-aid distribution categories (e.g., High-Aid/High-Trade or High-Aid/Low-Trade matrices; compare Tables 4 and 5).

Crucially, this structural rigidity should not be interpreted as a deterministic product of ODA nor dependence on ODA. Rather, it reflects severe macro-level constraints imposed by nation-specific exogenous conditions, including, but not limited to, institutional fragility, geopolitical volatility, and compounding geographic or epidemiological shocks. For instance, a recipient state's institutional architecture directly dictates its capacity to absorb external capital and its strategic resilience against compounding crises. Therefore, the categorical stagnation observed in Table 5 and the coefficient inversion between Tables 1 and 2 do not imply a mechanistic causality whereby aid actively suppresses or promotes trade. Instead, they represent a statistical signal: the global disruptions of the 2019–2024 period fractured the specific macro-level and institutional conditions that previously enabled the positive aid-trade co-movement of the 1989–2015 era.

The 2020–2024 global polycrisis, encompassing the COVID-19 pandemic, the macroeconomic fallout from Russia's invasion of Ukraine, and subsequent supply chain disruptions, severely fractured international trade networks and triggered a sharp escalation in global commodity

prices (Federal Reserve Bank of St. Louis, 2026). The net impact of this macroeconomic shock was highly asymmetrical. For developing countries that are net importers of essential commodities, particularly food and energy, these price shocks severely contracted their domestic fiscal space. Concurrently, imported inflation eroded end-user purchasing power, forcing both states and (household and industrial) consumers to prioritize basic life-sustaining necessities over diversified imports.

To bridge these deficits, developing countries were forced to increase their reliance on external aid and sovereign borrowing, thereby exacerbating public debt burdens amid aggressively rising global interest rates (OECD, 2024). Consequently, severe foreign exchange constraints dictated both *what* these nations could import and *from whom*. Therefore, even if external aid functioned as a fiscal substitute, recipient governments lacked the macroeconomic bandwidth to generate reciprocal demand for Canadian exports. Furthermore, this structural decoupling was compounded by Canada's own policy evolution during this era; Canadian ODA was increasingly directed toward non-commercial, socially oriented sectors, such as health, education, and grassroots women's rights programming, which naturally generate fewer direct economic linkages than aid for production-sector supports and economic infrastructure.

Finally, this new macroeconomic reality is inextricably linked to the endogenous realities of Canada's shift toward a different international assistance framework. Over the last decade, Canadian ODA has been redirected more toward the world's most fragile, conflict-affected states. While this pivot addresses urgent moral imperatives, it reflects economic reality: these environments lack the baseline institutional and physical infrastructure for a conventional end-user-driven commercial relationship. Even when Canadian assistance successfully helps local communities, they remain too economically marginalized to purchase Canadian goods and services en masse. [25]

In theory, any marginal gains in local purchasing power are offset by cheaper regional alternatives outside Canada's competitive price point. Ultimately, this supports the view that coupling a more socially oriented assistance policy with efforts to generate short-term growth in Canadian exports is a challenging endeavour in the modern global economy. Additionally, given the Canadian institutional context, the observed correlation is country- and/or portfolio-specific rather than a

[25] In fact, when we segregate data by the World Bank's income categories, the regression table for Low Income Countries (LIC) does not include a row for FTA/WTO because Canada has zero trade agreements with LICs.

strategic principle for Canada's international aid.[26, 27] However, that does not imply the absence of commerce-driven aid in the Canadian context; it means Canada has a mixed portfolio of ODA motivated by various concerns and objectives, including social, humanitarian, and commercial ones.

However, the updated data from 2016 to 2024 – and the stark reality of these findings – points unequivocally to the necessity of continued international development assistance. The global pandemic and subsequent trade disruptions stemmed directly from overwhelmed national and sub-national public health responses to emerging pathogens in a highly interconnected world characterized by the increasingly efficient movement of goods, services, and, crucially, people. Thus, diplomatic disconnection and economic disengagement are dangerously counterproductive.
Viewed from this broader perspective, ODA does not necessarily lead to immediate Canadian exports; rather, it funds vital capacity building in highly vulnerable areas. In essence, modern international assistance acts as a vital insurance policy against future global shocks. That insurance, however, requires our collective choice to sustain the investment.

Main takeaways from this paper:

1. Over the 1989-2024 period (see Table 3), ODA was positively and significantly correlated with Canadian exports: Canadian international assistance successfully built structural capacity that translated into commercial demand. By including lagged values of ODA to isolate the causal direction of aid, removing both ODA and exports outliers, and filtering out countries that did not receive ODA, **our improved models indicate that every $1 of Canadian net ODA historically generated approximately $0.04 in Canadian exports**. Over the long term, Canadian bilateral ODA serves as a consistent leading indicator for commercial engagement. Rather than claiming direct mechanical causality, our models

[26] The Canadian institutional context is crucial here. Unlike Canada's recent, and still current, socially oriented framework, several major OECD economies explicitly design their ODA architecture to function as a commercial export engine. For example, Japan's development policy relies on a formalized "trinity approach" (sanmi-ittai) that leverages infrastructure ODA to explicitly facilitate Japanese corporate investment and trade (Wang, 2024). Empirical evaluations show that Japanese ODA disbursements, through mechanisms such as the Special Terms for Economic Partnership (STEP), directly secured 17% of all overseas infrastructure contracts awarded to Japanese firms over the past 50 years (Nishitateno, 2023). Similarly, Germany's Federal Ministry for Economic Cooperation and Development (BMZ) openly utilizes ODA to expand external markets for German goods; econometric models demonstrate that for every dollar of German aid disbursed, German exports increase by roughly $1.33 to $1.40, with returns maximizing in BMZ-designated "strategic aid" recipient states (Martínez-Zarzoso et al., 2009). Therefore, evaluating Canada's aid-trade correlation requires recognizing that Ottawa currently lacks the structural and institutional mechanisms that other major donors use to secure commercial returns from international assistance.
[27] See BMZ (2025) for Germany's updated framework, which continued the historical practice highlighted by Martinez-Zarzoso et al. (2009).

enforce strict temporal lags (predicting exports 3 to 5 years after aid is disbursed) to map the historical correlation between international assistance and bilateral trade.[28]

2. The post-2015 era is defined by a structural decoupling associated with the polycrisis and socially-oriented assistance programmes: First, when international assistance increasingly flows toward highly fragile environments, recipient countries lack both the baseline institutional infrastructure and the fiscal capacity necessary to engage in reciprocal commercial trade. This operational constraint manifests empirically as a statistical decoupling of aggregate ODA from short-term export generation.

3. Targeted Aid for Trade (AfT) warrants further investigation: Preliminary estimates aimed at isolating the impact of Aid for Trade (AfT) disbursements suggest that **every $1 spent generates expected Canadian exports between $6.71 (coefficient of 0.0024, insignificant; 4-year lag) and $14.09 (coefficient of 0.0047, significant at α = 0.10; 3-year lag**).[29, 30] These are very large impacts. However, these findings must be interpreted cautiously because of the causal mechanisms at play. The standard OECD AfT designation encompasses a broad range of DAC sector codes, including general support for agriculture, forestry, and local capacity building. The macroeconomic literature builds these models on a highly theoretical assumption: that funding domestic productive sectors indirectly stimulates the broader economy, eventually facilitating donor exports – an outcome that may not materialize due to market realities, such as local consumers substituting toward cheaper alternatives to maximize their purchasing power.

   Consequently, Canada's international assistance is best understood as a diversified portfolio rather than a singular commercial lever. Within this portfolio, different instruments serve distinct purposes. This portfolio-based approach contrasts with the more highly institutionalized ODA-commerce linkages observed in countries such as

[28] This specific 3-to-5-year lag structure applies to the aggregate, non-segregated dataset. As outlined below, separating the dataset by the World Bank's income categories reveals an accelerated commercial dynamic in developing and middle-income markets.

[29] The dataset used for this analysis only includes parts of the Economic Infrastructure and Production Sectors. Additionally, it includes only Canada's bilateral aid and excludes all multilateral aid, over which Canada has limited control over disbursements.

[30] In a strict mechanical sense, much of this broad funding portfolio does not function as a direct, targeted commercial conveyor for Canadian exports. True "Core AfT", such as market-oriented investments, hard trade infrastructure, and trade policy regulations that directly lower transactional barriers, represents a much smaller, highly distinct share of Canada's aid footprint. Because the broad dataset bundles these indirect structural investments with direct commercial drivers, these baseline estimates remain preliminary. Disentangling the data to isolate the narrow, direct transmission mechanisms of Core AfT represents a critical avenue for future econometric research. That is the primary reason the above numerical figure for AfT remains preliminary, and a full discussion of AfT has yet to be presented.

Germany and Japan.[31] The statistical findings in this paper reflect this structural reality: because Canadian ODA is deployed across a complex portfolio that prioritizes diverse partnerships and local agency, the aggregate linkage between ODA and Canadian exports naturally exhibits weaker, mixed correlations.[32]

4. Modern ODA operates as a strategic investment in global resilience rather than a blunt commercial export driver. While it funds vital capacity-building in vulnerable regions, ODA effectively supports Canada's long-term diplomatic and commercial interests, *provided that expectations are clearly differentiated by funding instrument, project types, country context, and time horizon*. In an interconnected global economy, retreating from international assistance amplifies systemic risks and exposes domestic markets to severe downstream disruptions from unforeseen social, political, or economic shocks (as demonstrated by the COVID-19 pandemic). Therefore, maintaining these targeted investments serves as a necessary buffer against global volatility, securing varied partnerships and win-win outcomes over the long term.

We must ensure that poverty-focused and humanitarian assistance are protected, while using more targeted support where genuine opportunities for mutually beneficial trade exist.

[31] This should **not** be understood to mean that Germany and Japan only engage in aid to strengthen their commercial interests; they, too, utilize a portfolio approach to ODA, but with a clear-cut, mandated linkage between ODA and commercial interests in certain specific portfolios.

[32] A legally mandated, or informal, linkage between ODA and commercial interests would increase the likelihood of one-sided positive results between bilateral ODA and exports. The mixed outcomes that we found in this paper are an empirical reflection of its broader, multi-mandate approach.

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Appendix A

While the traditional gravity model relies on the natural logarithm, the presence of zero-valued observations in ODA and bilateral trade flows necessitates a transformation that preserves the zero-state without introducing significant bias. Following Burbidge, Magee, and Robb (1988), we employ the Inverse Hyperbolic Sine (IHS) transformation, defined as:

$$arcsinh(x) = ln(x + (x^2 + 1)^{1/2})$$

The IHS transformation is preferred over "plus-constant" transformations ($ln(x+c)$) for two critical reasons:

- **Avoidance of the "Ghost Dollar" (Scaling Bias):** The $ln(x + 1)$ transformation is highly sensitive to the units of measurement. If trade is measured in millions of dollars, adding "1" to a zero observation effectively introduces a "ghost" $1 million into the data, fundamentally skewing the intercept and the estimated slope. For an ODA partner country receiving CAD 2.0 million, such a transformation results in a 50% ODA inflation: [(2 + 1) – 2]/2 = (3 – 2)/2 = 1/2 = 0.50 = 50%. For a partner country receiving CAD 0.5 million, such a transformation leads to a 200% ODA inflation: [(0.5 + 1) – 0.5]/0.5 = 1/0.5 = 2 = 200%. Thus, although this transformation solves the "log(0) = undefined" problem, it distorts the entire dataset and the statistical results.

- **Avoidance of Extreme Negative Artifacts:** The decimal transformation (e.g., $ln(x + 0.000001)$) avoids the ghost dollar but creates a massive negative outlier when $x = 0$ (e.g., $ln(10^6) \approx -13.8$). This "stretched" tail at zero exerts undue leverage on the estimator, biasing the mean and potentially creating spurious significance.

In contrast, the IHS is defined at zero ($arcsinh(0) = 0$) and behaves asymptotically like $ln(2x)$ for large x, particularly for millions of CAD worth of ODA and Exports, providing a theory-consistent approximation to the log-linear model without the scaling traps identified by Linders and de Groot (2006).

The interpretation of the coefficient β_x when x is IHS-transformed, and the dependent variable y is in levels (via the PPML log-link) requires care. Following Bellemare and Wichman (2020), the marginal effect of x on the expected value of y is:[33]

$$\frac{\partial \boldsymbol{E}[y]}{\partial x} = \boldsymbol{E}[y] * \beta_x * \frac{1}{(x^2 + 1)^{0.5}}$$

[33] See Kristjansdottir (2012) for Iceland's gravity model with *HIS* transformation.

For sufficiently large values of x (typical in ODA and Export flows where $x > 2$), $(x^2 + 1)^{0.5} \approx x$. In this project, because we converted Canadian Net and Gross ODAs' unit of measurement from \$1 million current USD to \$1 current USD, we have $(1{,}000{,}000^2 + 1)^{0.5} \approx 1{,}000{,}000 = (1{,}000{,}000^2)^{0.5}$. Thus, the marginal effect – representing the dollar impact – can be approximated, without creating subsequent distortion, at the mean as:

$$\frac{\partial \boldsymbol{E}[y]}{\partial x} \approx \frac{\boldsymbol{E}[y]}{\boldsymbol{E}[x]} * \beta_x$$

This approach is considered "tolerable" given the large number of observations we evaluate, and it is statistically sound because it estimates the average marginal effect (AME) using the sample's expected values. It allows us to communicate a clear, policy-relevant metric: the expected change in Export dollars for every additional dollar of ODA, grounded in the elasticities derived from the IHS transformation.

Appendix B

Table B1: Canadian ODA's Impacts on Canadian Exports, Unfiltered Data, 1989-2015, Static PPML TW FE						
	(1)	(2)	(3)	(4)	(5)	(6)
	Gross, 3-yr Lag	Gross, 4-yr Lag	Gross, 5-yr Lag	Net, 3-yr Lag	Net, 4-yr Lag	Net, 5-yr Lag
Gross ODA, 3-yr Lag	0.009 (0.015)					
Net ODA, 3-yr Lag				0.004 * (0.003)		
Gross ODA, 4-yr Lag		0.012 (0.012)				
Net ODA, 4-yr Lag					0.005 ** (0.003)	
Gross ODA, 5-yr Lag			0.012 (0.010)			
Net ODA, 5-yr Lag						0.002 (0.004)
Log Partner GDP	0.595 *** (0.064)	0.586 *** (0.065)	0.582 *** (0.065)	0.645 *** (0.071)	0.626 *** (0.071)	0.591 *** (0.066)
Log Distance [1]	- 13.868 (19.013)	- 12.102 (20.585)	- 11.166 (21.144)	- 15.595 (18.744)	- 13.442 (20.746)	- 8.684 (21.676)
FTA / WTO Dummy	0.154 (0.122)	0.090 (0.112)	- 0.007 (0.109)	0.153 (0.130)	0.090 (0.114)	- 0.011 (0.107)
Log Partner Pop	- 0.772 (0.512)	- 0.824 (0.516)	- 0.808 (0.510)	- 0.857 (0.625)	- 0.852 (0.605)	- 0.740 (0.581)
Num. Obs.	3164	3022	2883	3164	3022	2883
R^2 Adj.	0.979	0.979	0.979	0.979	0.979	0.979
Within R^2	0.206	0.207	0.206	0.210	0.209	0.200
Adj. Within R^2	0.206	0.207	0.206	0.210	0.209	0.200
Significance level	'***' 0.01; '**' 0.05; '*' 0.10					
Note 1:	The distance between the two countries is weighted by population; therefore, it is not purely a physical distance.					

Table B2: Canadian ODA's Impacts on Canadian Exports, Unfiltered Data, 1989-2024, Static PPML TW FE						
	(1)	(2)	(3)	(4)	(5)	(6)
	Gross, 3-yr Lag	Gross, 4-yr Lag	Gross, 5-yr Lag	Net, 3-yr Lag	Net, 4-yr Lag	Net, 5-yr Lag
Gross ODA, 3-yr Lag	0.007 (0.014)					
Net ODA, 3-yr Lag				- 0.008 *** (0.002)		
Gross ODA, 4-yr Lag		0.013 (0.012)				
Net ODA, 4-yr Lag					- 0.007 *** (0.002)	
Gross ODA, 5-yr Lag			0.014 (0.011)			
Net ODA, 5-yr Lag						- 0.007 *** (0.002)
Log Partner GDP	0.040 ** (0.020)	0.040 ** (0.020)	0.039 * (0.020)	0.039 ** (0.017)	0.040 ** (0.018)	0.044 ** (0.019)
Log Distance [1]	2.658 (15.634)	1.164 (15.801)	- 1.133 (15.592)	4.861 (16.952)	5.013 (17.881)	3.401 (17.849)
FTA / WTO Dummy	- 0.078 (0.095)	- 0.088 (0.095)	- 0.092 (0.093)	0.012 (0.063)	- 0.004 (0.067)	- 0.011 (0.069)
Log Partner Pop	- 0.769 (0.762)	- 0.801 (0.788)	- 0.784 (0.797)	- 0.259 (0.547)	- 0.329 (0.577)	- 0.346 (0.598)
Num. Obs.	4449	4.306	4166	4449	4306	4166
R^2 Adj.	0.977	0.977	0.978	0.978	0.978	0.978
Within R^2	0.026	0.029	0.029	0.062	0.054	0.050
Adj. Within R^2	0.026	0.029	0.029	0.062	0.054	0.050
Significance level	'***' 0.01; '**' 0.05; '*' 0.10					
Note 1:	The distance between the two countries is weighted by population; therefore, it is not purely a physical distance.					

Table B3: Canadian ODA's Impacts on Canadian Exports, Unfiltered Data, 1989-2015, Dynamic PPML, TW FE						
	(1)	(2)	(3)	(4)	(5)	(6)
	Gross, 3-yr Lag	Gross, 4-yr Lag	Gross, 5-yr Lag	Net, 3-yr Lag	Net, 4-yr Lag	Net, 5-yr Lag
Gross ODA, 3-yr Lag	0.003 (0.006)					
Net ODA, 3-yr Lag				0.004 *** (0.001)		
Gross ODA, 4-yr Lag		0.006 (0.004)				
Net ODA, 4-yr Lag					0.003 ** (0.001)	
Gross ODA, 5-yr Lag			0.004 (0.003)			
Net ODA, 5-yr Lag						0.00001 (0.001)
Log Canadian Exports, 1-yr Lag	0.608 *** (0.044)	0.607 *** (0.044)	0.600 *** (0.049)	0.607 *** (0.043)	0.606 *** (0.044)	0.603 *** (0.044)
Log Partner GDP	0.241 *** (0.047)	0.243 *** (0.049)	0.242 *** (0.049)	0.284 *** (0.052)	0.266 *** (0.052)	0.244 *** (0.049)
Log Distance [1]	- 5.205 (8.060)	- 4.676 (9.369)	- 5.610 (9.284)	- 7.804 (6.764)	- 5.579 (9.339)	- 4.356 (9.476)
FTA / WTO Dummy	0.027 (0.046)	0.027 (0.053)	0.006 (0.051)	0.020 (0.047)	0.027 (0.052)	0.006 (0.049)
Log Partner Pop	- 0.366 (0.223)	- 0.386 (0.230)	- 0.365 (0.235)	- 0.466 * (0.256)	- 0.407 (0.256)	- 0.336 (0.255)
Num. Obs.	3164	3022	2883	3164	3022	2883
R^2 Adj.	0.988	0.988	0.988	0.988	0.988	0.988
Within R^2	0.532	0.530	0.525	0.538	0.532	0.524
Adj. Within R^2	0.532	0.530	0.525	0.538	0.532	0.524
Significance level	'***' 0.01; '**' 0.05; '*' 0.10					
Note 1:	The distance between the two countries is weighted by population; therefore, it is not purely a physical distance.					

Table B4: Canadian ODA's Impacts on Canadian Exports, Unfiltered Data, 1989-2024, Dynamic PPML, TW FE						
	(1)	(2)	(3)	(4)	(5)	(6)
	Gross, 3-yr Lag	Gross, 4-yr Lag	Gross, 5-yr Lag	Net, 3-yr Lag	Net, 4-yr Lag	Net, 5-yr Lag
Gross ODA, 3-yr Lag	0.004 (0.004)					
Net ODA, 3-yr Lag				- 0.002 ** (0.001)		
Gross ODA, 4-yr Lag		0.007 ** (0.003)				
Net ODA, 4-yr Lag					- 0.002 * (0.001)	
Gross ODA, 5-yr Lag			0.005 ** (0.003)			
Net ODA, 5-yr Lag						- 0.002 *** (0.001)
Log Canadian Exports, 1-yr Lag	0.673 *** (0.035)	0.672 *** (0.036)	0.664 *** (0.035)	0.665 *** (0.033)	0.666 *** (0.034)	0.658 *** (0.033)
Log Partner GDP	0.010 (0.011)	0.009 (0.011)	0.009 (0.011)	0.010 (0.011)	0.009 (0.011)	0.011 (0.011)
Log Distance [1]	2.445 (5.236)	2.047 (5.596)	0.696 (5.294)	3.286 (5.743)	3.744 (6.518)	2.450 (6.216)
FTA / WTO Dummy	0.016 (0.029)	0.017 (0.030)	0.019 (0.029)	0.034 (0.027)	0.037 (0.026)	0.042 * (0.025)
Log Partner Pop	- 0.309 (0.254)	- 0.323 (0.274)	- 0.287 (0.274)	- 0.203 (0.225)	- 0.191 (0.221)	- 0.155 (0.223)
Num. Obs.	4449	4306	4166	4449	4306	4166
R^2	0.989	0.989	0.989	0.989	0.989	0.989
R^2 Adj.	0.989	0.989	0.989	0.989	0.989	0.989
Within R^2	0.520	0.516	0.509	0.521	0.516	0.511
Adj. Within R^2	0.520	0.516	0.509	0.521	0.516	0.511
Significance level	'***' 0.01; '**' 0.05; '*' 0.10					
Note 1:	The distance between the two countries is weighted by population; therefore, it is not purely a physical distance.					