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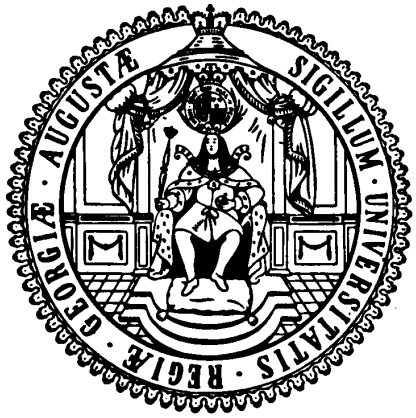

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Swiss ODA, Trade and GDP: A Quantitative Analysis

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Abstract

This paper presents the macroeconomic benefits of Swiss official development aid (ODA) in terms of exports for the Swiss economy. By using data on Swiss exports and ODA over the period from 1995 to 2024 a gravity model of trade is estimated with panel data techniques. We apply the model to Switzerland's total exports of goods and services and to sectoral exports at 2-digit level, using an input-output classification. The sectoral estimates together with input-output multipliers are used to compute the additional exports linked to ODA, the number of jobs secured through these additional exports, the value added generated and the additional gross domestic income that is generated by giving aid. The results show that ODA secures domestic jobs in both the goods and services sectors and that the effect on gross domestic income is economically important.

Key words: Swiss exports, development aid, gravity model, input-output analysis, PPML, FGLS.

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1. Introduction

Official Development Assistance (ODA) has traditionally been evaluated according to its effectiveness in promoting economic development and poverty reduction in recipient countries. A growing literature, however, recognizes that development cooperation may also generate important economic benefits for donor countries through trade creation, investment, employment, and knowledge spillovers. This perspective has become increasingly relevant as donor governments face growing fiscal constraints, heightened geopolitical uncertainty, and increasing demands to demonstrate the domestic economic returns associated with public development expenditures. Understanding whether, and through which channels, ODA contributes to the donor economy has therefore become an important empirical and policy question.

Theoretical arguments suggest several mechanisms through which aid can affect donor-country economic outcomes. Aid-financed projects may directly increase demand for goods and services supplied by donor-country firms, particularly when procurement or technical assistance involves domestic providers. More broadly, development cooperation can improve recipient countries' institutional quality, infrastructure, and productive capacity, thereby fostering future trade and investment relationships. These indirect effects are expected to materialize over longer horizons and may extend well beyond sectors directly involved in aid implementation. Despite these theoretical arguments, the magnitude of the economic returns to ODA remains an empirical question and existing evidence is still relatively scarce and limited to certain donors[1], whereas the sectoral returns for the Swiss case remain unaddressed.

[1] Sectoral returns to ODA in terms of exports have been estimated for the German and the Dutch case in Martínez-Zarzoso et al. (2016) and Martínez-Zarzoso et al. (2017), respectively.

This paper quantifies the macroeconomic benefits of Swiss bilateral ODA for the Swiss economy. We estimate the causal effect of bilateral aid on Switzerland's exports using a gravity model estimated with a panel dynamic feasible generalized least square (PDFGLS) estimator, controlling for several confounding factors and for time and country-pair fixed effects. The resulting export effects are subsequently combined with an input-output analysis on Switzerland to estimate the associated impacts on output, employment, and value added across industries. This integrated framework allows us to trace how aid-induced export demand propagates through domestic production networks and generates indirect economic effects.

Our study contributes to the literature in several respects. First, while previous studies have mainly focused on aggregate trade effects of aid, we provide one of the first comprehensive assessments of the broader macroeconomic returns of Swiss ODA by combining econometric estimation with input-output analysis. Second, we distinguish between goods and services exports, allowing us to identify the sectors that benefit most from aid-induced trade. Third, by translating export gains into employment and value-added effects, we quantify the broader contribution of development cooperation to the Swiss economy beyond conventional trade measures.

The empirical results indicate that bilateral ODA generates substantial economic returns for Switzerland. Our preferred estimates imply that each additional US dollar of bilateral aid is associated with approximately 1.5-3.0 US dollars of additional Swiss exports over the period 1995–2024. These export gains translate into approximately 44,000 jobs supported across goods and services sectors, more than USD 20 billion in additional gross output, and roughly USD 7.4 billion in domestic value added, corresponding to around 0.8% of Swiss GDP. The largest effects are concentrated in internationally competitive sectors such as pharmaceuticals, machinery, precision equipment, financial services, scientific and technical activities, and hospitality.

The remainder of the paper is organized as follows. Section 2 reviews the related literature on aid and donor-country economic effects. Section 3 presents the empirical methodology and the data sources. Section 4 reports the gravity model estimates of the impact of Swiss bilateral ODA on exports. Section 5 combines these estimates with input-output analysis to quantify the associated effects on employment, output, and value added. Section 6 concludes.

2. Development Aid and Domestic Exports

There are several channels through which Swiss Official Development Assistance (ODA) may generate economic benefits for Switzerland. ODA acts as a transfer of income to recipient countries who can consume and/or invest this additional income. However, demand for donors' products and services is not only pushed upwards by practices like tying aid or by the additional income received from donor countries, but also through a good experience with donors' goods and services, goodwill, and mutual trust (Martínez-Zarzoso et al., 2014).

2.1 Direct and Indirect Effects of Aid on Donors' Exports

Direct and indirect channels can explain the reasons why ODA could foster donors' exports (e.g. Wagner, 2003; among others). Direct effects arise from economic activities explicitly linked to aid-financed projects, while indirect effects refer to broader economic gains attributable to development cooperation but not directly tied to specific aid operations. This distinction is important because the mechanisms underlying each channel differ and imply different empirical approaches for evaluating the economic effects of Swiss ODA. In what follows we provide examples of the mechanisms that explain these direct and indirect effects.

Direct Effects

Tied aid. ODA is a financial transfer to a recipient country. When capital flows in, the recipient country can afford to import more goods and services. If such a transfer is conditional on a

procurement from the donor country, the additional export could be directly linked to a given development project. Tied aid was a practice used by many donors in the early days of post-war international cooperation. Nevertheless, it has been substantially reduced since the early 2000s and plays a minor role for most DAC donors nowadays, including Switzerland.

Informal tying. Donors can decide to spend aid for projects or sectors in which they have a comparative advantage. Even when aid is formally untied, Swiss firms may benefit from informational advantages, accumulated expertise, and established institutional networks. Switzerland possesses strong comparative advantages in sectors such as engineering, environmental technologies, pharmaceuticals, finance, sustainable infrastructure, humanitarian logistics, and renewable energy. Development projects in these areas may therefore generate business opportunities for Swiss actors. Firms already familiar with international standards, procurement procedures, and compliance requirements often enjoy advantages in accessing such markets. Consequently, Swiss ODA can contribute directly to export demand for Swiss goods and services and support economic activity in high value-added sectors of the Swiss economy.

Aid for trade (AfT). ODA projects might have an immediate and positive effect on bilateral trade flows, not only exports but also imports, such aid is referred to as AfT. For example, customs training or investments in trade infrastructure could generate AfT (Martínez-Zarzoso et al., 2017). Nevertheless, the monetary returns reported in the literature is in general smaller than the overall effect of ODA on exports.

Indirect Effects

Beyond project-related activities, Swiss development cooperation may also generate broader indirect economic benefits. By supporting *economic development*, institutional stability, infrastructure, and market creation in recipient countries, aid can increase future demand for

Swiss exports. As recipient economies grow and integrate further into global markets, they may import more machinery, pharmaceuticals, financial services, environmental technologies, and other products in which Swiss firms are internationally competitive.

Aid may also *reduce informational and transaction costs* that hinder trade relationships. Development cooperation often strengthens long-term institutional, diplomatic, and business ties between Switzerland and partner countries. Through repeated interactions, Swiss firms and institutions acquire knowledge about local markets, regulations, consumer preferences, and business environments. These relationships can facilitate future trade and investment beyond the duration of individual aid projects.

Moreover, development cooperation may contribute *to broader global public goods* that indirectly benefit the Swiss economy. Aid supporting climate adaptation, conflict prevention, public health, migration management, and institutional capacity can reduce international instability and mitigate risks that negatively affect trade, investment, and economic growth. Such effects are particularly relevant for a highly open and globally integrated economy such as Switzerland.

Another important indirect channel operates through *multilateral cooperation* and Geneva International. Switzerland hosts many international organizations, development agencies, humanitarian actors, and multilateral institutions in Geneva. Swiss contributions to international cooperation may therefore generate local economic spillovers through employment, conferences, knowledge creation, international procurement, and the strengthening of Switzerland's position as a global governance hub.

We will focus mostly on indirect effects of bilateral ODA, although some of the direct effects, such informal tying and AfT can also be materialized into higher trade due to aid.

2.2 Causality and Identification Challenges

A key challenge in assessing the economic effects of Swiss ODA concerns causality. While aid may stimulate trade and economic activity, it is also possible that Switzerland allocates more aid to countries with which it already maintains strong economic or political relations. In this sense, aid and trade may reinforce each other dynamically.

Furthermore, unobserved bilateral relationships—such as historical ties, political cooperation, migration networks, or common institutional frameworks—may simultaneously affect both aid allocation and economic exchange. Ignoring these factors could lead to biased estimates of the true impact of aid on the Swiss economy.

To address these concerns, the empirical analysis in this paper will rely on econometric methods capable of controlling for confounding factors, unobserved heterogeneity and reverse causality. These methods include gravity models with high-dimensional fixed effects (that control for unobservable factors), panel-data and time series approaches (addressing endogeneity), and dynamic specifications. In this setting we are able to control for persistent strong cultural or socioeconomic ties that do not vary over time, such as having long-lasting economic relationships. The objective is to isolate the extent to which Swiss development assistance contributes causally to Swiss exports, employment, and broader economic spillovers.

The identification strategy described in the next sub-section has been used for the analysis of domestic effects of foreign aid by the Dutch Ministry of Foreign Affairs (IOB, 2014) in cooperation with a team of researchers from the Development Economics Chair at the University of Göttingen. This team has also examined the impact of bilateral aid on trade, assessing benefits for OECD donors (Martínez-Zarzoso et al., 2014) and in more detail for

Germany (Martínez-Zarzoso et al., 2009, 2016) and the Netherlands (Martínez-Zarzoso et al., 2017; Lessing and Martínez-Zarzoso, 2025).

3. Data, Variables, Model Specifications and Stylized Facts

To analyse the impact of development aid on exports and imports, we will focus on net ODA and within this category on two types of aid, namely bilateral ODA disbursements from Switzerland *(i)* to a recipient country *j* (*oda*)[2] and the sum of bilateral aid given by all *other* OECD DAC donors to *j* (*odadac*), excluding Switzerland. We study the aid-export relationship within the framework of the gravity model, an established workhorse model in international economics[3]. Using a one-sided gravity model of trade, we can evaluate and quantify the impact of aid on exports to countries *j* at time *t* controlling for a variety of factors related to trade frictions, the business cycle, level of development, bilateral exchange rates, among others. In our modelling set-up, we add bilateral aid from Switzerland as a "trade facilitating" factor and aid from other DAC countries as a "trade-deterring" factor.

3.1 Data and Variables

We obtain data on development aid from the OECD Development Database on Aid, using net ODA disbursements in current USD. Data on trade in goods over the period from 1995 to 2024 is obtained from CEPII, which in turn relies on raw data from the UN COMTRADE database. For the sectoral results we map HS 2002 data on a six-digit-level to ISIC Rev. 4 using the correspondence by Roy et al. (2022) as starting point, which we adjust and expand manually. Data on trade in services is obtained from the OECD-WTO Balanced Trade in Services

[2] We will also consider a model that includes within bilateral ODA, the earmarked multilateral ODA that can be attributed to specific donors.

[3]The gravity model was mainly established and refined by Anderson (1979), Bergstrand (1985, and 1989), Helpman (1987), Deardorff (1998), Feenstra et al. (2001), Anderson and van Wincoop (2003) and Haveman & Hummels (2004). Recent advances concerning the estimation of gravity models are reviewed in Yotov (2024).

database (BaTIS). BaTIS is only available from 2005 onwards yet provides a dataset on trade in services that is balanced between exporter and importer data. For details, please refer to OECD (2025). Bilateral exchange rates are obtained from the IMF statistics, data on income are from the World Development Indicators database provided by the World Bank. Distances and trade influencing factors such as being a former colony or speaking a common language are taken from the CEPII database. The free trade agreement (FTA) variable is based on de Sousa (2012) and has been updated to the last year in our sample. For input-output analysis, we use the World-Input-Output Tables (WIOD) as presented by Timmer et al. (2015) and updated by Timmer et al. (2016). See Table B.1 in Appendix B for an illustration of the input-output tables.

Switzerland is a small open economy with trade focussed on a smaller set of sectors than large and export-oriented economies like Germany or the Netherlands, both subject to earlier studies[4]. We are aware of two studies for Switzerland in recent years. A Swiss report commissioned by SDC, based on 2014 data (DDC-SECO, 2014), specifically evaluates the economic effects of Swiss ODA on the Swiss economy. Using a different approach (flow-of-funds), the report concludes that: (i) Each Swiss franc of ODA generated between CHF 1.19 and CHF 1.56 in Swiss GDP once multiplier effects are considered. (ii) The estimated employment effect was around 25,000 full-time equivalent jobs in Switzerland. (iii) The study emphasizes that Swiss ODA is largely untied, meaning that positive domestic effects arise mainly through indirect channels, procurement, services, multilateral institutions, and knowledge-intensive sectors rather than formal tied aid. A subsequent doctoral thesis by López (2018) expanded the analysis going beyond simple multiplier analysis and examining whether Swiss ODA increases Swiss exports to recipient countries. Using an augmented gravity model

[4] See Martínez-Zarzoso et al. (2016) and Nowak-Lehmann et al (2009) for the German case and Martínez-Zarzoso et al. (2017) and Lessing and Martínez-Zarzoso (2025) for the Dutch case and Martínez-Zarzoso et al. (2014) for OECD donors.

of bilateral trade for a panel of 95 recipient countries over 51 years (1963-2013), Lopez finds that Swiss bilateral ODA has a statistically significant and economically meaningful positive effect on Swiss exports to recipient countries. The results indicate that every additional USD of Swiss bilateral aid generates about USD 0.59-1.73 of additional Swiss exports to recipient countries, corresponding these numbers to short-run and long-run effects, respectively. We update and extend this work by using more recent data, an econometric framework that accounts for endogeneity effects and uses disaggregated trade data for sectors in goods and services in combination with input-output analysis to compute employment and output effects.

3.2 Model specification and stylized facts

The model specification is based on a Panel Dynamic Feasible Generalised Least Squares (PDFGLS) framework. This method has been used in previous studies[5] and addresses potential endogeneity issues by adding dynamics into a linearized gravity model. For instance, there could be reverse causality, with trade influencing aid allocation. PDFGLS is based on a linear gravity model, applying a procedure detailed in Kao and Chiang (2000), Mark and Sul (2003) and Bai et al. (2021). It accounts for a cointegrating long-run relationship using leads and lags. The main specification (with *i*=Switzerland; *j*=recipient country; *t*=year) is given by:

$$LnTrade_{ijt\,(k)} = \chi_t + \alpha_j + \delta_1 lnODA_{ijt} + \delta_2 lnODADAC_{jt} + \delta_3 lnGDPjt \qquad (1)$$
$$+ \delta_4 lnExcr_{ijt} + \delta_5 FTA_{ijt}$$
$$+ \sum_{p=-1}^{p=+1} \theta_{1p} \Delta lnODA_{jt+p} + \ldots + \sum_{p=-1}^{p=+1} \theta_{lp} \Delta FTA_{jt+p} + \eta_{ijt(k)}$$

As we detect autocorrelation in the disturbances, we control for it in the error term by integrating a Panel Dynamic Feasible Generalised Least Squares (FGLS) procedure into the PDOLS procedure. This involves two steps: (i) the model is estimated via PDOLS (first step),

[5] Martínez-Zarzoso et al. (2017), Nowak-Lehmann et al (2009), among others.

the residuals are saved and the autocorrelation coefficient ρ of the residuals is estimated using $\eta_{ijt} = \rho\eta_{ijt-1} + v_{ijt}$. A weighted error term is generated $\eta^*_{ijt} = \eta_{ijt} - \hat{\rho}\eta_{ijt-1}$ which has the desirable properties. The estimated $\hat{\rho}$ is then used to transform all right- and left-hand-side variables into quasi-first or soft differences. (ii) equation (1) is re-estimated with the variables in soft differences (second step). The inclusion of the leads and lags of the variables in first differences are introduced in the model to tackle endogeneity, that is, to purge left-hand side variables from their endogenous parts. Therefore, their coefficients, θ, are not interpreted.

We start by estimating model (1) using aggregated trade data. Next, we allow the effects of aid on exports to differ across sectors, and re-estimate model (1) sector-by-sector using ODA flows by donor, recipient, and year.

We employ the Poisson Pseudo Maximum Likelihood (PPML) estimator with high-dimensional fixed effects as robustness check, following Santos Silva and Tenreyro (2006), and as recommended by Yotov (2024). Trade data often exhibits heteroskedasticity (present when the variance of the error term changes with the regressors) and PPML provides consistent estimates under heteroscedasticity. In addition, trade data contains zero trade flows when two countries do not have a commercial exchange in a specific sector each year and this method handles zeros in the estimation, since the model is estimated with the dependent variable in levels and not in logs (Santos Silva and Tenreyro 2022). Finally, PPML allows to include several sets of fixed effects to control for unobserved heterogeneity, such as the general business cycle (year fixed effects) or time-invariant recipient characteristics, such as distance from the donor or sharing an official language (donor-recipient fixed effects). The drawback is that it does not account for endogeneity.

This leads to the second model specification for Switzerland's export trade:

$$Trade_{jt\,(k)} = exp\left[\alpha_j + \gamma_t + \beta_1 \ln\left(ODA_{jt}\right) + \beta_2 \ln\left(ODADAC_{jt}\right) + \delta' Z_{jt}\right] \times \epsilon_{jt(k)} \quad (2)$$

where *Trade* represents Swiss exports to recipient *j* at time *t* (in industry *k)*. The coefficient of interest, β, represents the elasticity of exports with respect to Swiss bilateral aid. *Z* is a matrix of control variables that includes GDP of the recipient countries, bilateral exchange rates and a dummy variable for FTAs ratified between Switzerland and the recipient countries.

The coefficients obtained in the estimations are used to predict the increase in exports due to ODA. The estimated increase in sectoral exports together with data obtained from input-output tables (Table B.1) is then used to compute the associated increase in gross output due to the increase in exports, as well as the number of jobs, obtained applying output and job multipliers and the increase in Swiss GDP.

Given that an increase in final demand (additional exports; ΔExp) in a certain sector requires the production of intermediates, which in turn requires other intermediates/primary goods (and so forth), we need to calculate the additional gross output necessary to produce the additional exports ($\Delta output$). Based on this additional output, sectoral job multipliers (*Job_mult*) translate the additional output into additional employment, accounting for the inputs required from all other sectors in a donor country, Switzerland in this case. The same logic also applies to additional domestic sectoral value-added (See Appendix B for a detailed explanation).

The increase in output and jobs is given by:

$$\Delta output = (I - A)^{-1}\, \Delta Exp \quad (3)$$

$$\Delta Jobs = Job\_mult * \Delta output \quad (4)$$

where I denotes the identity (unit) matrix, and A is the matrix of input coefficients obtained from the input-output tables, being $(I - A)^{-1}$ the output multiplier. Thus, substituting (3) into (4) we obtain:

$$\Delta jobs = Job\_mult * Output\_mult * \ \Delta Exp \quad (5)$$

Export and employment effects are computed using the elasticities of exports with respect to aid that are statistically significant in the estimations. When the statistical link cannot be established with precision, no effects are computed.

Before we present the econometric analysis, we show the statistical associations between ODA and exports over time and across recipient countries. It can be observed in Figure 1 that there is a positive correlation between Swiss ODA and exports of goods in 2024. Similarly, more ODA is also associated with higher exports over the period from 1995 to 2024 (see Figure 2).

Figure 1 Correlation between Swiss ODA and Exports of Goods in 2024

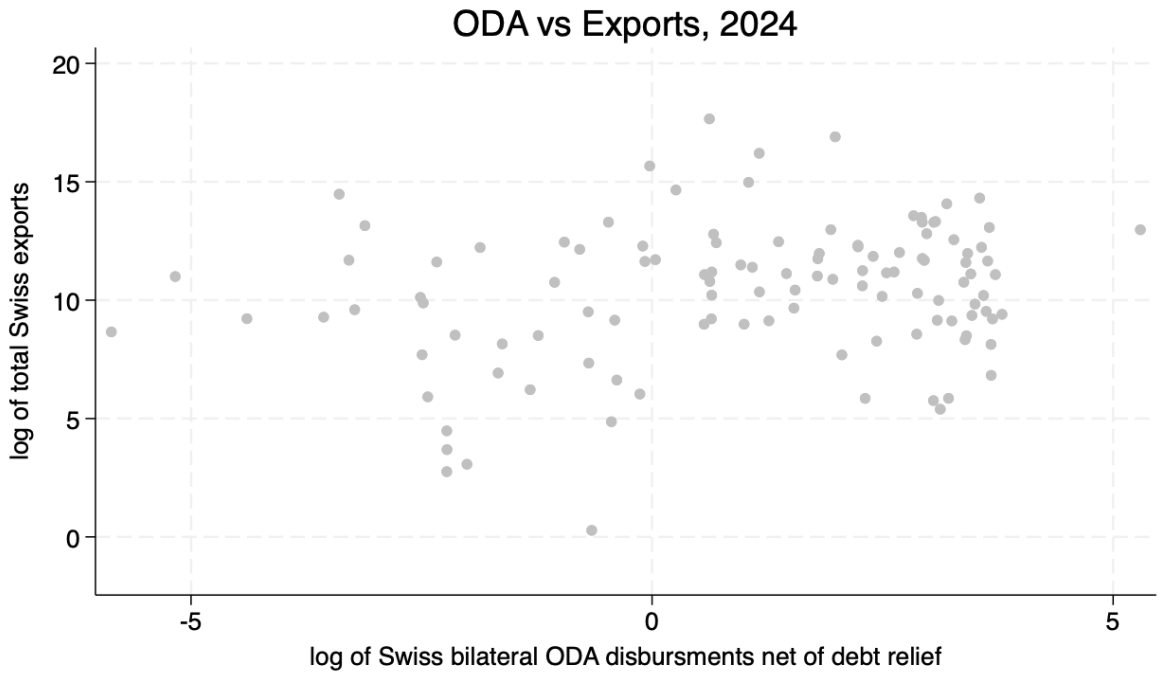


Figure 2 Correlation between Swiss ODA and Exports of Goods: Period 1995-2024

Since correlation does not imply causality, we present in the next section the main results obtained from the abovementioned econometric models.

4. Main Results

We start by presenting the results from the estimations for exports of goods for the whole period with data available (1995-2024) and for two subperiods in dynamic and static settings.

4.1 Results for Aggregated Swiss Exports of Goods

The main results obtained using the PDFGLS specification (1) are shown in Table 1[6]. In column (1), the coefficient on the target variable, Swiss bilateral ODA, is positive and statistically significant at the 5 percent significance level. The estimated coefficient for the

[6] Preliminary test of unit roots in the series and of the existence of a cointegrating relationship are available in the Appendix (Table A.2). The tests indicate that the series for exports, ODA, income and exchange rate are integrated of order 1, thus I (1) and there exists a cointegrating relationship between them, since the residuals of the estimated model are I(0).

overall period is slightly smaller in magnitude than the one reported by López (2018) for a longer time spam –1963-2013– using an econometric technique that did not account for endogeneity issues (0.045 versus 0.052).

When the period 1995-2010 is considered (column 2), the coefficient is not statistically significant, this could be since before 2010 ODA was focused on technical assistance, rural development and democratic governance and operated with a wider geographical footprint. Differently, using the period from 2010-2024 (column 3), the coefficient is significant at the 1 percent level and shows that a 10 per cent increase in Swiss bilateral ODA leads to an increase in Swiss exports of around 1.1 percent. A value at the upper bound of the range of comparable results from studies using recent data covering other OECD donors. Since 2010, Switzerland has significantly narrowed the number of long-term bilateral partner countries to maximize impact, according to SDC. Bilateral development cooperation in Latin America and the Caribbean has been phased out gradually and the priority regions are sub-Saharan Africa, Asia, Eastern Europe, and the Middle East and North Africa, with a stronger focus on Ukraine.

Table 1 Estimation Results for Swiss Exports in Goods

	(1)	(2)	(3)
Period of analysis:	1995-2024	1995-2009	2010-2024
Estimation method:	PDFGLS	PDFGLS	PDFGLS
VARIABLES:			
Log ODA net disbursements	0.0449**	-0.000707	0.109***
	[0.0190]	[0.0259]	[0.0208]
Log ODA DAC other donors	0.0403	0.0994***	-0.0827**
	[0.0266]	[0.0344]	[0.0324]
Log GDP recipients	0.961***	1.022***	0.935***
	[0.0182]	[0.0221]	[0.0197]
Log real bilateral exchange rate	0.0321***	0.0247***	0.0446***
	[0.00790]	[0.00714]	[0.00910]
Free Trade Agreement	0.641***	0.801***	0.664***
	[0.0646]	[0.110]	[0.0661]
Monetary Return (USD per 1 USD)	1.474		4.034
Observations	2,341	1,140	1,199
Number of recipient countries	104	98	103
Number of years	26	13	13

Note: Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. Leads and lags of all explanatory variables in first differences and country fixed effects included in all models, not shown. PDFGLS denotes panel dynamic feasible generalized least squares. For a list of recipient countries see Table A.1.

Using these results[7] to compute an elasticity of the respective aid spending, we find that the average return on aid for Swiss exports over the period from 1995 until 2024 is approximately a USD 1.47 increase in the value of exports for each dollar spent:

$$\beta_{AID} \times \frac{Avg.Exports}{Avg.Aid} \Rightarrow 0.0449 * \frac{380{,}988.5}{11{,}604.2} = 1.474 \quad (6)$$

The corresponding return over the period from 2010 until 2024 is approximately a USD 4.03 increase in the value of exports for each dollar spent:

$$\beta_{AID} \times \frac{Avg.Exports}{Avg.Aid} \Rightarrow 0.109 * \frac{519{,}386.2}{14{,}071.36} = 4.03 \quad (7)$$

where average exports and aid are in thousand USD and are calculated for the sample used in each estimation.

We observe that the monetary return to ODA calculated using equation (6) and based on the estimates and average exports and aid for the whole period (column 1) increases when the estimates for 2010-2024 are considered, which indicate that per each 1 USD of bilateral ODA spent, 4 USD of Swiss exports are generated (based on a coefficient of 0.109). This result should be dealt with more caution due to the smaller number of observations. It could be due to more targeted aid towards productive activities. This more than proportional increase is higher than the one found for Germany (2.5 USD of German exports generated per each 1 USD of ODA) in a recent unpublished study (Lessing and Martínez-Zarzoso, 2026) covering a similar period (2005-2024) and using the same econometric methodology.

The results are also comparable –slightly higher– to those shown in Table 2 obtained for the Netherlands, with an increase in Dutch exports of around 2.78 in return for a 1 USD increase in bilateral aid (2010-2022 period) according to Lessing and Martínez-Zarzoso (2025).

[7] Note that the averages of ODA and bilateral trade used for the computation of elasticities are based on the corresponding sample period used in each column.

The results obtained using the second methodology, shown in Table A.2, although less precise in terms of significance levels, confirm the positive effect of bilateral ODA on exports of goods since 2010. The corresponding monetary return is considerably higher, amounting to 6.73 per 1 USD spent, taking results from column (3) for the period since 2010.

Table 2 Estimation Results for Dutch Exports in Goods for Comparison

	(1)	(2)	(3)
Period of Analysis	2000-2022	2000-2010	2010-2022
Estimation method:	PDFGLS	PDFGLS	PDFGLS
VARIABLES:			
Log ODA net disbursements	0.0328***	0.0489***	0.0598***
	[0.0122]	[0.0164]	[0.0148]
Log ODA DAC other donors	-0.0168	-0.0146	-0.0718**
	[0.0252]	[0.0320]	[0.0299]
Log GDP recipients	0.778***	0.794***	0.798***
	[0.0168]	[0.0152]	[0.0172]
Log real bilateral exchange rate	-0.0633***	-0.0115	-0.0900***
	[0.0119]	[0.0117]	[0.0120]
Free Trade Agreement	0.484***	1.085***	0.513***
	[0.0588]	[0.0627]	[0.0596]
Monetary Return (USD per 1 USD)	0.74	0.705	2.778
Observations	1,364	793	561
Number of recipient countries	106	98	71
Number of years	22	10	12

Note: Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. Leads and lags of all explanatory variables in first differences and country fixed effects included in all models, not shown. PDFGLS denotes panel dynamic feasible generalized least squares. This table corresponds to Table 1 in Lessing and Martinez-Zarzoso (2025).

4.2 Results for Swiss Exports of Goods and Services

In this sub-section we present the results for Swiss exports of goods and services over the period with data available for services and also including earmarked multilateral ODA. The results indicate a positive and significant effect of bilateral ODA on the recipients' exports of goods and services (Table 3, column 1), when using the preferred methodology that accounts for endogeneity issues. The estimated coefficient is 0.062, indicating that for each 10 percent increase in bilateral ODA exports of goods and services increase by 0.62 percent over the period from 2005 to 2024. The monetary return is 3 USD per each 1 USD of bilateral ODA, which is higher than the one found for goods in the previous section and for the whole period

(1995-2024). The estimated coefficient in column (2) presents the results when multilateral ODA (non-core contributions earmarked to specific countries) is added to bilateral ODA, that is, the target variable is the sum of bilateral ODA and multilateral aid that can be imputed to a given recipient. It is worth to notice that the coefficient for the ODA variable slightly increases. The returns to ODA in terms of exports of goods and services are slightly higher in comparison to those in column (1), amounting to 3.18 UDS in exports for each 1 USD of ODA when the preferred econometric model is estimated.

Table 3 Estimation Results for Swiss Exports of Goods and Services

Type of ODA	(1) Bilateral	(2) Bilateral+Multilateral
Period of analysis:	2005-2024	2005-2024
Estimation method:	PDFGLS	PDFGLS
VARIABLES:		
Log ODA net disbursements	0.0621***	0.0644***
	[0.0134]	[0.0219]
Log ODA DAC other donors	-0.0340*	-0.0333
	[0.0194]	[0.0235]
Log GDP recipients	0.794***	0.793***
	[0.0128]	[0.0128]
Log real bilateral exchange rate	0.0186***	0.0169***
	[0.00536]	[0.00535]
Free Trade Agreement	0.509***	0.500***
	[0.0454]	[0.0478]
Monetary Return ($ per 1 USD)	**3.06**	**3.18**
Observations	1,471	1,486
Number of recipients countries	104	104

Note: Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. Leads and lags of all explanatory variables in first differences and country fixed effects included in PDFGLS, which denotes panel dynamic feasible generalized least squares. Swiss GDP is absorbed by the time FE. ODA denotes Official Development Aid. For a list of recipient countries see Table A.1.

Next, to complete the aggregated analysis, Table A.3 and Table A.4 present the results for the alternative estimator, PPML, in column (1) with bilateral aid and in column (2) adding multilateral earmarked aid. The coefficient is more accurately estimated in column (2) of Table A.4, for exports of goods & services and the monetary return is higher when using PPML (ranges between 4-6.74), but it is important to mention that endogeneity is not accounted for with this method.

Two additional robustness checks are conducted. First, we examine whether the effects differ between groups of recipient countries by distinguishing Swiss priority partner countries from all other recipients using our main estimation approach. The results, reported in Table A.5, indicate that the positive effect of ODA on Swiss exports is more pronounced for priority partner countries, as expected.

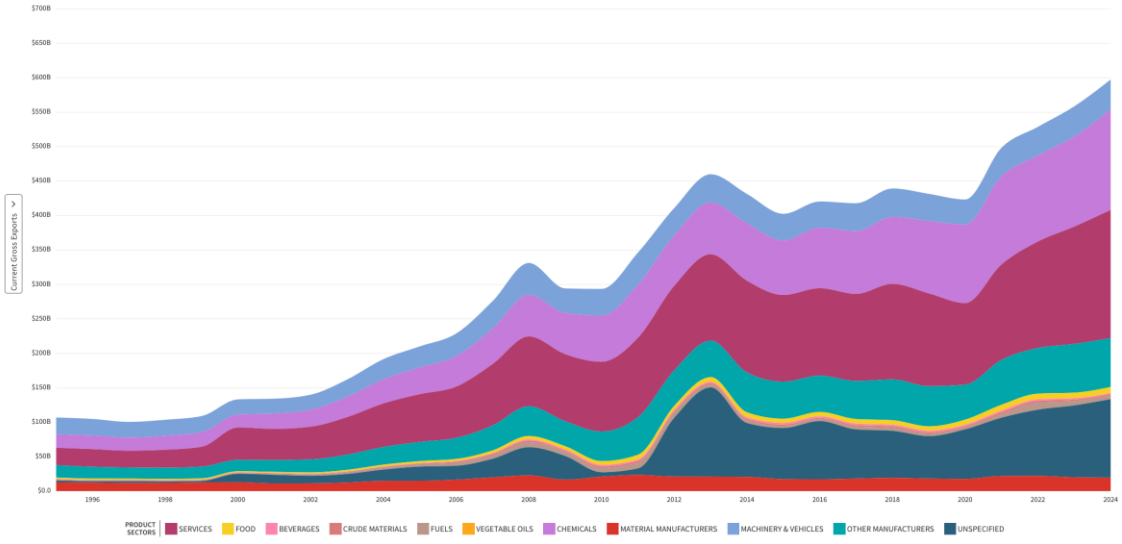
Second, we estimate the model using PPML, including two leads and two lags of the ODA variable. The results show that the effects of aid primarily materialize with a one-year lag, as the coefficient on ODA(t−1) is positive and statistically significant. In contrast, the coefficients on the lead variables, ODA(t+1) and ODA(t+2), are not statistically significant, providing no evidence of reverse causality from exports to aid allocations. These results are reported in Table A.6.

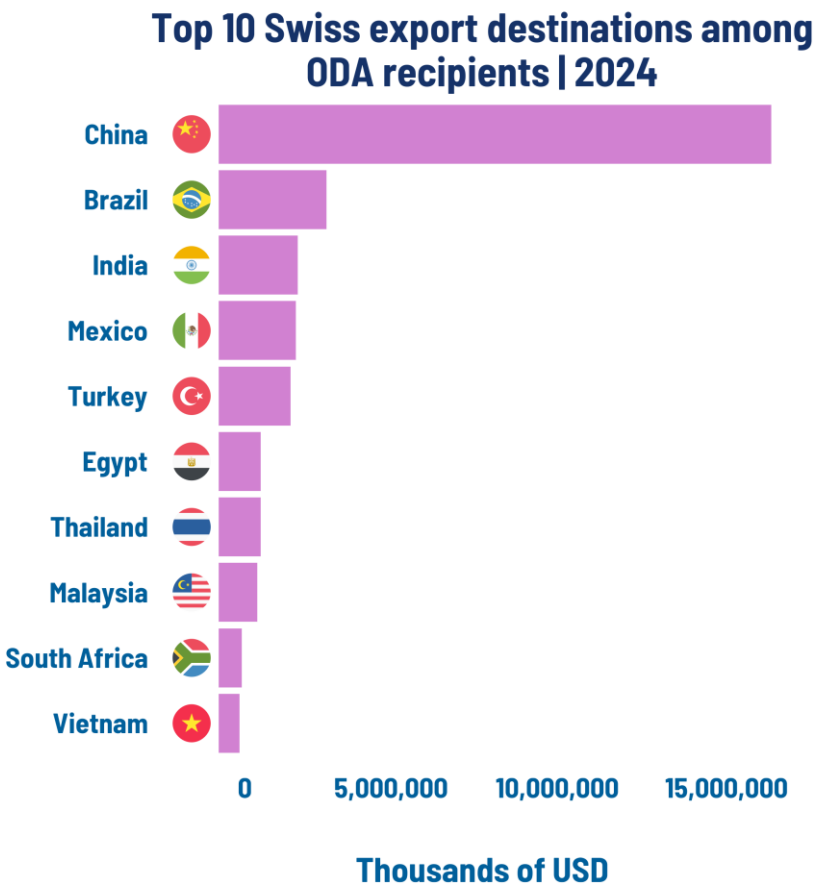
4.3 Sectoral Results for Goods (1995-2024)

The use of aggregated trade flows in the models estimated in the previous sections provides an overall picture of the average effect on ODA on Swiss exports. Nevertheless, with the aim of relating these effects to specific industries, we present in this section the results obtained for each industry or subsector separately. This will allow us to compute the associated effects in terms of increasing Swiss exports and link those to the input-output output and job multipliers to compute the number of jobs that are related to Swiss ODA in each industry and the corresponding increase in domestic value added and GDP. We present in this section the results from the corresponding estimations for the goods sector and in the next for services. Before that, we give a brief overview of main Swiss exporting sectors and the evolution over time. Figure 3 shows the evolution over time of Swiss exports of goods and services over the period from 1995 to 2024 for broad categories, on the top graph for all destinations and in the bottom graph for the ten more important recipients of ODA. It can be observed that the services

category started to gain in importance since the early 2000s, for this motive and due to data availability, the analysis for goods sectors includes the 1995-2024 period, whereas for services is restricted to 2005-2024. The figure also shows that a similar comparative advantage has been kept over time concerning goods, with steady growth in exports in most of the important broad categories, including chemicals, machinery, other manufactures, unspecified goods, other manufactures and food and beverages.

Figure 3 Switzerland Exports to the World in 1995-2024 and Main ODA Recipients' Destinations in 2024

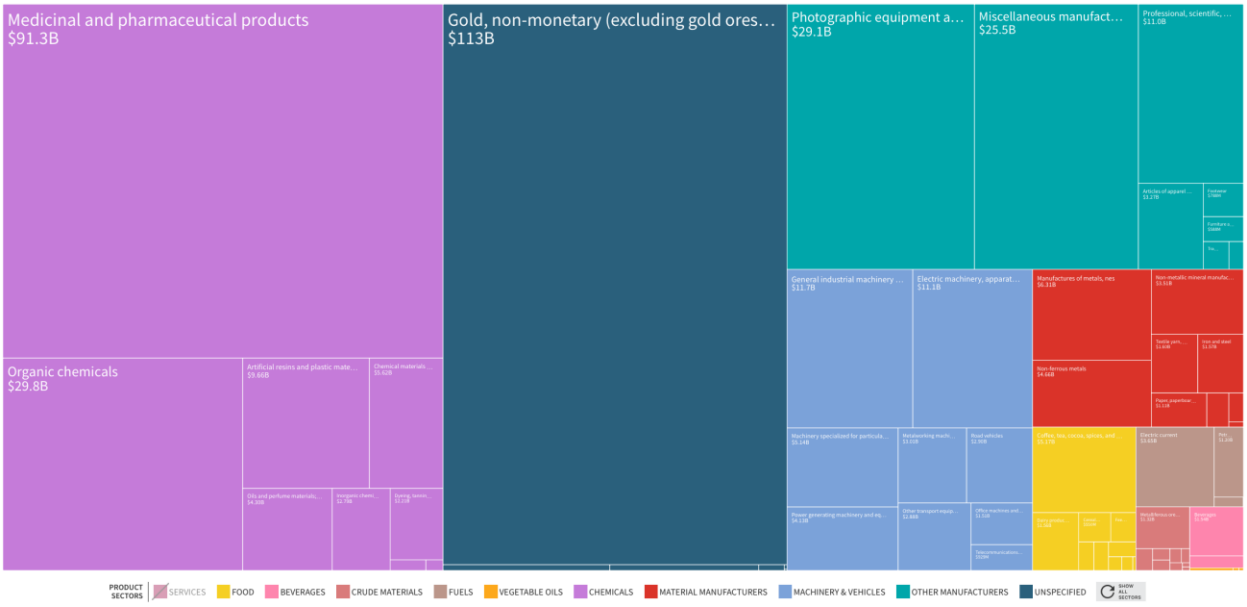


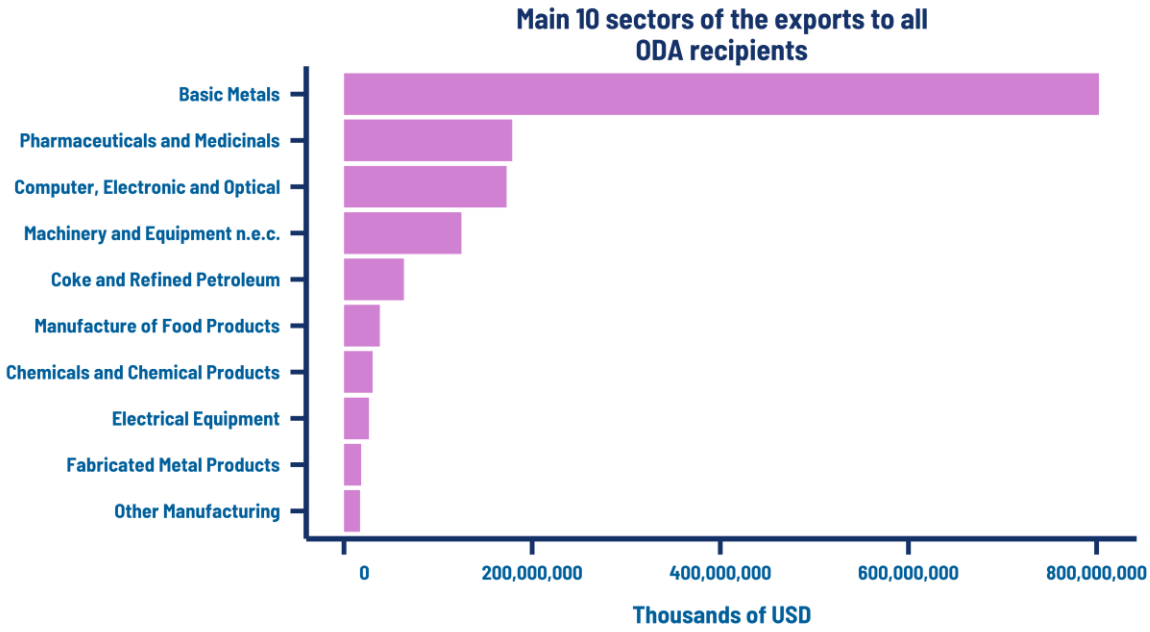


Source: Atlas of Economic Complexity (2026). Available at: https://atlas.hks.harvard.edu (top graph) and authors' calculations (bottom graph) based on the data used in the regression analysis.

A more detailed picture of Swiss merchandise exports in specific industries can be seen in Figure 4. Swiss exports are heavily concentrated in a few production sectors, which highlight the strength of Switzerland's international competitiveness in the chemical industry (with medicines and pharmaceutical products and organic chemicals accounting for the lion's share), in gold, as well as in mechanical engineering (industrial and electrical machinery), the materials industry (metals and non-ferrous metals) and the consumer goods industry (food and beverages). Swiss exports to recipients of ODA are strongly represented in a few production sectors in the manufacturing of basic metals (including gold), medicinal and pharmaceutical products, computer, electronic and optical devices, as well as machinery and equipment and in food products.

Figure 4. Exports in Goods Sectors to the World and to ODA's Recipients





Source: Atlas of Economic Complexity (2026). Available at: https://atlas.hks.harvard.edu (top graph) and authors' calculations (bottom graph) based on the data used in the regression analysis.

Given the level of aggregation at which input output tables are constructed, we are not going to be able to relate the increase in demand due to ODA with the specific industry categories in Figure 4. Nevertheless, we expect that the sectors in which we could infer output and job gains are those in which Switzerland is an important exporter as in shown in Figure 4.

Therefore, as advanced previously, we proceed with an input-output analysis to estimate for each subsector (according to the classification used in the input-output tables shown in Table A.7) the effect of ODA on exports applying model (1) to data. The estimated coefficient for ODA is linked, with the help of equations (3) to (5), to the number of jobs in each subsector that is generated by the additional exports due to ODA.

The main results for goods are presented in Table 4. We only compute employment effects for the subsectors with significant coefficients. The third column presents the estimated coefficients obtained from the regression analysis for each subsector, as described in the second column.

Table 4 Sectoral Estimations and Jobs for Goods

Sector IO16	**WIOD description**	**Loda Coefficient**	**X bil USD**	**ΔX (bil USD)**	**Output Mult**	**Δoutput (bil USD)**	**Job Mult**	**Δ jobs (T)**
B	Mining and quarrying	0.249**	0.166	0.041	1.781	0.073	2.336	0.172
C13-C15	Textiles, wearing apparel and leather products	0.0420*	1.239	0.052	1.414	0.074	4.138	0.305
C17	Paper and paper products	0.0693*	0.278	0.019	1.906	0.037	2.601	0.095
C21	Basic pharmaceutical products	0.0634***	33.070	2.097	1.526	3.200	0.521	1.668
C24	Basic metals	0.0779*	90.067	7.016	1.558	10.929	2.010	21.967
C26	Computer, electronic and optical products	0.0399**	22.617	0.902	1.897	1.712	1.621	2.774
C28	Machinery and equipment n.e.c.	0.0585***	6.506	0.381	1.678	0.639	2.233	1.426
C29	Motor vehicles, trailers and semi-trailers	0.0851**	0.257	0.022	1.522	0.033	2.149	0.072
C33	Repair and installation of machinery and equipment	0.124***	2.221	0.275	1.888	0.520	2.851	1.482
Total				**10.805**		**17.217**		**29.961**

Note: Output and job multipliers based on the World Input-Output Database (WIOD) 2016 release. https://www.rug.nl/ggdc/valuechain/wiod/. Loda denotes the coefficients of for each sector estimated using PDFGLS (Model 1) for Log ODA net disbursements.

The results in Table 4 indicate that most jobs are generated in a few sectors. The sector Basic metals is linked to 2/3 of the jobs, most probably due to the gold industry. The other sectors that stand out are pharma, computers and machinery equipment. In total 29,961 jobs are related to the increase in exports (USD 10.8 billion) and the corresponding increase in output (USD 17.22 billion) computed using jobs and output multipliers from the input output tables for Switzerland.

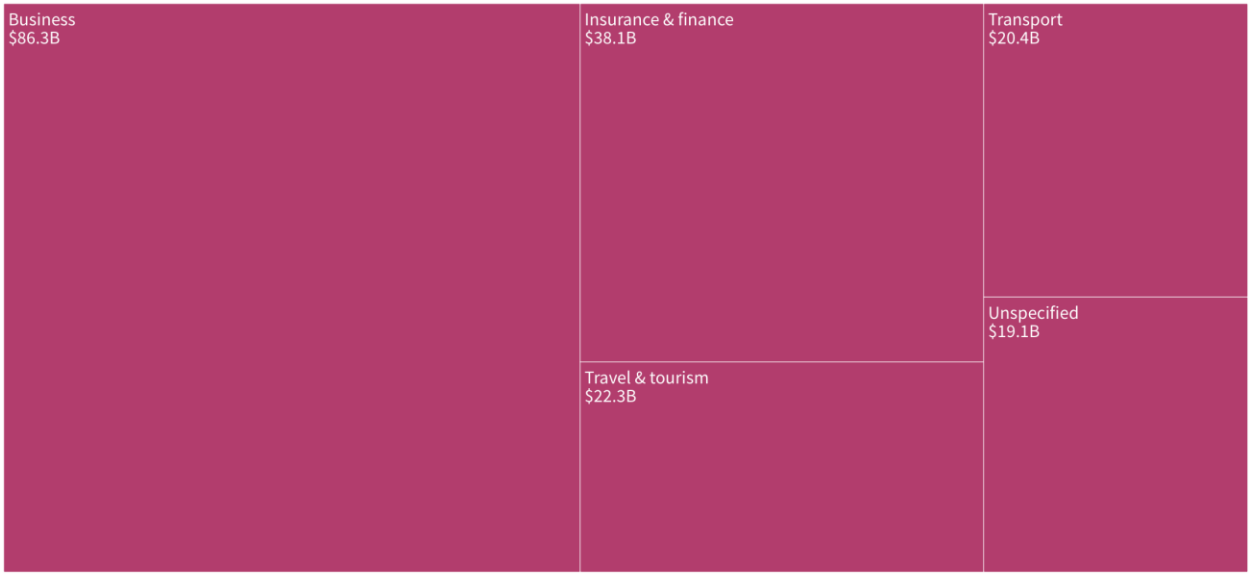
The number of jobs secured through the ODA is modest (29,961 jobs), making up about 2.8 percent of the total number of jobs in the production sector in Switzerland. With 21,967 jobs supported by aid in the basic metals industry, the importance of the gold industry within that sector becomes clear, while other key knowledge-intensive clusters like basic pharmaceuticals, computer and electronic products, and machinery equipment display statistically significant gains that directly validate the broader sectoral strengths of the Swiss economy.

Summarizing, despite the constraints of input-output data aggregation, the economic impacts of ODA systematically align with Switzerland's highly competitive industries—such as chemicals, pharmaceutical products, machinery and precision equipment (Figure 4.).

4.4 Sectoral results for Services (2005-2024)

We present in this section the results from the sectoral estimations for the services sector. Services are among the most dynamic economic sector in terms of exports (see Figure 3). The services sector is therefore an important driving force of the Swiss economy. It accounts for more than 70 percent of the gross value added. Three out of four companies are active in the services sector, more than four out of five newly created companies are services companies, and three out of four employees work in the service sector. The strongest sectors are business, insurance and financial services, travel and tourism, and transport, as can be seen in Figure 5.

Figure 5. Services Sectors Exports to the World in 2024



Source: Atlas of Economic Complexity (2026). Available at: https://atlas.hks.harvard.edu.

The business environment in Switzerland is known for its business, insurance and financial services that include private banking, wealth management and investment advisory. The financial system is well regulated, offers discretion, tailored strategies. It enjoys global trust and recognition for its expertise and reliability. Financial services enter as inputs in basically all sectors of the economy thus influencing the performance and functioning of companies. Moreover, Geneva hosts strong local and international firms, which offer strategy and management consulting, auditing and assurance, tax and regulatory advisory to support operational performance and sustainable growth and compliance with tax laws and regulation. Consulting on reporting and documentation requirements related to environmental, labor and health standards is provided as well. Given that these professional services are needed in many sectors they can have a deep impact on business outcomes.

We proceed with input-output analysis to estimate for each services subsector, according to the classification used in the input-output tables (see Table A.7), the effect of ODA on exports applying model (1) to data. The estimated coefficient for ODA is linked, with the help of equations (3) to (5), to the number of jobs in each subsector that is generated by the additional exports due to ODA.

The main results for services, presented in Table 5, compute employment effects for the subsectors with significant coefficients, as done for exports of goods. The third column presents the estimated coefficients obtained from the regression analysis for each subsector, as described in the second column.

Table 5 Estimated Coefficients and Jobs for Services

Sector IO16	WIOD description	Loda Coefficient	X bil USD	ΔX (bil USD)	Output Mult	Δoutput (bil USD)	Job Mult	Δ jobs (T)
F	Construction	0.0898***	0.530	0.048	1.781	0.085	2.969	0.252
H49	Land transport and transport via pipelines	0.119***	1.745	0.208	1.895	0.394	2.359	0.928
H51	Air transport	0.0802***	1.472	0.118	2.172	0.256	1.278	0.328
I	Accommodation and food service activities	0.0868***	4.867	0.422	1.820	0.769	6.364	4.894
J58	Publishing activities	0.106**	0.406	0.043	1.954	0.084	4.136	0.348
J61	Telecommunications	0.0434**	0.767	0.033	1.901	0.063	1.284	0.081
J62_J63	Computer programming, consultancy and info services	0.0541***	2.561	0.139	1.549	0.215	2.301	0.494
K64	Financial service activities	0.0703***	5.764	0.405	1.533	0.621	2.008	1.248
M69_M70	Legal, accounting, and management consultancy	0.0567**	2.861	0.162	1.553	0.252	3.134	0.790
M74_M75	Other professional, scientific and technical activities	0.106**	4.775	0.506	1.909	0.966	4.904	4.739
Total				**2.084**		**3.705**		**14.102**

Note: Output and job multipliers based on the World Input-Output Database (WIOD) 2016 release. https://www.rug.nl/ggdc/valuechain/wiod/. Loda denotes the coefficients of for each services sector estimated using PDFGLS (Model 1) for Log ODA net disbursements.

The results indicate that most jobs are generated in a few sectors that include accommodation and food service activities, Other professional, scientific and technical activities, financial services and legal, accounting, and management consultancy. In total 14,102 jobs are related to the increase in exports of services (USD 2.08 billion) and the corresponding increase in output (USD 3.7 billion) computed using jobs and output multipliers from the input output

tables for Switzerland. Aid secured 14,102 jobs in the services sector, making up about 1.9% of the sector's total jobs.

Summarizing, sectoral econometric estimations (Table 10) reveal that ODA-induced services exports of USD 2.08 billion expand output by USD 3.70 billion and secure 14,102 Swiss jobs, with the employment gains heavily concentrated within accommodation and food services, technical/scientific activities, and financial and legal consulting hubs.

4.5 Assessment of Macroeconomic Effects

In the previous section, and with the use of input-output analysis, we show that–taking the estimates obtained over the period under analysis until 2024–exports induced by aid translate into the security of ca. [44,064] jobs (0.8% of total jobs in Switzerland in 2024[8]), 29,961 in the goods sectors and 14,102 in the services sector).

To estimate how aid-induced additional exports can affect Switzerland's overall economic development (as measured by GDP), input-output analysis provides further insights. It allows tracing how export demand flows through the economy and extracting the value-added content of exports—that is, the portion of export value created domestically in terms of salaries, profits and taxes, excluding imported inputs. This procedure again includes the knock-on effects within the supply chain.

In the period under analysis, and according to the computations presented in Table 6Table 6, bilateral aid can be linked to an average amount of USD [7.41] billion value-added contribution to the Swiss GDP (which was USD 936.56 billions in 2024 according to the Word Bank), corresponding to around 0.8% of Swiss GDP (0.41% excluding basic metals). Goods and services sectors for which the estimation results were inconclusive were excluded from the calculation since it was not possible to reliably attribute job effects or Swiss value added.

[8] Number of jobs in Switzerland in 2024=5.5 million people according to: https://www.swissinfo.ch/eng/archive-workplace-switzerland/employment-up-slightly-in-switzerland-by-the-end-of-2024/88919047.

Consequently, this conservative approach could lead to an underestimation of the actual figures.

Table 6. Estimated Contribution to Swiss GDP

WIOD_description	Δoutput (bil USD)	VA Coefficient	Contribution to Swiss GDP (bil USD)
Mining and quarrying	0.073	0.4142	0.0302
Textiles, wearing apparel and leather products	0.074	0.3490	0.0258
Paper and paper products	0.037	0.3258	0.0121
Basic pharmaceutical products	3.200	0.3140	1.0048
Basic metals	10.929	0.3288	3.5935
Computer, electronic and optical products	1.712	0.3805	0.6514
Machinery and equipment n.e.c.	0.639	0.3797	0.2426
Motor vehicles, trailers and semi-trailers	0.033	0.3897	0.0129
Repair and installation of machinery and equipment	0.520	0.3779	0.1965
Construction	0.085	0.4324	0.0368
Land transport and transport via pipelines	0.394	0.3653	0.1439
Air transport	0.256	0.1686	0.0432
Accommodation and food service activities	0.769	0.4777	0.3674
Publishing activities	0.084	0.3862	0.0324
Telecommunications	0.063	0.4560	0.0287
Computer programming, consultancy and info services	0.215	0.5045	0.1085
Financial service activities	0.621	0.5675	0.3524
Legal, accounting, and management consultancy	0.252	0.5725	0.1443
Other professional, scientific and technical activities	0.966	0.4027	0.3890
Total	20.922		**7.4163**

Note: Based on authors estimates and on the World Input-Output Database (WIOD) 2016 release. Source: https://www.rug.nl/ggdc/valuechain/wiod/.

To put the results into perspective, we can compare them with those obtained for other donors, such as Germany, or more appropriately, the Netherlands and Sweden, which possess economic structures more comparable to Switzerland. According to the estimations obtained by Lessing and Martínez-Zarzoso (2026) for Germany, exports of goods and services generated by aid over the period from 2005-2024 translate into the security of ca. 378,933 jobs (338,015 in goods sectors, 40,918 in services), and aid can be linked to an average amount of around USD 37.86 billion value-added contribution to the German GDP.

The corresponding estimates obtained by the authors for the Netherlands are 28,782 jobs (10,576 in goods sectors, 18,206 in services) and an increase in GDP around USD 2.99 billion. Results for Sweden, on the other hand, indicate that the number of jobs linked to bilateral ODA are around 17,014 (12,680 in goods sectors, 4,334 in services), and in terms of GDP, an increase of USD 2.15 billion is estimated, also using disaggregated data over the period from 2005 to 2024 for exports on goods and services.

Compared to the Netherlands and Sweden, Switzerland's contribution to the value added by aid is larger. This divergence is potentially linked to Switzerland's exceptionally high wage and corporate profit levels; per capita income in Switzerland is nearly double that of the Netherlands and Sweden, while the globally renowned Swiss banking and insurance industries are characterized by notably high profit margins.

5. Conclusions

This paper provides a comprehensive assessment of the economic benefits that Switzerland derives from its Official Development Assistance (ODA). Combining state-of-the-art gravity model estimations with sectoral input-output analysis, the study quantifies how bilateral aid affects Swiss exports, employment, value added, and income generation. The econometric results consistently show that bilateral ODA generates significant additional exports of both goods and services. For the period 1995–2024, every additional US dollar of bilateral ODA is associated with approximately 1.5 US dollars of *Swiss exports of goods* and for the period 2005-2024, every additional US dollar of bilateral ODA is associated with approximately 3.0 US dollars of *Swiss exports of goods and services*. This return exceeds recent estimates reported for other donor countries using comparable methodologies. These findings indicate that development cooperation not only contributes to global development objectives but also strengthens Switzerland's economic performance.

The sectoral analysis shows that these export gains translate into substantial domestic economic activity. Through direct and indirect supply-chain effects, aid-supported exports secure approximately 44,000 Swiss jobs, generate more than USD 20 billion in additional output, and contribute an estimated USD 7.4 billion in domestic value added, corresponding to around 0.8% of Swiss GDP. Employment effects are concentrated in Switzerland's internationally competitive industries, including pharmaceuticals, machinery, precision equipment, financial services, scientific and technical activities, and hospitality. These results highlight that the economic benefits of ODA extend well beyond exporting firms, creating spillovers throughout the Swiss economy via production networks and service providers.

The analysis also shows that the economic returns to Swiss ODA extend beyond trade. Switzerland benefits from hosting a unique ecosystem of international organizations, development agencies, research institutions, and non-governmental organizations, which generate high-skilled employment, procurement opportunities, innovation, and international visibility. ODA strengthens Switzerland's role as a global hub for international cooperation while supporting domestic research, specialized professional services, and long-term economic partnerships with developing countries. These broader benefits reinforce the country's comparative advantages in high-value-added sectors and contribute to Switzerland's international competitiveness and economic resilience.

Taken together, the evidence suggests that Official Development Assistance should be viewed not only as an instrument of international solidarity but also as a strategic investment that generates measurable economic returns for Switzerland. In a context of increasing geopolitical uncertainty, fiscal constraints, and intensifying global competition, maintaining an effective and well-targeted development cooperation policy contributes simultaneously to global public goods and to Switzerland's own economic interests. While future research could further quantify additional channels—such as innovation, foreign direct investment, and long-term

business partnerships—the results presented here provide robust evidence that Swiss ODA generates substantial economic value alongside its development impact.

References

Anderson, J. E. (1979). A theoretical foundation for the gravity equation. *American Economic Review*, *69*(1), 106–116.

Anderson, J. E., & van Wincoop, E. (2003). Gravity with gravitas: A solution to the border puzzle. American Economic Review, 93(1), 170–192.

Bai, J., Choi, S. H., & Liao, Y. (2021). Feasible generalized least squares for panel data with cross-sectional and serial correlations. *Empirical Economics*, *60*(1), 309-326.

Bergstrand, J. H. (1985). The gravity equation in international trade: Some microeconomic foundations and empirical evidence. *Review of Economics and Statistics*, *67*(3), 474–481.

Bergstrand, J. H. (1989). The generalized gravity equation, monopolistic competition, and the factor-proportions theory in international trade. *Review of Economics and Statistics, 71*(1), 143–153.

Deardorff, A. V. (1998). Determinants of bilateral trade: Does gravity work in a neoclassical world? In J. A. Frankel (Ed.), *The regionalization of the world economy* (pp. 7–32). University of Chicago Press.

De Sousa, J. (2012). The currency union effect on trade is decreasing over time. *Economics Letters, 117(3), 917-920.*

Feenstra, R. C., Markusen, J. R., & Rose, A. K. (2001). Using the gravity equation to differentiate among alternative theories of trade. *Canadian Journal of Economics, 34*(2), 430–447.

Heidland, T., Michael, M., Schularick, M. and Thiele, R. (2025) Identifying Mutual Interests: How Donor Countries Benefit from Foreign Aid. Kiel Working Paper No. 2291. Kiel Institute for the World Economy (IfW Kiel), Kiel.

Helpman, E. (1987). Imperfect competition and international trade: Evidence from fourteen industrial countries. *Journal of the Japanese and International Economies, 1*(1), 62–81.

IOB (2014). *Good things come to those who make them happen – Return on aid for Dutch exports* (No. 392). IOB Study.

Kao, C. and Chiang, M.H. (2000) On the estimation and inference of a cointegrated regression in panel data. *Advances in Econometrics* 15, 179-222.

Lessing, J. and Martínez-Zarzoso, I. (2026) More than Meets the Port: Donor Export Effects of Foreign Aid Revisited, University of Goettingen. IAI Working Paper, forthcoming.

Lessing, J. and Martínez-Zarzoso, I. (2025). Domestic Effects of foreign Aid. Cordaid Working Paper. Available at: https://www.cordaid.org/nl/wp-content/uploads/2025/06/Domestic-Effects-of-Foreign-Aid-Report.pdf.

López, L. (2018). The impact of official development assistance on the donor's economy: the case of Switzerland. Doctoral dissertation, University of Neuchâtel.

Mark, N. C., & Sul, D. (2003). Cointegration vector estimation by panel DOLS and long-run money demand. *Oxford Bulletin of Economics and statistics*, *65*(5), 655-680.

Martínez-Zarzoso, I., Nowak-Lehmann, F., Parra, M. D., & Klasen, S. (2014). Does aid promote donor exports? Commercial interest versus instrumental philanthropy. *Kyklos*, *67*(4), 559-587.

Martínez-Zarzoso, I., Nowak-Lehmann, F., Klasen, S., & Johannsen, F. (2016). Does German development aid boost German exports and German employment? A sectoral level analysis. *Jahrbücher für Nationalökonomie und Statistik*, *236*(1), 71-94.

Martínez-Zarzoso, I., Nowak-Lehmann, F. D., & Klasen, S. (2017). Aid and its impact on the donor's export industry: The Dutch case. *The European Journal of Development Research*, *29*(4), 769-786.

Nowak-Lehmann D, F., Martínez-Zarzoso, I., Klasen, S., & Herzer, D. (2009). Aid and trade–A donor's perspective. *The Journal of Development Studies*, *45*(7), 1184-1202.

OECD (2025). *The OECD-WTO Balanced Trade in Services Database (BaTIS)*. https://doi.org/10.1787/c321a7a7-en.

Santos Silva, J., & Tenreyro, S. (2006). The log of gravity. *The Review of Economics and Statistics*, 641-658.

Santos Silva, J. M., & Tenreyro, S. (2022). The log of gravity at 15. *Portuguese Economic Journal*, *21*(3), 423-437.

Timmer, M. P., Dietzenbacher, E., Los, B., Stehrer, R., & de Vries, G. J. (2015). An illustrated user guide to the World Input-Output Database: The case of global automotive production. *Review of International Economics*, 23(3), 575–605.

Timmer, M. P., Los, B., Stehrer, R., & de Vries, G. J. (2016). An anatomy of the global trade slowdown based on the WIOD 2016 release (No. 162). GGDC Research Memorandum.

Wagner, D. (2003). Aid and trade—an empirical study. *Journal of the Japanese and international economies*, *17*(2), 153-173.

Yotov, Y. V. (2024). The evolution of structural gravity: The workhorse model of trade. *Contemporary economic policy*, *42*(4), 578-603.

Appendix A: List of Recipient Countries, Robustness Checks & IOT

Table A.1. List of Recipient Countries

List of Recipients				
Angola	Colombia	India	Senegal	Somalia
Albania	Cabo Verde	Iran	Sierra Leone	Serbia
Argentina	Costa Rica	Iraq	Mongolia	Eswatini
Armenia	Dominican Republic	Jordan	Mozambique	Syria
Azerbaijan	Algeria	Kazakhstan	Mauritania	Chad
Burundi	Ecuador	Kenya	Malawi	Togo
Benin	Egypt	Kyrgyzstan	Malaysia	Thailand
Burkina Faso	Ethiopia	Cambodia	Namibia	Tajikistan
Bangladesh	Fiji	Laos	Niger	Tunisia
Bosnia and Herzegovina	Gabon	Lebanon	Nigeria	Türkiye
Belarus	Georgia	Liberia	Nicaragua	Tanzania
Bolivia	Ghana	Sri Lanka	Nepal	Uganda
Brazil	Guinea	Lesotho	Pakistan	Ukraine
Bhutan	The Gambia	Morocco	Panama	Uruguay
Central African Republic	Guinea-Bissau	Moldova	Peru	Uzbekistan
Chile	Equatorial Guinea	Madagascar	Philippines	Venezuela
China	Guatemala	Mexico	Paraguay	Vietnam
Côte d'Ivoire	Honduras	North Macedonia	State of Palestine	Yemen
Cameroon	Haiti	Mali	Rwanda	South Africa
Dem. Republic of the Congo		Myanmar	Sudan	Zambia
Republic of the Congo	Indonesia	Montenegro	El Salvador	Zimbabwe

Note: List of recipient countries included in the regression analysis. China excluded for analysis after 2010.

Table A.2. Panel Unit Root and Cointegration Tests

a) Panel Unit Root Tests (Fisher type)		
Variable	**Unit root result**	**Order of integration**
All variables	Non-stationary in levels; stationary in first differences	**I(1)**
b) Cointegration Tests (PDFGLS)		
Estimated equation	Residual unit root	Conclusion
Residuals	Stationary	I(0) – Evidence of cointegration

Notes: Using Fisher-type unit-root test with a trend and 2 lags for the single unit root tests of the series (log exports, log ODA, log ODA DAC, log GDP and log real bilateral exchange rate). Fisher-type unit-root test with a trend and 1 lag for the Fisher-type unit-root test on the residuals of the main model (b).

Table A.3. PPML Estimation Results for Swiss Exports in Goods

	(1)	(2)	(3)
Period of analysis:	1995-2024	1995-2009	2010-2024
Estimation method:	PPML 2wfe	PPML 2wfe	PPML 2wfe
VARIABLES:			
Log ODA net disbursements	0.0607	0.0151	0.171*
	[0.0448]	[0.0395]	[0.0956]
Log ODA DAC other donors	-0.000463	0.0768**	-0.0462
	[0.0305]	[0.0339]	[0.0403]
Log GDP recipients	1.041***	2.128***	0.503
	[0.267]	[0.373]	[0.534]
Log real bilateral exchange rate	-0.0459	-0.115	-0.0139
	[0.0566]	[0.105]	[0.0858]
Free Trade Agreement	-0.103	-0.112	0.335**
	[0.138]	[0.114]	[0.142]
Monetary Return (USD per 1 USD)	2.064		6.734
Pseudo R2	0.963	0.973	0.968
Observations	2,812	1,411	1,395

Note: Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. Time and country fixed effects (2wfe) included in all models. Swiss GDP is absorbed by the time FE. ODA denotes Official Development Aid.

Table A.4. Estimation Results for Swiss Exports of Goods and Services: PPML

Type of ODA	(1) Bilateral	(2) Bilateral+Multilateral
Period of analysis:	2005-2024	2005-2024
Estimation method:	PPML	PPML
VARIABLES:		
Log ODA net disbursements	0.0810*	0.131***
	[0.0435]	[0.0495]
Log ODA DAC other donors	-0.0193	-0.0218
	[0.0287]	[0.0280]
Log GDP recipients	0.618**	0.675***
	[0.277]	[0.255]
Log real bilateral exchange rate	-0.0147	-0.0170
	[0.0428]	[0.0415]
Free Trade Agreement	0.140*	0.132
	[0.0816]	[0.0814]
Monetary Return ($ per 1 USD)	**4.153**	**6.74**
Observations	1,882	1,891
Number of recipients	104	104

Note: Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. Leads and lags of all explanatory variables in first differences and country fixed effects included in PDFGLS, which denotes panel dynamic feasible generalized least squares. Time and country fixed effects included in PPML model. Swiss GDP is absorbed by the time FE. ODA denotes Official Development Aid.

Tables A.5. Results for Priority countries and the Rest. Swiss Exports in Goods

	(1)	(2)	(3)	(4)
	1995-2024	2010-2024	1995-2024	2010-2024
VARIABLES	PDFGLS	PDFGLS	Prior	Prior
Log ODA net disbursements	0.0449**	0.109***		
	[0.0190]	[0.0208]		
Loda non-priority countries			0.0197	0.0693***
			[0.0196]	[0.0218]
Loda priority countries			0.0561***	0.117***
			[0.0189]	[0.0203]
Log ODA DAC other donors	0.0403	-0.0827**	0.0132	-0.119***
	[0.0266]	[0.0324]	[0.0270]	[0.0323]
Log GDP recipients	0.961***	0.935***	0.979***	0.963***
	[0.0182]	[0.0197]	[0.0186]	[0.0191]
Log real bilateral exchange rate	0.0321***	0.0446***	0.0294***	0.0383***
	[0.00790]	[0.00910]	[0.00789]	[0.00884]
Free Trade Agreement	0.641***	0.664***	0.555***	0.500***
	[0.0646]	[0.0661]	[0.0659]	[0.0689]
Observations	2,341	1,199	2,341	1,199
Number of recipients	104	103	104	103
Leads and lags of explanatory vars in first differences	yes	yes	yes	yes
N_t	26	13	26	13

Note: Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. Leads and lags of all explanatory variables in first differences and country fixed effects included in PDFGLS, which denotes panel dynamic feasible generalized least squares. Swiss GDP is absorbed by the time FE. ODA denotes Official Development Aid. The 42 Priority recipients are: Albania, Armenia, Bangladesh, Burundi, Benin, Bosnia and Herzegovina, Burkina Faso, Cambodia, Chad, Democratic Republic of the Congo, Egypt, Ethiopia, Georgia, Ghana, Indonesia, Iraq, Jordan, Kenya, Kosovo, Kyrgyzstan, Lao People's Democratic Republic, Lebanon, Republic of Moldova, Myanmar, Morocco, Mozambique, Nepal, Niger, North Macedonia, State of Palestine, Peru, Rwanda, Serbia, Somalia, South Africa, Tajikistan, Tanzania, Tunisia, Ukraine, Uzbekistan, Viet Nam, Zambia, Zimbabwe.

Table A.6. PPML with leads and lags

VARIABLES	(1) 2010-2024 PPML 2wfe	(2) 2010-2024 PPML 2wfe	(3) 2010-2024 PPML 2wfe
Log ODA net disbursements (t+2)	-0.0579	-0.0119	-0.0504
	[0.0648]	[0.0503]	[0.0502]
Log ODA net disbursements (t+1)	-0.00257	0.0139	0.0427
	[0.0546]	[0.0264]	[0.0878]
Log ODA net disbursements (t)	-0.0109	-0.0800	0.0475
	[0.0355]	[0.0492]	[0.0405]
Log ODA net disbursements(t-1)	0.0555*	0.0539***	0.0977***
	[0.0336]	[0.0207]	[0.0351]
Log ODA net disbursements (t-2)	0.00524	0.0294	0.0670***
	[0.0272]	[0.0201]	[0.0252]
Log ODA DAC other donors	-0.0141	0.100*	-0.0437
	[0.0344]	[0.0570]	[0.0355]
Log GDP recipients	0.921***	2.035***	0.325
	[0.228]	[0.359]	[0.369]
Log real bilateral exchange rate	-0.0223	-0.0131	0.0527
	[0.0516]	[0.158]	[0.0564]
Free Trade Agreement	-0.0496	-0.157	0.400***
	[0.135]	[0.0972]	[0.131]
Observations	2,372	1,139	1,230

Note: Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. Time and country fixed effects included in all PPML models. Swiss GDP is absorbed by the time FE. ODA denotes Official Development Aid.

Table A.7. Sectoral Input-Output Classification and IO Multipliers

Sector IO16	WIOD_description	Output Multiplier	Job_Multiplier	VA Coefficient
A01	Crop and animal production, hunting	1.840	5.928	0.397
A03	Fishing and aquaculture	1.374	4.766	0.732
B	Mining and quarrying	1.781	2.336	0.414
C10-C12	Food, beverages and tobacco products	2.072	2.325	0.303
C13-C15	Textiles, wearing apparel and leather products	1.414	4.138	0.349
C16	Wood and of products of wood and cork	1.926	4.465	0.378
C17	Paper and paper products	1.906	2.601	0.326
C18	Printing and reproduction of recorded media	1.657	5.529	0.512
C19	Coke and refined petroleum products	1.740	0.566	0.120
C20	Chemicals and chemical products	1.543	1.672	0.355
C21	Basic pharmaceutical products	1.526	0.521	0.314
C22	Rubber and plastic products	1.678	2.838	0.356
C23	Other non-metallic mineral products	1.763	2.470	0.406
C24	Basic metals	1.558	2.010	0.329
C25	Fabricated metal products	1.549	3.801	0.477
C26	Computer, electronic and optical products	1.897	1.621	0.381
C27	Electrical equipment	1.915	1.602	0.257
C28	Machinery and equipment n.e.c.	1.678	2.233	0.380
C29	Motor vehicles, trailers and semi-trailers	1.522	2.149	0.390
C30	Other transport equipment	1.677	1.805	0.385
C31_C32	Furniture; other manufacturing	1.524	2.516	0.416
C33	Repair and installation of machinery and equipment	1.888	2.851	0.378
D35	Electricity, gas, steam and air conditioning supply	2.509	0.640	0.195
F	Construction	1.781	2.969	0.432
H49	Land transport and transport via pipelines	1.895	2.359	0.365
H50	Water transport	1.872	2.045	0.381
H51	Air transport	2.172	1.278	0.169
H53	Postal and courier activities	1.538	7.150	0.197
I	Accommodation and food service activities	1.820	6.364	0.478
J58	Publishing activities	1.954	4.136	0.386
J59_J60	Motion picture, video, TV, and broadcasting	1.000		
J61	Telecommunications	1.901	1.284	0.456
J62_J63	Computer programming, consultancy and info services	1.549	2.301	0.505
K64	Financial service activities	1.533	2.008	0.568
K65	Insurance, reinsurance and pension funding	1.419	1.555	0.640
M69_M70	Legal, accounting, and management consultancy	1.553	3.134	0.573
M72	Scientific research and development	1.835	0.630	0.334

M74_M75	**Other professional, scientific and technical activities**	1.909	4.904	0.403
N	**Administrative and support service activities**	1.630	6.320	0.561
O84	**Public administration and defence**	1.489	4.329	0.635
R_S	**Arts, entertainment, recreation and other services**	1.610	6.588	0.562
Average	**Goods Sector**	1.701	2.761	0.380
Average	**Services Sector**	1.735	3.333	0.435

Notes: Notes: Output Multiplier=Sum of column j of $(I-A)^{-1}$. Total USD of gross output generated economy-wide per USD 1 of final demand in sector j. Job Multiplier=For every 1 direct job created, how many jobs are generated in total (direct + indirect).VA Coefficient=$v_j = VA_j / X_j$. Domestic VA generated per unit of output (X) in sector j.
Source: Based on the World Input-Output Database (WIOD) 2016 release. https://www.rug.nl/ggdc/valuechain/wiod/.

Appendix B: Economic Multipliers and GDP Impact Analysis

A Step-by-Step Technical Guide to Input-Output (I-O) Analysis

To calculate output and job multipliers from an Input-Output (I-O) table, we rely on the foundational work of **Wassily Leontief**. The core of this analysis is the **Leontief Inverse matrix**, which captures both the direct and indirect effects of an economic shock.

Here is a step-by-step guide to calculating these multipliers and using them to estimate GDP growth based on an exogenous change in final demand.

Step 1: Derive the Leontief Inverse Matrix
Before calculating any specific multiplier, you must transform your standard I-O transactions table into a technical coefficient matrix.

- **Calculate the Direct Requirements Matrix (A):** For each industry, divide every input by that industry's total output (X_j).

$$a_{ij} = z_{ij} / X_j$$

Where z_{ij} is the intermediate purchase from sector *i* by sector *j*.

- **Calculate the Leontief Inverse (L):** Subtract the matrix **A** from an Identity matrix (**I**, which has 1s on the diagonal and 0s elsewhere), and then take the mathematical inverse of the result:

$$L = (I - A)^{-1}$$

Each element in this matrix (l_{ij}) represents the total (direct + indirect) output required from sector *i* to fulfill one unit of final demand for sector *j*.

Step 2: Calculate the Output Multiplier

The Output Multiplier for a specific sector measures the total value of production across the entire economy generated by a single-unit increase in final demand for that sector's output.
Calculation: Sum the columns of the Leontief Inverse matrix (**L**).

$$\text{Output Multiplier}_j = \Sigma_{i=1..n}\, l_{ij}$$

> **Interpretation Example:**
> *If Sector j has an output multiplier of 1.75, it means a $1.00 increase in final demand for Sector j's goods will generate a total of $1.75 of economic activity throughout all sectors of the economy (the original $1.00 direct effect + $0.75 in indirect supply-chain effects).*

Step 3: Calculate the Job (Employment) Multiplier

To convert economic output into employment impacts, you need to integrate a vector of industry employment coefficients.
Calculate Employment Coefficients (e_i): For each sector, divide total employment (E_i) by total economic output (X_i).

$$e_i = E_i / X_i$$

(This metric yields the physical number of jobs generated per dollar of gross output).

There are two standard types of job multipliers derived from this relationship:

- **Type I (Direct + Indirect) Job Multiplier:** Measures the total jobs created across the entire economy per single direct job created in sector *j*.

$$\text{Job Multiplier}_j = [\ \Sigma_{i=1..n} (e_i \times l_{ij})\ ] / e_j$$

- **Employment Effect (Jobs per Dollar):** Alternatively, to find how many total jobs are created per dollar of final demand, omit the industry specific denominator (e_j):

$$\text{Employment Effect}_j = \Sigma_{i=1..n} (e_i \times l_{ij})$$

Step 4: Infer the Increase in GDP from an Exogenous Shock

An "exogenous increase in demand" represents a sudden external injection of spending into the matrix model (e.g., public infrastructure investments, a spike in global export channels). Crucially, while the Output Multiplier dictates how much gross economic transaction volume scales, Gross Domestic Product (GDP) is strictly a metric of Value Added rather than gross output. Gross output baseline accounting double-counts intermediate transaction layers. To discover the net authentic expansion in national GDP, Value-Added Multipliers must be deployed.

The GDP Impact Estimation Workflow:

1. **Calculate Value-Added Coefficients (v_i):** For each sector, divide total Value Added (wages, direct taxes, and corporate profits—found at the baseline of the I-O table matrix) by total output (X_i).

$$v_i = \text{Value Added}_i / X_i$$

2. **Calculate the Value-Added (GDP) Multiplier for Sector j:** Sum the product of value-added coefficients and Leontief elements down column *j*.

$$\text{VA Multiplier}_j = \Sigma_{i=1..n} (v_i \times l_{ij})$$

3. **Calculate the Final Net Impact on National GDP:** Multiply the initial exogenous change in final target demand ($\Delta \mathbf{Y}_j$) by that industry's calculated Value-Added GDP Multiplier:

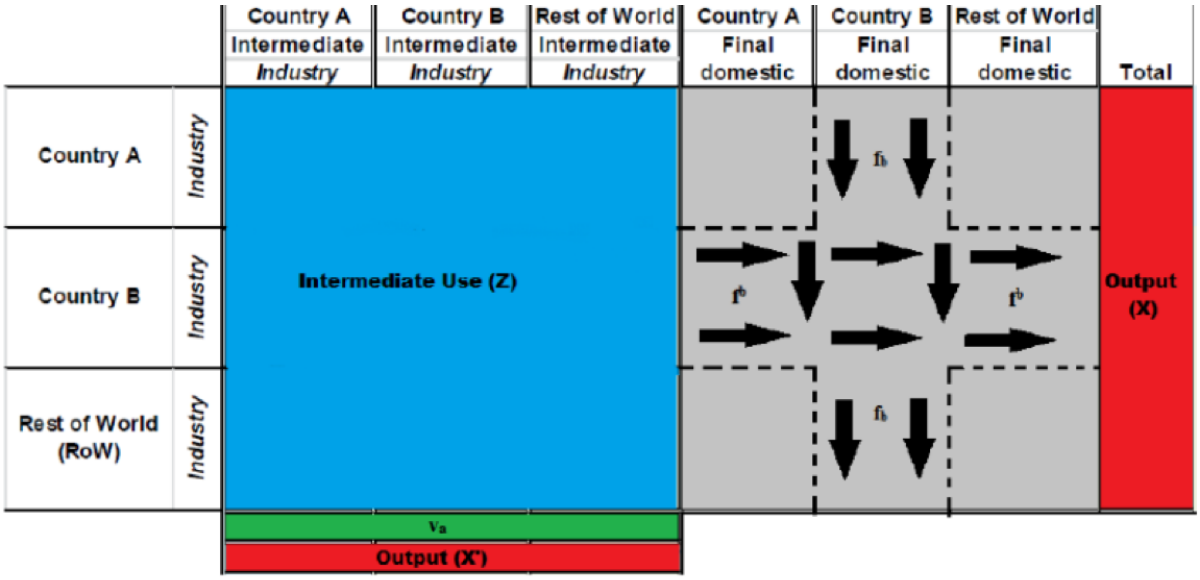
$$\Delta VA = \Delta Y_j \times \text{VA Multiplier}_j$$

Summary Model Shortcut Matrix

If you are managing a concurrent vector of demand adjustments distributed dynamically across multiple sectors (ΔY), you can calculate the exact macroeconomic adjustments using compact matrix algebra expressions:

> $$\mathbf{\Delta VA = \hat{V}\ (I - A)^{-1}\ \Delta Y}$$
> *where* $\mathbf{\hat{V}}$ is a diagonalized matrix constructed from individual sector value-added coefficients, and $\mathbf{(I - A)^{-1}}$ represents the standard Leontief Inverse matrix. Aggregating the elements of the output column vector $\mathbf{\Delta VA}$ yields the absolute, unduplicated net increase in aggregate national GDP.

Table B.1. Input-Output Table: Illustration



Source: Kaplan, Kohl and Martínez-Zarzoso (2018)

where: Jobs_ab=j_a∗L∗f_b

•j_a is a vector of employment inputs with a dimension of 1,435x1.
•L is the Leontief inverse, covers the Input-Output structure via a matrix of 1,435x1,435 dimensions.
•f_b measures the final export demand with a dimension of 1x1,435.