



**UNIVERSITA' DEGLI STUDI DI PADOVA**  
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**"The Gravity Model of Trade: A Case Study"**

**RELATORE:**

**CH.MO/A PROF./SSA Marco Bertoni**

**LAUREANDO/A: Dzhuliieta Behlaryan**

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# 1 Description of the organization

## 1.1 PreZero Polymers' History

PreZero Polymers Italy operates in the manufacturing sector and is engaged in waste management services and plastic recycling. The company carries out its business from Fonte, Italy, where its operating and administrative centre are located.

The company was established in 1993 and initially operated under the name Sky Max. In 2019, it was acquired by the Schwarz Group through its environmental division, PreZero. In August 2020, it became fully integrated into the group and now operates under the name PreZero Polymers, as part of PreZero International.

PreZero specializes in the recycling and transformation of polymers deriving from industrial scrap and post-consumer plastic waste. These materials are used as raw input to produce regenerated granules made from polypropylene (PP), polyethylene (PE), and polystyrene (PS). The resulting products are marketed under the company's registered trademarks and are supplied to various industries to produce new goods, including household appliances, garden furniture and children's toys.

PreZero Polymers Italy operates as part of a larger international corporate structure. It is a subsidiary of PreZero Polymers, owned by PreZero International, the environmental division of the Schwarz Group. The Schwarz Group is widely recognized for its global supermarket chains, Lidl and Kaufland, with thousands of stores across multiple countries. The establishment of PreZero reflects the group's broader commitment to sustainability and a circular economy model.

## 1.2 Key Data Related to PreZero Polymers Italy

PreZero operates in 10 European countries, including Germany, Italy, Austria, and the Netherlands, and runs around 460 sites<sup>1</sup> across Europe and North America. Its operations involve approximately 30,000 employees, working together to process nearly 4.6 million tons of recyclable materials annually, of which over 150.000 tonnes of plastic.

PreZero Polymers Italy has 95 employees and recorded a turnover of about €25 million<sup>2</sup> in the 2023–2024 fiscal year<sup>3</sup>, showing a 32.58% decrease compared to the last three-year consistent growth [Figure 1]. A significant positive jump in turnover of 18.86% from 2019 to 2020 and 21.11% from 2021 to 2022 can be observed.

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<sup>1</sup>The information regarding the geographical areas covered and the number of employees were obtained from PreZero's official website[21], prezero-international.com.

<sup>2</sup>The financial information was sourced from the Orbis database[17].

<sup>3</sup>PreZero Polymers Italy follows its parent company's fiscal year, which runs from March 1st to February 28th of the following year.

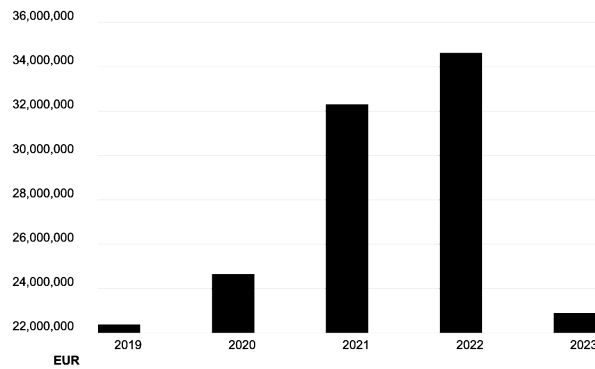


Figure 1: Operating revenue (turnover) [EUR]. Source: Orbis Database

Despite healthy gross margins (62.9% in the 2023–2024 fiscal year and 51.3% in the 2022–2023 fiscal year), the net result over the last two years has been negative. A breakdown of the cost structure [Figure 2] will help explain which expenses affect overall profitability the most. As reported in AIDA Database[1], the company’s total production costs of €32.5 million are dominated by services (€15.5 million), followed by raw materials (€8.5 million) and labour (€4.8 million). Combined with depreciation (€2.5 million) and other expenses, this structure results in a €9.6 million operating loss, highlighting potential inefficiencies in cost management and service-related spending.

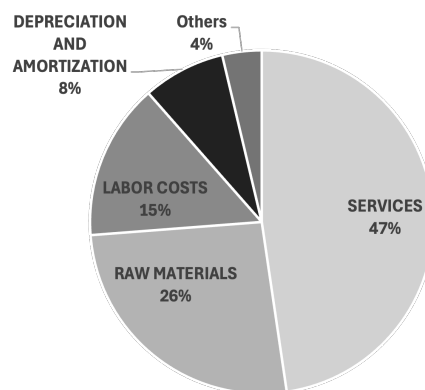


Figure 2: Cost structure for 2022-2023 fiscal year

The negative net result is linked to high service expenditures, including Research and Development (R&D), administrative, marketing, and logistics costs, which are amplified by the company’s investments in innovation and expansion. These strategic costs cover increased staff, office buildings, and intangible assets like software, all essential for long-term growth, at the expense of short-term profitability. The focus on investment is confirmed by the 89.5% growth in tangible fixed assets over the past two years [Figure 3].

However, the main reasons for negative net result are the unfavourable conditions of the plastic recycling industry, as will be explained in Section 2.

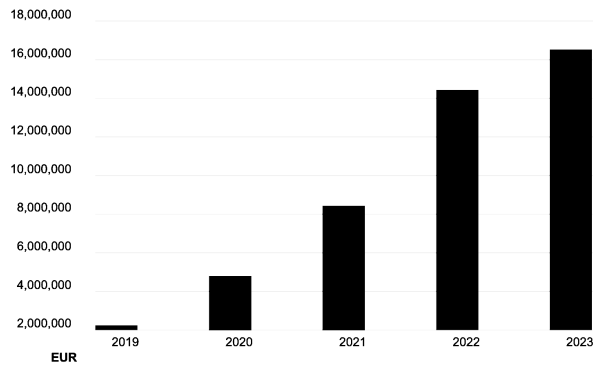


Figure 3: Tangible fixed assets [EUR]

### 1.3 Organizational Structure

PreZero Polymers Italy operates under a hierarchical structure, led by two Managing Directors (see Figure 4). One oversees Purchasing and Plant Operations, the other manages Sales, R&D, Human resources and Finance.

In the Purchasing and Plant division, the Raw Material Manager purchases industrial waste and post-consumer plastics, mainly from Italian sorting centres through auctions. The Plant Manager is responsible for several areas: the Production Manager, responsible for around 30 operators working in extrusion, washing, and technical roles; the Production Planner, who coordinates daily operations; and the logistics team, which includes a Logistics Manager, a Traffic and Transport Officer (handling truck bookings), an Entry and Exit Document Clerk, and Warehouse Workers. The Maintenance Manager ensures equipment upkeep, while the Laboratory Manager leads a 10-person team ensuring quality control and blocking non-compliant batches.

The second Chief Executive Officer oversees the Chief Financial officer (managing the IT Manager, Accounting and Treasury, and a Senior Controller), as well as Human Resources, R&D, and the Sales Department. The Sales department is geographically structured, with dedicated Sales Managers for Italy, Northern and Eastern Europe, and Western Europe, acquiring clients and negotiating prices. A Customer Service team supports client relationships and a QHSE Manager ensures compliance with quality, health, safety, and environmental standards.

The company uses System Applications and Products in Data Processing (SAP) management platform for inventory, transport, sales, purchasing, waste documentation and finance. Communication across departments is supported by Teams messages, emails and daily meetings among department heads to ensure coordination and alignment.

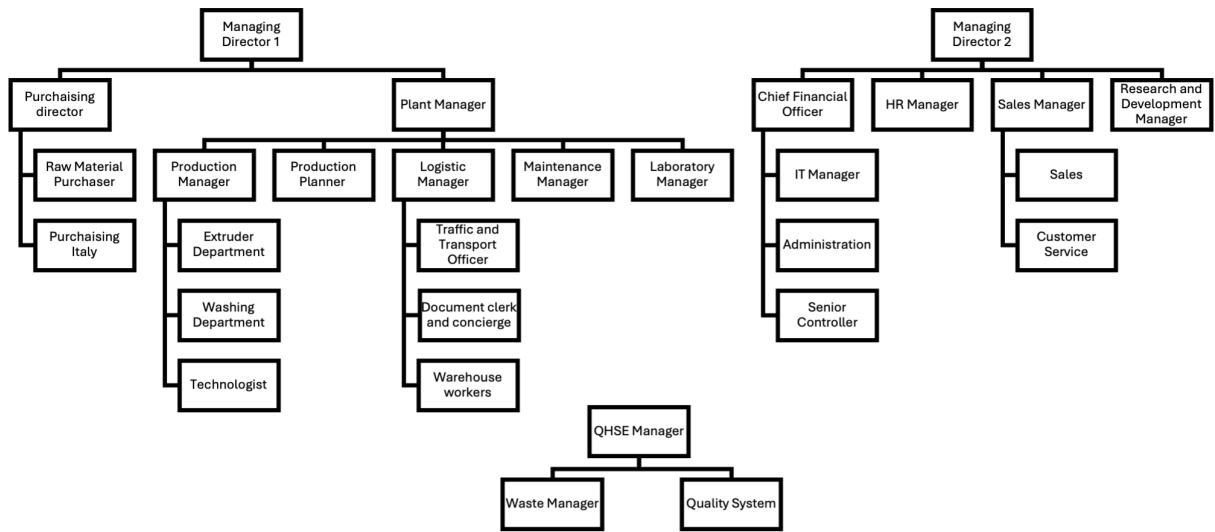


Figure 4: PreZero Polymers Italy’s Organizational Chart

## 2 Competitive Environment Analysis

### 2.1 Plastic Recycling Industry Analysis

According to Plastic Europe[18] and Plastic Recyclers Europe 2024 reports[19][20], the plastic recycling industry in Europe reached a turnover of €9.1 billion in 2023 with 850 companies across the continent and a total recycling capacity of 13.2 million tonnes of plastic, employing 30.000 people. In 2023, the industry registered a 6% year-on-year growth, a significant decrease from the 17% and 10% growth rates registered in 2021 and 2022, respectively. Germany has the highest installed plastic recycling capacity in Europe with 2-2.5 million tonnes, followed by Spain at 2 million tonnes. Italy, the UK, and France each have 1-1.5 million tonnes of capacity.

The contraction in growth, mainly due to market disruptions and price fluctuations, has led to negative results for the companies operating in the recycling industry. Factors negatively affecting the growth include the decrease in demand for recycled polymers, mainly driven by geopolitical and macroeconomic conditions and a lower price of virgin plastics. A general increase in production costs, due to inflation and high energy prices, contributed to lowering companies' operating margins. Alongside these factors, the increase in low-cost imports of recyclates from non-EU countries had a substantial impact. Those recyclates are often denounced as "fraudulent", because they lack traceability and transparency about their origin and actual composition. Priced below the market, they are attractive to European manufacturers looking to enhance their compliance with sustainability standards (for e.g. The Packaging and Packaging Waste Regulation<sup>4</sup>, End-Of-Life Vehicles Regulation<sup>5</sup>), while incurring minimal cost expenditures.

The consequences of these market conditions have affected European companies' competitiveness and caused the price of some recycled plastics to drop by up to 50%. As a result, many European recyclers, including PreZero Polymers Italy, have seen their turnover decrease over the past 2 years. Some have suffered financial losses putting the EU's circular economy and environmental targets at risk. As shown in Figure 4, based on data from the Orbis database[17], all nine selected Italian recycling companies operating in the same value chain phase as PreZero (washing and extrusion processes) experienced a decline in turnover in 2023. The average decrease was -24.25%, with the smallest drop recorded by Romei S.r.l. at -5.40%, and the largest by Sirmax New Life S.r.l. at -65.27%.

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<sup>4</sup>The Packaging and Packaging Waste Regulation (PPWR), which entered into force on February 11, 2025, imposes minimum recycled content requirements for packaging and bottles to be met by 2030, with these percentages ranging from 10% to 35%. These percentages will increase further by 2040.

<sup>5</sup>The upcoming End-Of-Life Vehicles Regulation (ELVR) ensures that at least 25% of plastic used to build a vehicle is recycled plastic.

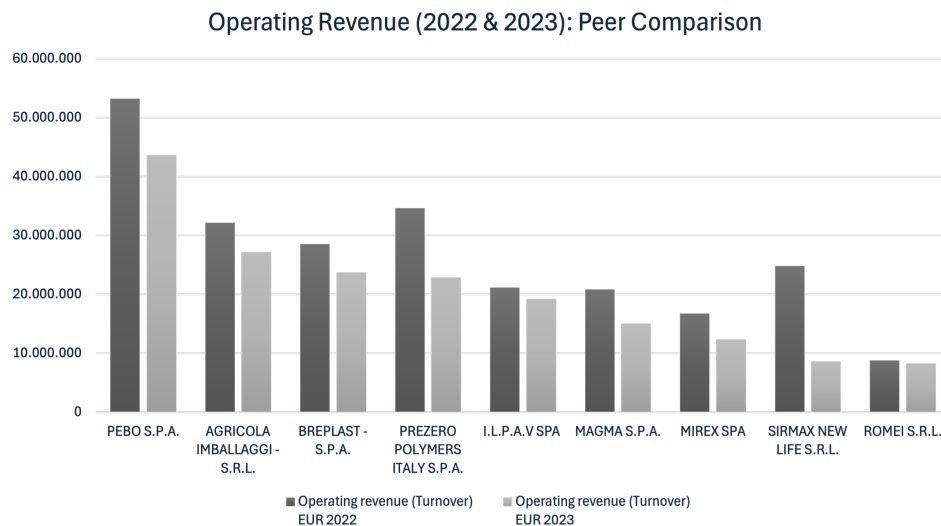


Figure 5: Peer comparison: Operating Revenue 2022 and 2023

## 2.2 Porter’s Five Forces Framework

The plastic recycling industry plays a central role in the ecological transition and in the reduction of CO2 emissions. It is a competitive and growing sector, fueled by an increasingly strong focus on sustainability, which is reflected in European regulations encouraging the use of recycled polymers.

The threat of new entrants in the industry is relatively low as the sector is characterized by high barriers to entry. To start operating, substantial initial investments in infrastructure are required. New companies must invest in plants for the extrusion and washing of plastic waste, cutting-edge technologies and know-how. Regulatory barriers are also significant, given that the sector is subject to mandatory authorizations (*Autorizzazione Unica Ambientale e Iscrizione all’Albo Dei Gestori Ambientali*) as well as supplementary environmental certifications, conferring strategic advantages, guaranteeing transparency and traceability (e.g., ISO 14002, EuCert-Plasr, Second Life Plastic).

Suppliers in the recycling industry include municipalities, consortia, sorting centers and waste management companies. PreZero Polymers Italy mainly purchases polypropylene and rigid polyolefins bales, representing raw materials in its value chain. The acquisition takes place through telematic auctions organized by the COREPLA consortium, selling post-consumer waste to recycling companies. On one hand, a wide availability of suppliers located throughout Italy and PreZero’s affiliation with the Schwarz Group contributes to reducing suppliers’ bargaining power. On the other hand, companies have little opportunity to negotiate favourable sales conditions as these are managed at the national level by COREPLA to ensure fair purchasing terms. Hence, the bargaining power of suppliers is moderate.

PreZero operates nationally and internationally, maintaining strong presence in Germany, France, The Netherlands, Poland, Croatia and Israel. Its buyers are primarily companies active in the packaging, automotive, household appliance and gardening tool industries. The bargain-

ing power of buyers is moderately high, considering that products must meet precise technical requirements. However, companies can differentiate themselves by enhancing quality and offering tailored solutions (e.g. colour, elasticity, type of polymer) based on the needs of the client.

The main substitute for recycled plastic is virgin plastic, which outperforms recycled polymers in all aspects: quality, functionality, aesthetics and lower price. However, thanks to raising awareness of sustainability and EU directives about mandatory recycled content in plastic products, the threat from substitutes is medium-low.

As for the rivalry among competitors, the intensity is moderately high. Low-cost imports from non-EU countries have generated unfair competition and pushed market prices down. To maintain a competitive advantage, European companies focus on differentiation through quality, product customization, certified compliance with regulatory standards, rather than solely on price.

### **3 Internship Experience Description**

I got the opportunity to get closer to the corporate world through the internship experience at PreZero, which took place in the logistics department. The logistics department plays a significant role within the company's structure and is connected with most functional areas. In particular, the interaction with the customer service office is essential to inform clients about freight delays or early deliveries. The laboratory manager is often contacted to request certificates of authenticity for products. The link with production management is strong: the logistic department needs to know the quantity and type of raw material required and align their availability by organizing the arrival from external warehouses or directly from suppliers. Logistics also interfaces with the administration department, as transporter invoices need to be checked against internal transport orders. Finally, it collaborates with the waste manager who provides the necessary documentation for waste disposal.

The scope of the internship was to support the logistics department through statistical analysis of transfer costs, transportation costs and material stock levels in external warehouses. One of the main activities involved conducting a detailed evaluation of transportation costs, with a focus on the fiscal year 2024–2025. Data were extracted from the SAP system, cleaned and analyzed through Microsoft Excel. For each transport company, total expenditure, number of orders, and an estimate of tonnes shipped were calculated. The analysis identified the main transport providers on which PreZero relies, revealing a vulnerability due to the company's dependence on a limited number of suppliers. These reports supported decision-making processes in logistics planning and cost control.

Subsequently, I was assigned to a research task, aimed at identifying and contacting potential new logistics partners through emails, calls and meetings. Diversifying logistic providers will reduce strategic dependency and optimize logistics costs, by taking advantage of more competitive offers available on the market.

Finally, I provided operational support, by sending transport orders to suppliers and managing those orders within the SAP system. The internship allowed me to improve my communication skills in a professional environment and gain confidence in interaction with national and international partners. I acquired practical skills and learned how to use an Enterprise Resource Planning (ERP) software.

In conclusion, I developed a deeper awareness of the internal functioning of a company and the interconnection between different departments.

## **4 Thematic Analysis**

### **4.1 Introduction**

The thematic analysis focuses on the Gravity Model of trade and its application to a case study. The subject has direct links with the internship experience in the logistics department at PreZero Polymers. Transportation costs are at the core of logistics, which engage its resources to minimize their impact on the company's profitability. These costs represent one of the main components of trade costs, which, according to the Gravity Model of trade (Tinbergen, 1962 [22]) contribute to a reduction in trade volumes between two countries.

The case study examines the economic relationship between Italy and Israel. The latter is one of the largest buyers of PreZero, with an average of 4/5 weekly sea shipments to this destination. After a brief theoretical framework concerning the Gravity Model of trade, the main macroeconomic indicators of the commercial partner and the import and export sectors between Italy and Israel are analysed.

Thereafter, the empirical results following the application of the Gravity Model of trade are discussed and compared with the actual observed values. For the formulation of a simplified and updated model data analysis instruments were implemented. R platform and Microsoft Excel are among the most used.

The work has a strictly economic and quantitative approach and has the sole purpose to provide a neutral study of the specific bilateral trade dynamics, based on impartial data sourced from supranational authorities and properly referenced. Any political considerations related to current situations are beyond the scope of this work.

## 4.2 Gravity Model Of Trade: Theoretical Framework

The Gravity Model of Trade, proposed by Jan Tinbergen (1962)[22], explains trade flows between two countries based on their economic size and distance. The model uses the analogy with the Newton's Universal Law of Gravitation (1687), according to which the force between two objects is proportional to the product of their masses and inversely proportional to the square distance between them. In economic terms, the standard gravity model of trade suggests that the bilateral volume of trade between two countries is proportional to the product of their respective gross domestic product (GDP), and inversely proportional to the distance between them.

The economic size plays a key role in determining trade volumes, mainly for two reasons. On the supply side, larger economies produce greater quantities of goods and services, which increase their potential to export. On the demand side, higher income increase purchasing power, enabling larger countries to import more.

Distance negatively affects trade volumes by increasing transportation costs and hindering personal relationships and communication.

The standard model can be expressed by the following functional relationship:

$$T_{ij} = \frac{A(Y_i^\alpha \times Y_j^\beta)}{D_{ij}^\gamma} \quad (1)$$

Where  $A$  is a constant,  $T_{ij}$  is the bilateral trade volume between country  $i$  and country  $j$ ,  $Y_i$  and  $Y_j$  are their GDP,  $D_{ij}$  is the distance, and  $\alpha$ ,  $\beta$ , and  $\gamma$  are the parameters to be estimated by the model.

A linear econometric model can be obtained by applying the natural logarithm to all variables:

$$\ln T_{ij} = \ln A + \alpha \ln Y_i + \beta \ln Y_j + \gamma \ln D_{ij} + \varepsilon_{ij} \quad (2)$$

Empirical applications suggest the following elasticity estimates: a 1% increase in GDP leads to a 1% increase in trade volumes, while a 1% increase in distance results in a 0.7% to 1% decrease in trade volumes. The model captures around 80% of the variation in trade flows, suggesting strong explanatory power (Anderson, 2010 [3]; Krugman et al., 2019 [13]).

The model's fit could be improved by adding other relevant variables. For example, cultural proximity, given by the common language (Melitz, 2008)[14], common religion and colonial liens between two countries increase trade volumes by reducing communication barriers. Borders represent a deterrent to trade, increasing costs and time of exchanges. The two economists Anderson and van Wincoop (2004)[4] estimated that borders reduce trade volumes between two industrialized countries by 30%. Trade agreements, if effective, boost trade flows beyond model predictions, while tariffs and embargoes lower them.

Trade costs, as defined by Anderson and van Wincoop (2004, pp.2)[4], refer to "all costs incurred in getting a good to a final user" other than production costs, including transportation costs, policy barriers, information costs, legal and regulatory costs, currency exchange and

local distribution costs. The economists estimated that for industrialized countries the tariff equivalent of trade costs is approximately equal to 170%, of which: 21% are for transportation costs, 44% border related costs, 9% time value of goods and 55% retail margins. Technological progress and globalization have reduced transportation costs, simplifying connections between geographically distant regions. Figure 6 illustrates the evolution of trade costs, showing a clear decreasing trend in intra-European trades (Head and Mayer, 2021)[8].

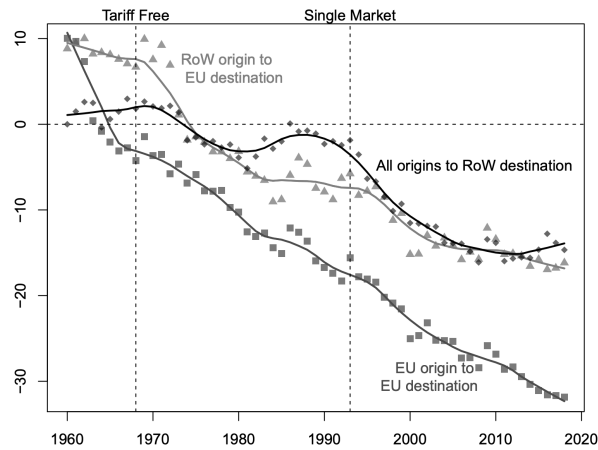


Figure 6: Evolution of trade costs in Europe. Source: Head and Mayer (2021, pp.7)[8]

Despite being considered one of the most successful empirical models, the gravity model initially lacked solid theoretical foundations. It was Anderson the first one to provide this “intellectual orphan” (2010, pp.3)[3] with microeconomic explanations, assuming constant elasticity of substitution and product differentiation by origin (1979)[2]. Later Anderson and van Wincoop (2003)[5] introduced the multilateral resistance factors, affirming that trade depends not only on bilateral direct costs, but also on relative barriers faced with other countries. These contributions paved the way for new theoretical approaches.

### 4.3 Main Macroeconomic Indicators of Israel

Despite its small demographic size and persistent political instability, Israel has one of the most advanced and diversified economies in the Middle East and North Africa (MENA) Region, accounting for 12% of the region's GDP in 2023 [Figure 7]

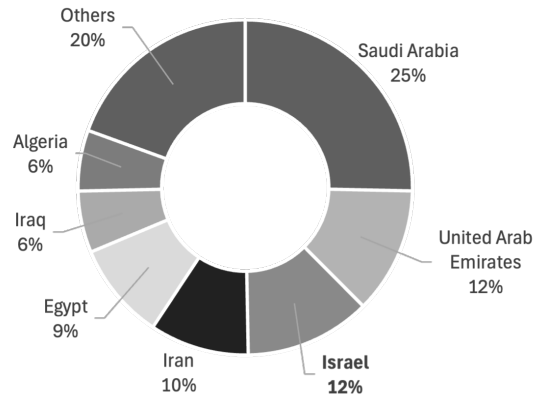


Figure 7: MENA Region: GDP Share by Country (2023). Data source: World Development Indicators[25]

Before the COVID-19 pandemic and the recent geopolitical situation, Israel recorded an average GDP growth of 3.3%, according to the Organisation for Economic Cooperation and Development (OECD)[16], with a rate of 3.8% in 2019. Between 2020 and 2024, the economy experienced strong fluctuations, in line with global trends [Figure 8], due to pandemic-related restrictions, the war in Ukraine and the escalation of the Israeli-Palestinian conflict. GDP fell by -1.5% in 2020, due to a decline in consumption levels, followed by a sharp recovery: +9.5% in 2021 and +6.5% in 2022. The positive trend was interrupted in the last quarter of 2023, with real GDP growth falling to 2%, and further to 0.4% in 2024, reflecting the economic impact of the war.

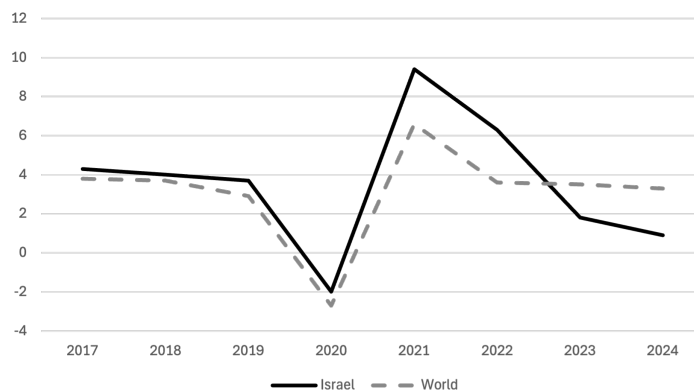


Figure 8: Israel Annual GDP growth rates. Data source: International Monetary Fund[11].

From 2003 to 2023, inflation was moderate but volatile, averaging at 1.5%, below the mid-point of the pursued target inflation range of 1%-3% (OECD data[16]). In 2020 it reached a

low of -1.57% and it rose rapidly peaking at 5.34% in 2022. Since July 2024, inflation has consistently exceeded the 1%-3% target range, reaching 3.5% in April 2025. This reflects labour shortages (especially in agriculture and construction sectors) and supply constraints (such as those caused by the Red Sea Crisis), linked to ongoing geopolitical tensions.

Key economic sectors include high-tech, cybersecurity, artificial intelligence (AI), agricultural and medical technology, industrial manufacturing, defense and financial services sectors.

Ranked by Tortoise Media (2024 [23]) among the top ten countries for investment, innovation and implementation of AI, Israel is often referred to as a Startup Nation, with a highly skilled workforce and huge investments in R&D. Other important sectors include diamond cutting and polishing, defense industry and petroleum industry. In 2020 Israel has shifted from being net importer to net exporter of natural gas, thanks to the discovery of Leviathan and Tamar gas deposits in 2009 (International Energy Agency (IEA)[10]).

Examining trade dynamics between Italy and Israel [Figure 9], Italian exports to Israel reached €3.337 million in 2024, slightly in decline compared to the previous year (-1.11%). High growth in the value of exports has been observed in 2021 (+25.94%) and in 2022 (+14.80%), reflecting both an increase in volume and an increase in prices following the post-COVID recovery. In 2024, Italy represented Israeli 4th supplier in terms of share. As for the imports, Italy imported a total of €1.008 millions in 2024 (+2.08%).

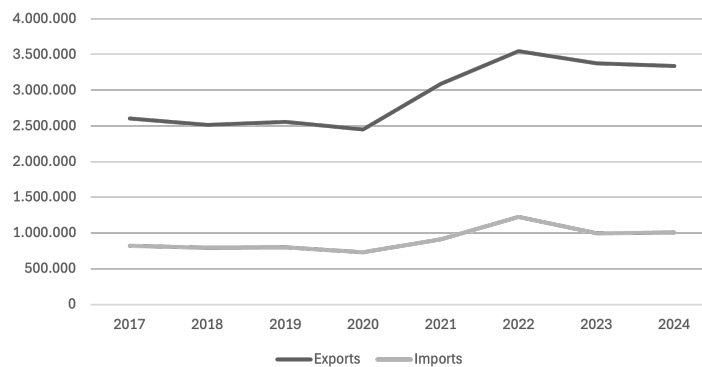


Figure 9: Export and Import Value Trends (2017-2024)

The main categories of goods that Italian companies export to Israel cover a diversified range of industrial products, like machinery, vehicles, jewellery, food products, metals and furniture [Figure 10]. Meanwhile main imported products are chemicals, plastics and rubbers, refined petroleum, precious metals (diamonds), aerospace and navigation equipment, medical appliances and agricultural chemicals [Figure 11].

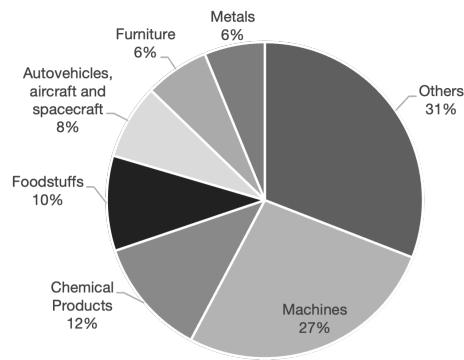


Figure 10: Export composition by sector in % (Italy-Israel, 2023). Data source: The Observatory of Economic Complexity [15]

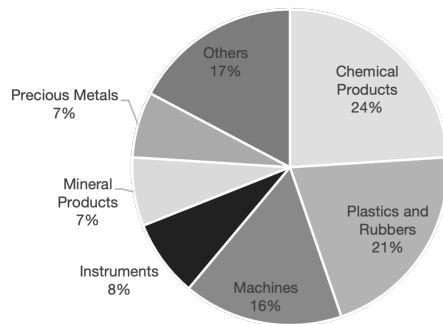


Figure 11: Import composition by sector in % (Italy-Israel, 2023). Data source: The Observatory of Economic Complexity [15]

## 4.4 Gravity Model Of Trade Applications

One of the most insightful empirical findings emerged from analysing the relationship between EU countries' exports to Israel and their GDP. Figure 12 applies the assumptions of the gravity model of trade by illustrating the relationship between the 2023 value of EU countries' exports to Israel (as a percentage of total EU exports to Israel) and their GDP in 2023 (as a percentage of total EU GDP). Switzerland was included by analogy, due to its relevant economic size and geographic position.

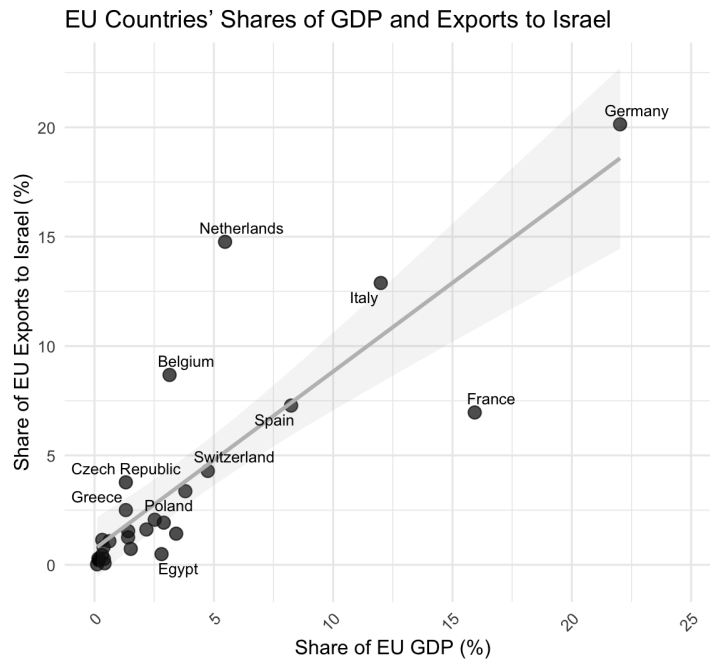


Figure 12: Relationship Between EU's Export Share to Israel and Their GDP Share of total EU

A positive functional relationship was observed between bilateral export values and the economic size of the partner country, as suggested by Tinbergen's gravity equation (1962)[22]. However, for some countries the observed values significantly diverge from model predictions. The grey area shows the 95% confidence area around the estimated regression line, meaning that the true relationship is expected to lie within this range with 95% confidence. Points outside this area indicate deviations from the predicted values.

In particular, Israel imports more than predicted from Belgium, the Netherlands and Italy. The higher-than-predicted export volumes can primarily be attributed to the geographical position and logistics infrastructure of the three countries. The ports of Rotterdam (the Netherlands), Antwerp (Belgium) are among the largest and most efficient in the world, serving as key logistical hubs for container shipping in Europe. Their advanced infrastructure enables fast and low-cost trade flows between Israel and European markets. In addition, their strategic location along Rhine river facilitate goods distribution across the continent, boosting bilateral commerce.

Similarly, Italy benefits from the strategic positioning of its main ports in Trieste and Genoa, which serve as major access point to eastern Mediterranean trade routes. Alongside geographi-

cal and logistics factors, trade agreements also contribute to increased trade flows between Italy and Israel. These agreements concern double taxation agreements (1957, 1998), industrial, scientific, technological R&D cooperation (2002), military cooperation (2018) and contribute to enhance communication between companies encouraging commercial relationships (InfoMercatiEsteri, 2025 [12])

Trade flows data were extracted from the IMF [11] database and are expressed in US\$. GDP data were extracted from the World Bank [25] database and are expressed in constant 2015 US\$.

The same method is applied to EU imports from Israel [Figure 13]

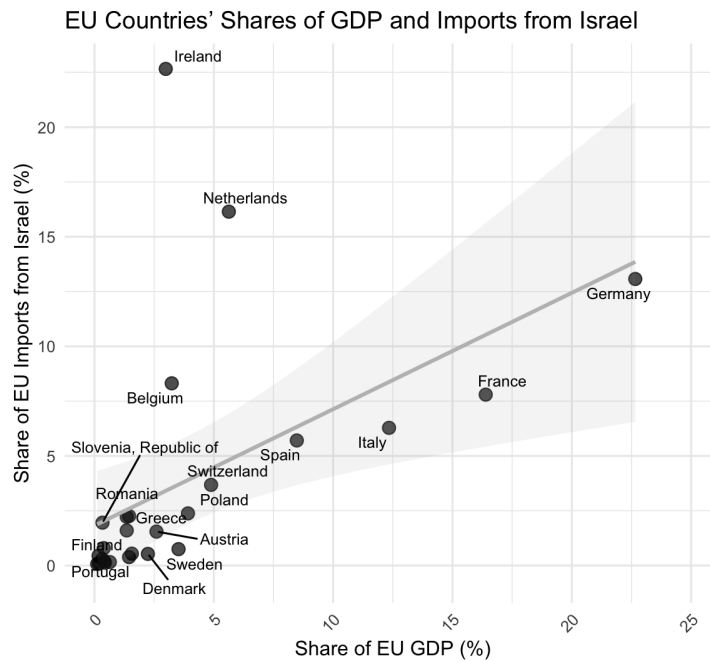


Figure 13: Relationship Between EU’s Import Share from Israel and Their GDP Share of total EU

As can be noticed from the wider grey confidence interval, the imports model shows considerably greater variability compared to the exports model. This suggests a greater dispersion in import data, which together with a small sample (26 trade flows) contribute to reduce the precision of the estimates. This implies that other factors not included in the model influence import volumes.

Belgium, the Netherlands and Ireland import share from Israel is higher than predicted. For the first two countries the previous explanation is still valid. In the case of Ireland, the higher-than-expected import share is primarily due to sectoral compatibility: Ireland’s economy has a strong focus on high-tech industries, closely aligned with Israel’s exports of integrated circuits and related high-technology products.

Finally, a gravity model of trade was formulated based on 2023 trade flows between 21 countries<sup>6</sup>, differing in terms of GDP and geographical region. Table 1<sup>7</sup> illustrates the results,

<sup>6</sup>Austria, Brazil, Canada, China, Czech Republic, Egypt, France, Germany, Greece, India, Israel, Italy, Japan, Morocco, Poland, Romania, Saudi Arabia, Spain, Sweden, Turkey, United Arab Emirates

<sup>7</sup>Created using the stargazer package (Hlavac 2018 [9]).

which confirm the key implications of the gravity model of trade. In particular:

- a 1% increase in the GDP of country A or country B is associated with about 0.9% rise in bilateral trade volume, reflecting how larger economies tends to trade more with each other;
- a 1% increase in the distance between two countries leads to a 1.16% decrease in bilateral trade flows, confirming that distance makes trade more costly, hence less frequent.

The model explains approximately 82.1% of the variability of the dependent variable. The explanatory power could be further improved by adding other relevant variables, such as shared borders, common language or colonial ties.

Table 1:

<i>Dependent variable:</i>	
log(Trade_Volume)	
log(GDP_A_2023)	0.945*** (0.040)
log(GDP_B_2023)	0.901*** (0.035)
log(Distance_km)	-1.159*** (0.061)
Constant	-19.001*** (1.447)
Observations	230
R <sup>2</sup>	0.821
Adjusted R <sup>2</sup>	0.818
Residual Std. Error	0.711 (df = 226)
F Statistic	344.906*** (df = 3; 226)

*Note:* \*p<0.1; \*\*p<0.05; \*\*\*p<0.01

Data about trade flows were extracted from the UN Comtrade database [24]. GDP data are sourced from World Development Indicators [25]. Distance was calculated between the capitals of each country pair.

## 4.5 Conclusions

The analysis confirms the applicability and relevance of the gravity model in explaining bilateral trade flows between countries. The results are consistent with the core assumptions of the gravity model: bilateral trade volume depends on the economic size of the countries involved and the distance between them.

The model proved useful in identifying deviations from predicted trade flows, such as those observed for Belgium, the Netherlands, Ireland, and Italy. These discrepancies were explained by factors not included in the model, such as logistical efficiency, strategic geographic position, economic agreements and complementarities in import and export sectors.

Furthermore, the macroeconomic analysis of the partner country on which the study focused made it possible to account for the impact of the COVID-19 pandemic, as well as political tensions between Russia and Ukraine and between Israel and Palestine.

In conclusion, the gravity model is a powerful and statistically significant tool for explaining trade flows. Its explanatory power can be enhanced by including additional relevant factors, reflecting broader economic, political, historical and cultural dynamics.

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<sup>7</sup>Number of words: 4062

## 5 Abstract in italiano

La prima parte della tesi descrive la struttura organizzativa, i principali indicatori di performance economica e finanziaria e il settore competitivo dell'azienda presso cui si è svolto il tirocinio curricolare, PreZero Polymers. In particolare, vengono analizzate le cause del drastico calo di fatturato nel 2023. Successivamente, viene descritta brevemente l'esperienza di tirocinio nell'ufficio logistica della stessa azienda.

L'approfondimento tematico si concentra sul modello gravitazionale di commercio e sulla sua applicazione pratica a un caso di relazione bilaterale. Il tema è direttamente collegato all'esperienza di tirocinio in logistica presso l'azienda. I costi di trasporto costituiscono il fulcro della logistica che impiega le proprie risorse per minimizzare l'impatto di tali costi sulla redditività aziendale. Inoltre, essi rappresentano una componente rilevante dei costi di commercio che, secondo il modello gravitazionale (Tinbergen, 1962), contribuiscono a ridurre il volume di commercio tra due paesi.

Il caso di studio pone al centro dell'analisi i rapporti commerciali tra Italia e Israele, quest'ultimo uno dei maggiori clienti di PreZero, con una media di 4–5 spedizioni marittime settimanali verso tale destinazione.

Dopo una breve contestualizzazione teorica del modello gravitazionale del commercio, verranno presentati sinteticamente i principali indicatori macroeconomici del partner economico analizzato, insieme ai principali settori di esportazione e importazione tra Italia e Israele.

Successivamente verranno illustrati i risultati empirici dell'applicazione del modello gravitazionale, per poi essere discussi e comparati con i valori effettivamente osservati. Per la formulazione del modello di gravitazione semplificato verranno utilizzati strumenti econometrici, impiegando il linguaggio R e Microsoft Excel.

La tesi ha come unico obiettivo quello di analizzare in modo rigoroso e imparziale le dinamiche commerciali tra i paesi in questione, sulla base dei dati provenienti da enti sovranazionali, opportunamente citati e con riferimenti ai modelli econometrici e di economia internazionale affrontati durante il corso di Laurea. L'autrice non intende esprimere in alcun modo opinioni di natura politica.

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