Lisbon School of Economics & Management
Universidade de Lisboa

# MASTER

## INTERNATIONAL ECONOMICS AND EUROPEAN STUDIES

## MASTER'S FINAL WORK

DISSERTATION

# EUROPEAN INTEGRATION AND ITS EFFECTS ON TRADE AND EMPLOYMENT: EVIDENCE FROM POLAND

GONÇALO CORREGEDOR DA FONSECA OSÓRIO DE CASTRO

JUNE – 2026

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**SUPERVISION:**

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JUNE - 2026

*Eu sou eu e a minha circunstância,*

*e se não a salvo a ela,*

*não me salvo a mim.*

Ortega y Gasset

## GLOSSARY

CAP – Common Agricultural Policy

CEE – Central and Eastern Europe

CEECs – Central and Eastern European Countries

CEPII – Centre d'Études Prospectives et d'Informations Internationales

COMECON – Council for Mutual Economic Assistance

DiD – Difference-in-Differences

EC – European Community

EEC – European Economic Community

EU – European Union

EU-15 – Fifteen Member States of the European Union before the 2004 Enlargement

EU-8 – Eight Central and Eastern European Countries that joined the European Union in 2004

FDI – Foreign Direct Investment

GDP – Gross Domestic Product

GVCs – Global Value Chains

IIT – Intra-Industry Trade

ILO – International Labour Organization

NMS – New Member States

OECD – Organisation for Economic Co-operation and Development

OLS – Ordinary Least Squares

RTA – Regional Trade Agreement

WDI – World Development Indicators

## ABSTRACT

The present dissertation analyses the impact of Poland's integration in the European Union (EU) on its trade flows and subsequent employment dynamics. Being the largest economy of the Central and Eastern European countries that joined the EU in 2004, Poland suffered profound economic alterations during the adjustment period that preceded its formal accession to the Union and the moments following its full membership status.

This work employs three frameworks, to investigate whether European integration altered Polish trade patterns and whether effects on trade were associated with changes in employment performance. First, gravity models are estimated, making use of bilateral trade data over the period from 1995 to 2015, to capture long-term adjustments and structural determinants of trade. Second, a difference-in-differences (DiD) strategy is employed, focusing on a narrower time window (1999-2009) to estimate the impact of accession to the EU on Poland's international trade with EU members relative to its trade with non-members. Finally, a sectoral fixed-effects model is estimated to examine the relationship between a sectors' exposure to the trade shock prior to accession and post-accession employment performance.

The gravity models confirm that market size, measured by the destination countries' Gross Domestic Product (GDP), is a strong determinant of trade flows, despite country-pair and year fixed effects' absorbing the EU integration impact. The difference-in-differences models estimate an increase in Polish exports to EU members of 28.5%, when compared to non-EU members. However, no statistically significant effect is found for total trade or import flows. Despite not presenting any statistically significant coefficient, the event-study analysis finds support for the parallel trend assumption for all three specifications. This does not contradict the DiD results, as the event-study model estimates the annual impacts of accession policies, in an isolated manner, while the DiD models estimate the average effect over the entire post-2004 period.

With respect to the labour market, the preferred sectoral employment model, which includes year fixed effects, highlights that the most exposed sectors to European Union trade, before accession, experienced relatively less favourable employment trends after 2004, when compared to less exposed sectors. This suggests that economic gains and trade creation associated with Polish integration were expressed through technological and productivity gains, associated with high levels of Foreign Direct Investment, rather than direct, proportional, increases in labour demand.

**Keywords: European Union enlargement; Economic integration; Poland; gravity model; difference-in-differences; employment.**

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## 1. INTRODUCTION

The European Union constitutes a two-pronged project. It is firstly understood as a process of European Integration and secondly, as a result of such process, viewed as an established pre-eminent organization (Phinnemore, 2013).

The 2004 enlargement to the countries of Central and Eastern Europe was regarded, since its first reports, as a critical matter for the future of the Union (Preston, 1997). The debate surrounding this issue addressed a vast range of matters regarding fundamental topics such as the institutional decision-making process, the common agricultural policy (CAP) or other, more generic questions, like the limits to fiscal transfers or the migration flows that would surge (Kaiser & Elvert, 2004).

Moreover, the fact that many of the adhering member states were or had been, at some point in recent history, authoritarian regimes with highly centralized economies, raised concerns in respect to cultural differences and the capability of such vast groups of people to integrate themselves in a structure that was, at the time, dominated by Western institutional and economic structures.

The integration process of these 10 countries into the European Union was officially consolidated in 2004, but was, in fact, initiated in the previous decade, having allowed for the elaboration of several case studies regarding multiple economic shifts. This process of economic, commercial, administrative and political integration triggered profound industrial restructuring. Particularly, these changes implied a substantial reallocation of resources across sectors and a large reorientation of trade flows towards European markets. This drastic change is particularly relevant in the context of the transition that has taken place, within these States, from highly centralized economies to open market economies which are integrated into global value chains (GVC). Although trade integration and harmonization were initiated before formal accession through trade agreements, only in 2004 were tariff rates between EU-15 and New Member States (NMS) eliminated.

With the metamorphosis of the economic and social panoramas in Europe, over the second half of the twentieth century it became clear that commercial specialization between certain European Union (EU) member states happened within commercial industries rather than between them (Greenway & Hine, 1990). The “intra-industrialization” of trade reflects, to a certain extent, the growing fragmentation of production and value chains because of integrationist policies. In fact, Los, Timmer and de Vries (2015) state that between 1995 and

2008, value chains for virtually all European Union countries saw an increase in their fragmentation.

This work arises from the need to better understand the extent of the impact of such economic integration in the labour market. Shingal (2015) suggests that the integration of a given economy into global value chains is associated with larger labour opportunities. This is, however, a limited analysis, as that same impact is largely dependent on the positioning of the countries' firms in the global value chain.

At the time of its EU accession, Poland was the largest economy among the Central and Eastern European countries (Eurostat, 2004). Poland's internal market dimension – 38.2 million inhabitants –, its degree of economic openness to the outside world – 70,9%, in 2010 – and its growth potential allowed, not only for the attraction of foreign direct investment (FDI) - $9.950 million in 2010 -, but also for the country's integration into the global value chains, characterized by vertical specialization.

Additionally, Poland had undergone significant economic alterations because of the transition process from a centralized, planned, economy to an open market system. This implied liberalization of prices and the privatization of state-owned companies as efforts for European economic alignment. These reforms were accompanied by stabilization procedures like currency devaluations, fiscal simplifications and exchange-rate adjustments, resulting from Balcerowicz' plan (1997).

The liberalization process which preceded Poland European integration had significant impact in Poland's exports and imports structures throughout the 1990 decade and the beginning of the twenty-first century. Additionally, the collapse of the soviet-lead Council for Mutual and Economic Assistance (COMECON) directed Polish trade towards western economies, particularly Germany. According to the Polish Central Statistical Office, Polish exports witnessed a 127% increase between 1990 and 2000 while imports increased by 426%.

This change in trade and economic policy was enhanced by the provisions of the European Community associate membership that came into force in 1991 and that implied gradual, and sometimes immediate, removals of tariffs and quotas on Polish food and industrial goods. Moreover, the Europe Agreements that were signed during the last decade of the twentieth century entailed significant regulatory and legislative convergence regarding CEC countries and the European Communities. This created incentives for the adoption of more efficient, western-aligned, management practices for Polish firms thus attracting foreign direct

investment. The FDI that took place during this period began in 2001, with the conclusions of the accession negotiations but it was only in 2004, with the stabilization of Polish-EU relations and the alignment of regulations, that Polish firms started being acquired by foreign firms, specifically German enterprises (Bastos et al., 2022).

The harmonization that took place in multiple domains deepened Polish integration into the Western and, particularly, European markets. This integration, with a strong vertical specialization, was mainly driven by backward linkages. This means that most Polish exports rely on imported, intermediate, goods, reinforcing Poland's position in the middle of the GVCS.

Despite this specialization, the dynamics of global trade flows and the geometry of the GVCs raise relevant questions in the context regarding job creation and diversion in less competitive sectors and the leveraging of benefits achieved through the establishment of scale economies and product differentiation (Krugman, 1979).

Moreover, Autor, Dorn and Hanson (2013) argue that, when analysing Chinese imports to the United States of America, a rapid increase in trade exposure with the importing country has a negative impact in employment and wages and, consequently, lowers households' income.

This work aims to reduce the existing gap between literature and the impact that new trade dynamics might have on employment, in the context of integrationist economic policies.

While industrial specialization associated with inter-industry trade entails significant adjustments due to the transfer of workforce between sectors, intra-industry trade involves smooth adjustments, albeit with a lag of approximately 2 years (Faustino & Leitão, 2009).

Thus, this study will, firstly, analyse the trade flow dynamics during the 1995-2015 period, using gravity models for total trade flows and exports, between Poland and its trading partners. The above-mentioned period allows, first, for the effects of adjustment periods prior to accession to be considered and, subsequently, for the convergence that occurred after 2004 to be analysed, taking into consideration possible lags in trade policy.

Secondly, the analysis is complemented through a difference-in-differences model, focused on the period of 1999-2009. This allows for a more accurate identification of the EU accession effect on trade flows while, at the same time, permitting the comparison of trade flows between EU and non-EU member states with reduced influence of long-term structural changes.

Afterwards, this work analyses, through a set of regression models, whether the change in trade flows, originating in the EU accession, are associated with fluctuations in Poland's employment levels. This part seeks to comprehend if an eventual intensification of trade flows, resulting from the EU accession process is correlated with decreases in unemployment levels.

## 2. LITERATURE REVIEW

In the context of economic studies, the word "integration" was mainly used to indicate synergies between two or more separate firms. This word mostly described coordination, acquisition or merging processes between private individual units. The meaning of the term represented, as such, corporate strategies of productive and market organization, related to the notion of vertical or horizontal integration.

It was only around 1954, with the publication of *International Economic Integration* (Tinbergen, 1954) that the unification, fusion and economic cooperation started being defined in a systemic manner as a macroeconomic process. Tinbergen's contribution in this domain is significative, having defined economic integration processes as the unification of other economic policy aspects – beyond the elimination of trade barriers – as optimization methods.

Tinbergen lists two groups as a form of public policy to achieve a certain degree of integration. The first, consisting of financial public policy, would be composed of the parametrization of public expenditure and taxes. The second would comprise instruments associated with wages and exchange rates, as mechanisms for establishing the general price level and foreign demand regulation.

Despite its terminology, the first theoretical, contemporary framework, of economic integration is developed by Jacob Viner in *Studies in the Theory of International Trade* (1937) and in the *Customs Union Issue* (1950).

Viner establishes a qualitative relation between the creation or deviation of trade, caused by the establishment of customs unions and the setting of trade tariffs on countries outside those unions.

Viner also defines trade creation as the desirable effect of integration processes, since it is the result of the elimination of trade barriers, which, consequently, leads to a more efficient resource allocation, globally, and a consumer price reduction, in particular.

On the other side, the deviation of trade occurs as an undesirable effect, caused by tariff preferences – rather than competitive advantage – shifting production to less efficient producers.

Additionally, Viner divides the effects of tariff-driven price changes into two categories: production effects – when there are changes in the location of the production of a given good – and consumption effects – when there are changes in demand and consumption patterns of that same good, resulting from changes in relative prices

Despite the association of several evolutive and dynamic mechanisms with the concept of economic integration, it was only in 1961 that Bela Balassa, in *The Theory of Economic Integration,* clearly defines it as gradual process, bringing together "measures designed to abolish discrimination between economic units belonging to different national states".

Moreover, the author defines the existence of several degrees of economic integration, equating them with free trade areas, custom unions, common markets, economic unions and full economic integration.

Later, due to the evolution of the trade patterns in the northern industrialized economies, the establishment of the New Trade Theory and the consequent relevance given to intra-industry trade dynamics, the concept of economic integration was broadened, in order to include the reduction of non-tariff trade barriers and the reduction of coordination costs between firms and industries operating in different countries. Economic integration became, therefore, associated with the fragmentation of production processes and the consequent expansion of multinational enterprises, besides the reduction of tariffs.

Other authors, such as Dennis M. P. McCarthy (1996), dwell on economic integration, not only as an economic process, but also as a political procedure, stating that the interrelationship between economic agents and political institutions is "pivotal" for a well-succeeded economic integration process.

Empirical analysis of economic integration processes necessarily demands its translation into quantitative indicators. While the qualitative definition lists the mechanisms and procedural underlying integration processes, the quantitative definition of this phenomenon is focused on the degree of commercial and, consequently, economic interdependence between countries. Variables representing the intensity of trade flows, their structure and the institutional framework of these policies should, therefore, be used.

Despite the existence of indicators such as the ratio of total trade to gross domestic product or the weight of exports and imports in national income, these have limitations regarding the study of economic integration, since they only allow us to assess the degree of openness of a

given economy – and not its relationship with another. Additionally, these indicators do not differentiate intra-industry trade and inter-industry trade.

Authors such as Marvel & Ray (1987) establish positive correlations between the intensification of intra-industry trade and economic integration processes, particularly through the establishment of regional trade deals.

Grubel & Lloyd (1975) propose an index as a tool for measuring the intensity of this type of trade between two countries, in each industrial sector and time period, defined as the degree of overlap between exports and imports of the same goods. The index calculates the relative balance between exports and imports and takes values between 0 and 1. Values closer to 0 indicate a higher degree of inter-industry trade, while values closer to 1 correspond to greater intra-industry trade intensity.

Frankel & Rose (1998) state that deeper economic integration between a group of countries leads to an increase in bilateral trade flows and greater business cycles' synchronization. This implies that such groups might have highly correlated business cycles because of common demand shocks or intra-industry-trade.

Measuring an economy's exposure to external shocks by assessing its sensitivity to changes in existing trade barriers can also serve as a mechanism for perceiving integrationist policies in concrete economic results.

Economic integration, which is not only observable in trade flows but also in the way integrationist policies alter those flows, allows the use of gravitational models to assess the impact of those policies.

In the preceding moments of the 2004 enlargement, Fertig (2003) estimated a measure of economic integration for EU countries, estimating a linear model that was based on a factor analysis.

Zaninovic (2022) uses a gravitational model to estimate the expected level of trade between two countries based exclusively on their structural determinants. This model utilizes the Linder hypothesis, thus incorporating income similarity, as well as other indicators of Central European Free Trade Agreement (CEFTA), EU and other RTAs membership status. Additionally, the author includes interaction terms between income similarity and trade agreements' indicators to consider possible enhancements on the relation between demand similarity and intra-industry trade, resulting from economic integration.

In this sense, the gravitational model and the inclusion of variables representing integration policies, such as RTAs, enable, in practice, a ceteris paribus analysis. While not a direct measure of the degree of economic integration, it allows us to quantify its impact on the intensity and structure of trade between two countries.

The concept of economic integration has, therefore, evolved throughout time from a time-elongated process that encompasses several policy measures to a mensurable economic occurrence, observable through the intensity of trade flows and its composition between partner states. This means that economic integration has, as of today, a measurable effect on today's modern economies measured in terms of economic advantaged or disadvantages, acquired though the previously mentioned processes.

Gravity Models use for explanation of trade, capital and population flows has become common practice (Bergeijk & Brakman, 2010). Ravenstein's laws of migration (1885, 1889), are often cited as the original theoretical foundation for the latter models. These state that migrants, in general, only move across a short distance, directed towards rapidly growing towns with expanding economic activity. Additionally, Ravenstein poses that migration volume is inversely proportional to the distance that is to be travelled.

Later, critics of the classical economic theory noted that, when dealing with trade patterns, this framework only considered countries' production structures and specialization, neglecting the distance between those countries (Metzler, 1948). As such, authors like Isard (1960) develop empirical models which establish that distance is a negatively correlated to the intensity of trade patterns due to transportation costs. Isard draws inspiration from Newton's equation of gravity, replacing physical mass with economic mass and the fixed distance with a flexible distance decay.

Tinbergen (1962) introduced the first gravity model of trade, having accomplished a faithful reproduction of the observed trade flows between countries thus, affirming the models' validity for prediction of such flows. It also reinforced the idea that trade flows were positively related to the dimension of the countries' GDP and negatively related to their geographical distance.

Later, authors such as James Anderson (1979) in *A Theoretical Foundation for the Gravity Equation* established a microeconomic basis in order to suppress the flaws of what was, then, convened as the models' "unidentified properties". Through is work, Anderson approaches the assumption that countries must have "identical expenditure" if they have

"identical structure", listing the bias problems related to transit costs that these assumptions would imply. In fact, Anderson's approach to the gravity model includes the total world income as a mean to assess the relative importance of the countries' economies.

Gravity models have become one of the main economic instruments for geography and size-based predictions of trade flows (Anderson, 2011).

Moreover, gravity models also allow comprehensive studies on potential and effective trade. Baldwin (1994) concluded, after comparing gravity models' estimates to real results, that effective trade between EU-12 countries and other developed countries was smaller than its potential trade.

In fact, these models have been utilized as complementary quantitative instruments for measurement of Viner's Trade Creation and Trade Destruction (Jadhav & Ghosh, 2024). Moreover, gravity models have shown good performance when explaining trade for intermediate inputs, allowing for a good framework of today's integrated global value chains (Greaney, 2020).

Traditional gravity models rely on panel data, usually being static models with explanatory variables that are assumed to impact trade instantaneously. However, as explained previously, trade is, in fact, a dynamic process which evolves across time. As such, some models have included lags of the regressors and lags of trade, to account for factors that have, for instance, longer adjustment periods (Bun & Klassen, 2003).

However, several applications of the gravity model relied on cross-section or pooled Ordinary Least Squares (OLS) specifications, frequently ignoring heterogeneity and, consequently, leading to biased estimates of trade flows (Matthieu et al., 2005). As such, one must account for country-pair specific effects, as to reduce the heterogeneity and endogeneity bias (Cheng & Wall, 2005). Conversely, the use of such fixed effects may absorb a considerable part of the impact associated with policy-related alterations – trade policy, in this case – particularly in the context of long panel datasets where integration processes occur gradually. As such, variables that intend to reflect said variations such as EU membership dummies might have a considerable reduction in their statistical significance due to the absorption of their effect by country-pair specific characteristics and common time trends

Nonetheless, a reduced number of studies using gravity models have shown to use instrumental variables or control-function methods, with cross-section data. This tends to happen because there is an inherent instability to the estimates of trade agreement effects due

to the difficulty of isolating instruments and associated variations that are genuinely exogenous to bilateral trade flows. (Magee, 2003).

It is also important to note that gravity models frequently overstate a country's economic contributions due to accounting practices inherent to gross trade statistics. Part of the attributed value to a country's exports might, in fact, originate from foreign intermediate inputs due to international value chains thus posing a double accounting issue (Kaplan e. al., 2017)

Difference-in-differences (DiD) models have been commonly used in non-experimental settings (Fredriksson & Oliveira, 2019). These models require, at least, two time periods and two experimental groups, in which one is treated, and the other one is not, serving as the control group (Baker et al., 2025). The DiD estimator equals the difference between the outcomes of the treated group and the control group – hence the name difference-in-differences.

This approach allows to overcome potential ambiguities of single-difference studies (Slaughter, 1998) and simple cross-sectional comparisons that lack on the identification of causal effects such as gravity models. DiD models account for time-invariant heterogeneity between both groups thus providing a robust tool for causal inference in data related to changes like trade liberalisation or European Union accession.

Underlying these models is the assumption that, in the absence of treatment, both groups would follow similar trends – parallel trends assumption. This is a fundamentally untestable assumption which can only be partially evaluated through pre-treatment analysis of trends. As such, violations of these assumptions can lead to biased estimates (Wang et al., 2024).

Recently, complex DiD models have been found to fail in the estimation of causal effects, posing a relevant question as to the reliability of much of modern economic papers which tend to use these tools (Baker et al. 2022). This recent criticism has reinforced the use of event-study designs and group-time average treatment effects, as alternative estimators and robustness checks, as a mean to improve identification and interpretation of such effects.

The use of such models has allowed for the quantification of policy decision impacts, such as EU accession decisions, in given economies. Authors like Gilbert and Muchová (2018), have stated that both the accession economies of 2004 and the EU-15 have, since then, increased their shares of world merchandise exports. The most relevant finding, however, is

the fact that the increase in exports' share was driven, mostly, by an increase in market share within the European Union itself.

Additionally, although large integration efforts were made before 2004, at the time of the enlargement many border effects remained at the time of the official accession. In fact, this is consistent with Hornok's findings (2010) where the author states that the 2004 enlargement generated significant trade creation, particularly in the three years following formal accession where trade creation amounted to 14%. Hornok also states that this was especially evident in the EU-8 countries, once again eventuating the increase in East-East trade, post-accession. Complementarily, other authors like Wilhelmsson (2006) argue that the 2004 enlargement process contributed, significantly, to an increase in trade between EU-15 and Central and Eastern Europe Countries (CEECs) as well as within CEECs themselves.

Despite its mostly positive effect, from an aggregate perspective, the enlargement' effects were not homogeneous across industry sectors. Multiple studies have evaluated the impact of European Integration on trade flows and labour market dynamics in both *ex-ante* and *ex-post* examinations. The transition period that the 5 Central European Countries (CEC-5) went through, as a mean to their accession, caused profound changes to their economic structures and, consequently, their labour allocation dynamics. The shift from highly agricultural economies to service and industry-based ones caused drastic reductions of employment (Havlik, 2001).

The fact that trade between the EU and the CEE countries is too small to change relative wages and employment at the aggregate level does not rule out that specific sectors and regions are affected (Boeri & Brücker, 2000).

Furthermore, labour mobility increase, resulting from integration, constitutes another factor for labour market changes. In fact, following EU accession, CEC countries witnessed an increase in workers emigration predominantly destined to western European countries such as the United Kingdom. Moreover, these migratory flows were significantly higher than the European Commission had predicted with the total number of Polish workers abroad having an increase of 420.000 people (Michałek & Hagemejer, 2024). This relief in labour market pressure caused wage increases, particularly for lower-skilled workers as the level of unemployment amongst these was considerably higher. Poland was the main beneficiary of these mass migrations (Caliendo et al., 2017).

These findings are coherent with the latter ones from the European Commission (2009), relating to Bulgaria and Romania EU accession in 2007, where it is stated that there is a negative pressure on the receiving countries' low-skilled workers' wages as a result of the migration flows from these eastern economies.

## 3. EMPIRICAL ANALYSIS

### 3.1 DATA SOURCES

Trade flows relating to bilateral trade between Poland and its trading partners were extracted from the Centre d'Études Prospectives et d'Informations Internationales (CEPPI) Gravity 2022 version dataset. The initially considered timespan raged between 1995 and 2015. This period choice allows for the analysis of an extended period of trade adjustments, capturing not only the immediate accession effects but also the convergence policies that were undertaken before and after the official accession.

It is important to note that the trade adjustments for the establishment of a free trade area began in 1993 with the entry into force of the Interim Agreement, prior to Poland's formal membership request in 1994. These preliminary deals significantly altered bilateral trade flows between Poland and the remaining European Economic Communities (EEC) countries thus justifying the inclusion of the pre-2004 period in the analysis. Moreover, the extension of the analysis range to 2015 allows the observation of any adjustments made after the formal accession, particularly during a period of intensified integration into European value chains.

However, the difference-in-differences analyses are conducted using a narrower time period, ranging from 1999 to 2009, in order to reduce the influence of long-term structural changes and unrelated macroeconomic shocks that might have affected countries' economic structures, focusing on the immediate period before and after Poland's accession.

The COMTRADE-based variables included in the CEPII dataset are used and aggregated for measurement of the trade flows between Poland and the partner countries. The flows are used in their logarithmic form as to reduce skewness in data and to allow for relative increases interpretation.

Additionally, the analysed countries are categorized and aggregated according to their European Union membership status in each year.

For the labour market analysis, the collected data is grouped according to employment sectors, and, later, combined with sector-level trade data. The resulting panel covers 16 economic sectors over the period 1999-2009, allowing for the examination of sectors that were exposed to EU trade, prior to Polish accession.

For the exposure indicator, sectoral trade data regarding 2003 was used, thus reducing potential endogeneity problems which could potentially occur with a post-accession time reference.

### 3.2 METHODOLOGY

The empirical work carried out sought to analyse the effects of Poland's accession to the EU on its trade with the block, relative to trade with non-EU countries, and employment effects. The choice of this country is linked to several economic factors, with subsequent methodological impacts. Firstly, Poland, due to its population and geographical size, was, at the time of accession, the largest economy in Central and Eastern Europe (CEE), having a Gross Domestic Product of €256 billion.

In addition, Poland had an export structure based largely on machinery, car parts, and electronic components. Since these products are a fundamental part of various integrated value chains, it is reasonable to assume that accession to the European Union and the resulting economic integration may have had an impact on Poland's productive structure and employment levels, especially with the intensification of intra-industry trade.

This study consists of three complementary analyses. Firstly, gravity models of international trade are estimated to assess the impact of Poland's accession to the European Union on bilateral trade flows, controlling for structural determinants of trade and highlighting the effect of EU membership after 2004. Later, several difference-in-differences models are used as to isolate the effect of Poland's accession in 2004 on trade flows. This phase establishes a comparison between Poland-EU trade flows and Poland-Non-EU trade flows prior and following the 2004 enlargement. Finally, a sector fixed-effects model is developed to explore the relation between EU accession and employment dynamics after 2004, in the sectors that were more exposed to European Union trade.

The gravity models make use of an extended period, ranging from 1995 to 2015, in order to capture both the pre-accession economic adjustments and the post-2004 convergence dynamics, considering potential lags in trade policy and effects.

Conversely, the difference-in-differences models rely on a shorter time span, ranging from 1999 to 2009, reducing the influence of long-term structural changes and unrelated macroeconomic shocks. The sectoral model follows the same time span as the DiD ones, ensuring consistency in the treatment of accession impacts' analysis.

As for the exposure model, the exposure to trade is measured using sector trade data from 2003, to potentially reduce endogeneity concerns, regarding accession effects and exposure levels. Due to this decision, the model is able to capture changes in sectors' exposure levels due to integration in the European markets and not its changes resulting from accession.

The CEPII Gravity 2022 database was utilized in all gravity models, making use of the period between 1995-2015. The unit of observation corresponds to unit-pair-year. The logarithm of bilateral trade flows (tradeflow_baci) is the dependent variable. The explanatory variables are the logarithm of Poland's GDP (the origin country), the logarithm of the destination countries' GDP and a dummy variable that accounts for EU accession and it's equal to 1 when both countries are EU members and equal to 0 otherwise. Country-pair fixed effects are accounted for, to control for time-invariant bilateral characteristics such as geographical and cultural proximity and time fixed effects capture other usual macroeconomic shocks.

Currently, gravity models rely, mostly, on country-pair fixed effects, rather than the inclusion of specific traditional gravity variables. Being time-invariant, the effects of such variables are mostly absorbed by the bilateral fixed effects, addressing heterogeneity between the country-pair (Baier & Bergstrand, 2007). This methodology reduces omitted-variable impacts and improves the isolation of policy-related effects. Additionally, the authors note that EU membership is not an exogenous variable and, consequently, countries that are, already, preferred trade partners are more likely to strive for deeper integration.

The equation is as follows:

$$\ln Trade_{\{ijt\}} = \beta^1 \ln GDP_{\{it\}} + \beta^2 \ln GDP_{\{jt\}} + \beta^3 EU_{\{ijt\}} + \alpha_{\{ij\}} + \lambda_t + \varepsilon_{\{ijt\}} \quad \textbf{(1)}$$

Where $Trade_{\{ijt\}}$ denotes bilateral trade flows between country *i* and country *j,* in year *t.* Additionally, $GDP_{\{it\}}$and ln $GDP_{\{jt\}}$ represent the gross domestic product in the origin and destination countries. $EU_{\{ijt\}}$ stands as a dummy variable for European integration, $\alpha_{\{ij\}}$ represents country-pair fixed effects and $\lambda_t$ represents time fixed effects.

Three specifications are estimated: one for total trade flows one for Polish exports and one for Polish imports. This allows for a separation between the demand and supply determinants of trade and enables the detection of asymmetries in the accession effect across trade flows.

This analysis intends to establish the basic structural relation between market size and bilateral trade, thus providing the foundation for the contextualisation of the accession effect for latter models.

Although Baier and Bergstrand state that fixed-effects models reduce omitted-variable bias, thus providing more reliable estimates, the absorption of EU membership dummies in long panels with country-pair fixed effects, such as the utilized one make it difficult to properly isolate the accession effects.

Therefore, difference-in-difference models are later developed, comparing trade flows to EU and to non-EU partners, before and after Poland's accession.

Similarly to the gravity models, three DiD models are estimated to detect directional asymmetries resulting from European integration. The DiD general specification is as follows:

$$\ln(Trade_{ijt}) = \beta(EU_dest_j \times Post2004_t) + \alpha_{ij} + \lambda_t + \varepsilon_{ijt} \textbf{ (2)}$$

Where $\ln(Trade_{ijt})$represents the logarithm of the bilateral trade flows between Poland (country *i*) and country *j*, in year *t*. $EU_dest_j$ is a dummy variable which is equal to 1 if country *j* is a member of the European Union in year *t* and $Post2004_t$ acts as a dummy variable equal to 1 for years following 2004. β captures the relative change in trade flows between EU destinations and non-EU destinations, after Poland's integration. $\alpha_{ij}$ stands for country-pair fixed effects, $\lambda_t$ denotes year fixed effects and $\varepsilon_{ijt}$ is the error term.

In order to assess the validity of such models and evaluate the dynamic effects of accession, the parallel trends assumption is evaluated through an event study model which interacts the EU destination indicator with dummies for each year, for the period between 1999 and 2009, excluding 2003 which serves as the reference category. This model is not intended to estimate the average impact of Polish accession but rather to evaluate the validity of the parallel trends' assumption in different trade flows. The estimated coefficients capture the relative evolution of trade flows between EU and non-EU members before and after accession. The specification is as follows:

$$\ln(Trade_{ijt}) = \sum_{k \neq 2003} \delta_k \left(EU_dest_j \times \mathbf{1}[t = k]\right) + \alpha_{ij} + \lambda_t + \varepsilon_{ijt} \textbf{ (3)}$$

Where $\delta_k$ estimates the differential effect of Poland's EU membership on trade with EU members, relative to that with non-EU members, in each year, except 2003. The coefficients relating to the years prior to 2004 (1999-2002) allow for the evaluation of the

parallel trends assumption and the coefficients regarding the post-accession period (2004-2009) capture the evolution of the treatment effect relative to the reference year.

The final analysis estimates the effects of EU membership on employment across sectors. To that end, sectoral employment data is combined with pre-2004 trade exposure indicators. Therefore, this model intends to verify if more exposed sectors to EU trade, prior to joining the EU, experienced differential employment effects, following accession.

EU trade exposure is calculated for each sector through the following equation:

$$Exposure_s = \frac{EUTrade_{s,2003}}{TotalTrade_{Poland,2003}} \textbf{ (4)}$$

Where $EUTrade_{s,2003}$ denotes Poland's trade in a given sector, *s,* with EU-15 countries in 2003 and $TotalTrade_{Poland,2003}$ represents Poland's total trade in that year. The exposure indicator captures the relative weight of EU trade for each sector, prior to accession.

Later, an accession dummy is included, $Post,$ which is equal to 1, if $t \geq 2004$ and equal to 0, if $t < 2004$. The interaction between the accession dummy and the exposure indicator is the main explanatory variable of interest. It evaluates if sectors more exposed to trade were, at the employment level, impacted after accession. The interaction stands as:

$$ExposurePost_{st} = Exposure_s \times Post2004_t \textbf{ (5)}$$

The baseline specification is estimated through a fixed-effects model:

$$\ln(Employment_{s,t}) = \beta_1 ExposurePost_{s,t} + \gamma_t + \alpha_s + \varepsilon_{s,t} \textbf{ (6)}$$

where $\ln(Employment_{s,t})$ is the logarithm of employment in sector *s* and at year *t,* $\alpha_s$ denotes sector fixed effects, $\gamma_t$ represents year fixed effects and $\varepsilon_{s,t}$ stands as the error term.

As to remove general economic trends which may affect all sectors simultaneously, two specifications are estimated where one of them only includes sector fixed effects and the other also includes year fixed effects.

### 3.3 RESULTS

**First Gravity Model – Total trade flows**

To assess the changes in trade patterns, caused by Poland's accession to the European Union, this work starts by examining the evolution of bilateral trade flows between this country and its trade partners through the estimation of the gravity model presented in Equation (1). The model is estimated at the country-pair level, incorporating both country-pair and year fixed effects. It allows to control for structural determinants of trade while, at the same time, isolating the effect of EU integration.

As to allow for arbitrary correlation and heteroskedasticity, standard errors are clustered at the country-pair level. This happens since observations for a given pair are extremely unlikely to be independent across time.

The results of the baseline gravity model are presented in Table 1.

*Table 1. Gravity Model – Total Trade Flows*

| **Gravity – Total Trade Flows** | |
|---|---|
| | (1) |
| | Total Trade |
| ln GDP Poland | 0.141 |
| | (0.211) |
| ln GDP Partner | 1.664*** |
| | (0.141) |
| EU Dummy | 0.088 |
| | (0.089) |
| Observations | 6,738 |
| Number of Pairs | 388 |
| Within R-squared | 0.302 |
| Pair Fixed Effects | Yes |
| Year Fixed Effects | Yes |

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

These results partially confirm the validity of the traditional gravity model structure, as the destination country's GDP coefficient is positive and significant.

This implies that bilateral trade flows are proportional to the size of the destination country's market, measured through its GDP. It is also relevant to mention that the EU dummy is not statistically relevant, indicating that, in this baseline model, EU accession does not generate an average increase in bilateral trade flows.

**Second Gravity Model – Baseline for Exports**

Afterwards, Equation (1) is estimated using Polish export flows as the dependent variable to evaluate, in an isolated manner, the determinants of Poland's exports. The restriction of the dependent variable to exports from Poland, allows for a clearer recognition of aggregate demand effects and, as in the previous model, of the impact of the size of the destination market.

The results are presented in Table 2:

*Table 2. Gravity Model – Export Flows*

| **Gravity – Export Flows** | |
|---|---|
| | (1)<br>Exports |
| ln GDP Poland | 1.619***<br>(0.191) |
| ln GDP Partner | 0.610***<br>(0.144) |
| EU Dummy | 0.022<br>(0.101) |
| Observations | 3,386 |
| Number of Pairs | 194 |
| Within R-squared | 0.414 |
| Pair Fixed Effects | Yes |
| Year Fixed Effects | Yes |

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The gravity model for exports is coherent with the theoretical framework established for these models. The GDP variables are positive and statistically significant, confirming the positive correlation between the countries' GDPs and their trade flows. In fact, Poland's GDP coefficient being equal to 1.619 implies a strong correlation with export flows, thus highlighting the importance of the production capacity and supply factors. Moreover, the GDP

of the destination country also implies a positive and statistically significant correlation of 0.610, which proves that larger countries – and markets – will have higher levels of imports due to higher demand.

EU membership does not, however, have a statistically significant impact on average export flows, which might reflect the more prominent effect of market size and cultural proximity than the formal accession process.

**Third Gravity Model – Imports**

Additionally, a gravity model for imports is developed. Similarly to the one developed for exports, this model allows for the identification for determinants of Poland's import flows.

In line with gravity models' theory, the inclusion of these countries' GDPs captures both the supply capacity of trading partners – in the case of $GDP_{j,t}$ - and the domestic demand – in the case of $GDP_{Poland,t}$.

$EU_{Poland,j,t}$ acts as a dummy variable equal to 1 when Poland and country $j$ are both members of the European Union in year *t.* If the coefficient of such variable is positive, this will imply that EU accession and membership promote import flows.

Country-pair fixed effects are included to control for time-invariant bilateral characteristics. Time fixed effects account for common shocks.

Results are displayed in Table 3:

*Table 3. Gravity Model – Import Flows*

| **Gravity – Import Flows** | |
|---|---|
| | (1) |
| | Imports |
| ln GDP Poland | 0.196 |
| | (0.211) |
| ln GDP Partner | 1.285*** |
| | (0.288) |
| EU Dummy | 0.168 |
| | (0.142) |
| Observations | 3,352 |
| Number of Pairs | 194 |
| Within R-squared | 0.201 |
| Pair Fixed Effects | Yes |
| Year Fixed Effects | Yes |

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Despite providing useful insights into structural determinants of trade, the utilised gravity models do not allow for a viable measurement of EU accession consequences in trade flows. The EU dummy encapsulates average differences between trade partners, but it does not isolate the change in trade flows related to Poland's EU accession in 2004.

Additionally, the use of a long time span for the gravity models may underestimate short-term dynamics related to the accession moment. Particularly, data for earlier years might incorporate effects from Poland's transition to a full-market economy and later years might reflect exogenous shocks such as the sovereign debt crisis.

As to address this limitation, a difference-in-differences model is developed, to evaluate the temporal variation around the periods concerning Poland's entry in the European Union and its trade patterns to EU and non-EU destinations. This model takes into consideration the previously mentioned concerns regarding time span and uses a narrower time window (1999-2009) as to allow for a more precise comparison of exports' trade flows around 2004 while, at the same time, reducing the influence of long-term trends and exogenous events.

**First difference-in-differences Analysis – Total Trade Flows**

The difference-in-differences model for total trade flows is developed using the outlined specification in the methodology. Equation (2) is estimated, considering bilateral trade flows over the period of 1999 to 2009. The treatment group consists of trade flows between Poland and EU countries, and the control group encompasses trade flows between Poland and non-EU countries.

Results are presented in Table 4:

*Table 4. DiD Model – Total Trade Flows*

| **DiD – Total Trade Flows** | |
|---|---|
| EU_dest x Post2004 | 0.085 |
| | (0.096) |
| Post2004 | 1.513** |
| | (0.119) |
| Pair Fixed Effects | Yes |
| Year Fixed Effects | Yes |
| Observations | 2,125 |
| Number of Pairs | 221 |
| Within R-squared | 0.205 |

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The estimated coefficient of the interaction term is positive, although statistically insignificant. As such, there is no statistical evidence, establishing a relation between Poland's entry to the European Union and a more significant increase in total trade flows with EU partners when compared to non-EU partners.

These results are consistent with the ones from the event-study model and the fact that it indicated only moderate support within the parallel trends assumption framework for the total trade flows scenario.

The estimated coefficient 0.085 would suggest a relative increase of 8.9% in total trade flows with EU partners after 2004. It is, nonetheless, impossible to establish such connection due to the statistical insignificance of the coefficient. Nevertheless, the positive coefficient result is in line with the previously mentioned subject of increasing FDI and decreasing trade barriers in the post-accession era.

Conversely, the coefficient of the Post2004 variable is positive and statistically significant, stating that Polish total trade flows increased after 2004, for both EU and non-EU members.

Altogether, it is possible to state that Poland's total trade flows increased after 2004. However, the increase appears to have occurred in both EU and non-EU partners and, therefore, it is not possible to establish a relation between such increase and stronger trade integration with EU countries.

**Second Difference-in-differences Analysis - Exports**

Following the specification outlined in the Methodology, the difference-in-differences model is estimated for Polish exports over the period of 1999-2009. The treatment group consists of exports to EU members, and the control group consists of exports to non-EU members.

The result of the difference-in-differences estimation is presented in Table 5:

*Table 5. DiD Model – Export Flows*

| **DiD – Export Flows** | |
|---|---|
| EU_dest x Post2004 | 0.251** |
| | (0.101) |
| Post2004 | 1.264** |
| | (0.121) |
| Pair Fixed Effects | Yes |
| Year Fixed Effects | Yes |
| Observations | 2,354 |
| Number of Pairs | 214 |
| Within R-squared | 0.098 |

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

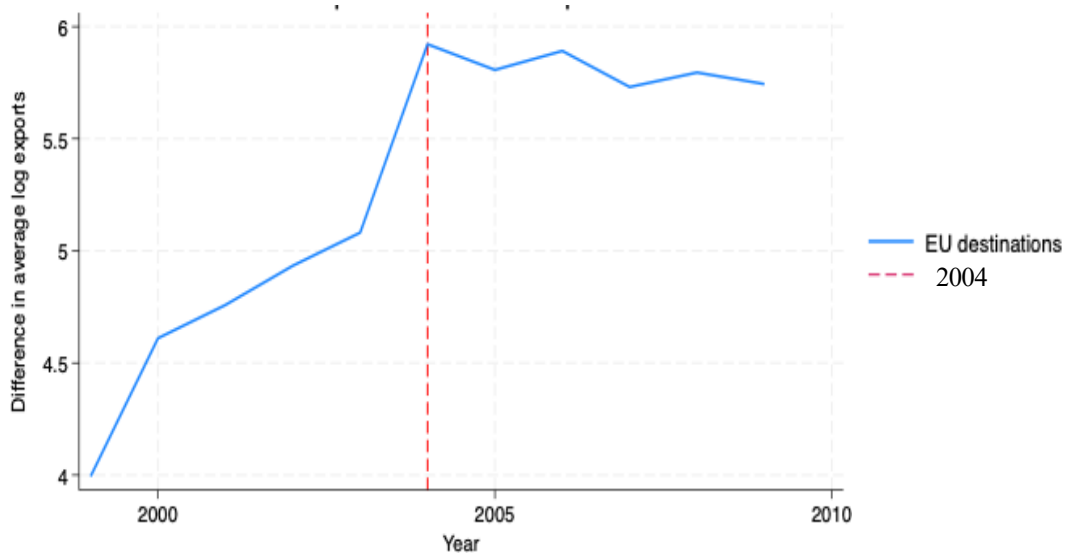
These results show us that, following EU accession, Poland's exports to EU member states increased relatively, when compared to exports to non-EU member states. Specifically, the estimated coefficient of 0.251 suggests that exports to EU countries were approximately 28.5% higher in comparison to non-EU countries after 2004. This happens due to the logarithmic form expression of the dependent variable which translates into $e^{0.251} - 1 \approx$

0.285 This is a statistically significant result, indicating a positive and meaningful impact on Poland's exports, arising from its European Union entry.

This DiD model is developed to assess the causal impact of EU accession rather than predict the changes in trade flows. As such, the statistical significance of the coefficient, instead of the overall fit, should be the relevant criterion when evaluating the quality of such models.

Opposed to the findings in the gravity models, these results highlight the relevance of the DiD specification, as it isolates the change in export flows, whereas the gravity models capture average differences across EU member states. The evolution of Polish Exports to EU and non-EU members can be found in Figure I and in Appendix I.

*Figure I – Evolution of the Difference in Average Log Exports between EU and Non-EU countries*




**Third Difference-in-differences Analysis – Imports**

Deepening the assessment of the impact of European integration on Poland's trade flows, a difference-in-differences model is applied to import flows, thus allowing for the evaluation of EU accession's impact on import behaviour.

The same DiD specification is applied to Polish import flows. In this case, the dependent variable is the logarithm of imports from country *j* to Poland in year *t*, while the treatment and control groups remain the same as for the export specification.

Results for the difference-in-differences estimation for imports are presented in Table 6:

*Table 6. DiD Model – Import Flows*

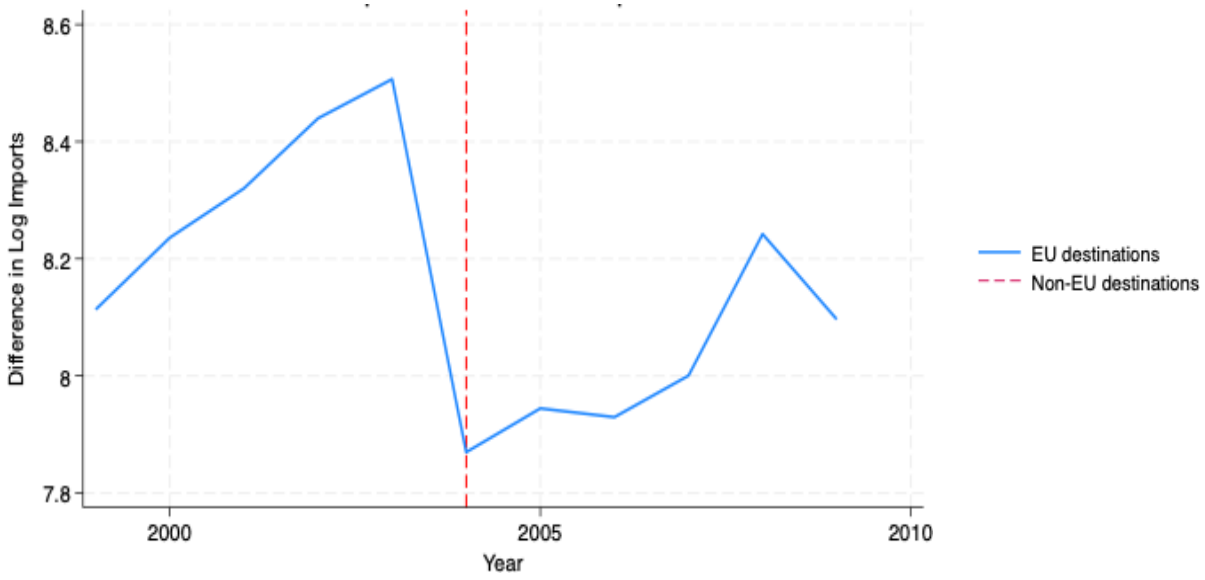
| **DiD – Import Flows** | |
|---|---|
| EU_dest x Post2004 | 0.031 |
| | (0.082) |
| Post2004 | 1.447*** |
| | (0.127) |
| Pair Fixed Effects | Yes |
| Year Fixed Effects | Yes |
| Observations | 1,631 |
| Number of Pairs | 180 |
| Within R-squared | 0.332 |

Standard errors in parentheses
$^{*}$ $p < 0.10$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$

The results are consistent with the fact that Poland's imports originating in EU member states did not significantly increase following its EU entry, when compared to imports from non-EU countries. The estimated coefficient of the EU_dest x Post2004 variable is statistically insignificant, suggesting that there is no clear evidence of a change in import flows from EU members after 2004.

A graphical variation was also developed for visual analysis, as presented in Figure II and Appendix II:

*Figure II Evolution of the Difference in Average Log Imports between EU and Non-EU countries*



Opposed to the exports' results, where a positive effect was detected, the imports' analysis shows us that Poland's EU accession had a much stronger impact on its exports flows than its imports.

**Difference-in-differences models – Event Study**

Additionally, econometrical and graphical approaches are developed to ensure that the parallel trends assumption is verified in all DiD scenarios.

The graphical analysis presented in Index I confirms that total trade and total exports presented different levels with EU members having consistently higher volumes of trade. However, this does not constitute a violation of the parallel trends' assumption. Moreover, the slope of both curves appears to be similar.

On the contrary, the graphical analysis of the imports' flows presents notable differences in the lines' evolution before 2004, revealing a possible contradiction with the parallel trends' assumption.

An event-study model is estimated, through Equation (3), by interacting year dummies with the European Union indicator, to formally evaluate if the parallel trends assumption is met. The event-study results are displayed in Table 7:

*Table 7. Event Study*

| **DiD – Event Study** | | | |
|---|---|---|---|
| | (1)<br>Total Trade | (2)<br>Exports | (3)<br>Imports |
| 1999 x EU | 0.092 | -0.239 | 0.160 |
| | (0.135) | (0.172) | (0.163) |
| 2000 x EU | 0.171 | -0.146 | 0.160 |
| | (0.117) | (0.130) | (0.162) |
| 2001 x EU | -0.009 | -0.087 | -0.009 |
| | (0.105) | (0.121) | (0.150) |
| 2002 x EU | -0.022 | -0.076 | -0.016 |
| | (0.091) | (0.123) | (0.112) |
| 2004 x EU | -0.131 | -0.106 | -0.154 |
| | (0.104) | (0.116) | (0.173) |
| 2005 x EU | 0.071 | -0.063 | 0.063 |

| | | | |
|---|---|---|---|
| | (0.132) | (0.144) | (0.175) |
| 2006 x EU | 0.012 | 0.010 | 0.076 |
| | (0.132) | (0.137) | (0.195) |
| 2007 x EU | 0.155 | 0.079 | 0.264 |
| | (0.139) | (0.144) | (0.201) |
| 2008 x EU | 0.101 | 0.032 | 0.123 |
| | (0.141) | (0.157) | (0.189) |
| 2009 x EU | -0.036 | -0.060 | -0.021 |
| | (0.133) | (0.165) | (0.180) |
| Observations | 2,281 | 2,125 | 2,139 |
| Number of Pairs | 222 | 221 | 222 |
| Pair Fixed Effects | Yes | Yes | Yes |
| Year Fixed Effects | Yes | Yes | Yes |

Standard errors in parentheses
$^{*}$ $p < 0.10$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$

*Figure III - Estimated Annual Effects of EU Accession on Export Flows*

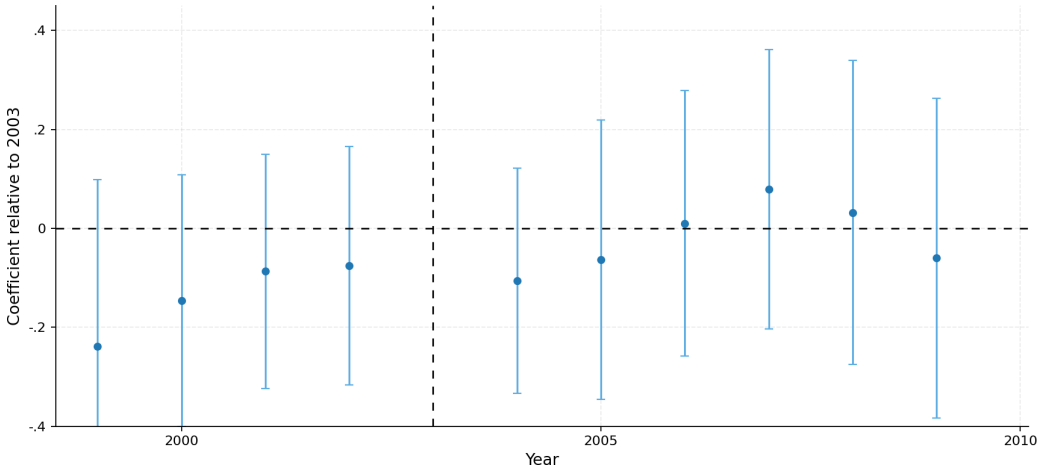


*Figure IV - Estimated Annual Effects of EU Accession on Total Trade Flows*

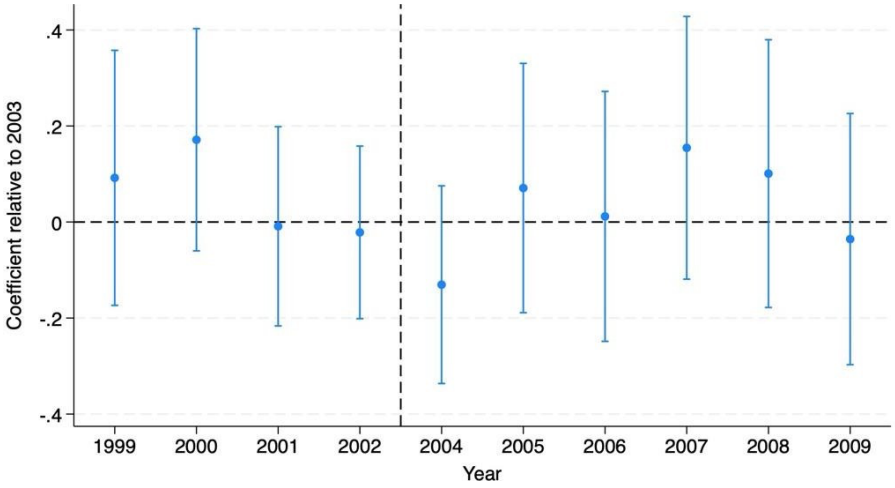
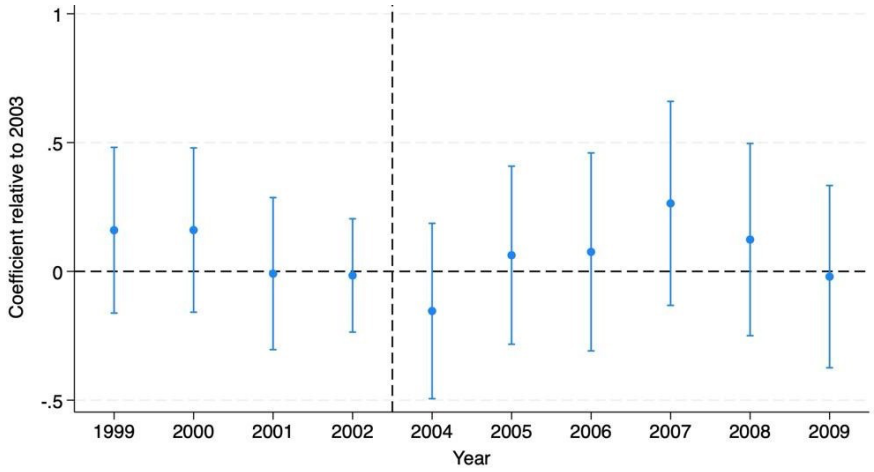



*Figure V - Estimated Annual Effects of EU Accession on Polish Import Flows*




Figures III, IV and V provide a graphical representation of the event-study coefficients and their 95% confidence intervals, for total trade and import flows, respectively.

For total trade flows, pre-treatment coefficients are small and statistically insignificant. The model indicates support for the parallel trends' assumption. This reveals that trade dynamics between EU and non-EU members, were, in general, similar before Polish accession.

Regarding export flows, all the coefficients are also statistically insignificant. The coefficients regarding the period between 1999 and 2002 are close to zero and do not indicate considerable differences in the evolution of exports to EU and non-EU countries. Thus, the event-study analysis provides support for the parallel trends' assumption. It should be noted that

the event-study is intended to evaluate the validity of the DiD models, rather than estimate the average treatment effect of Polish accession.

Concerning import flows, the model reveals statistically insignificant coefficients, revealing no pre-existing diversion trends before accession, for imports.

In sum, the parallel trends assumption seems to be met across all the three specifications. One must consider, however, that this purpose of the event-study is to analyse the validity of the DiD models' usage and not to estimate the average treatment effect of Polish European integration.

In addition, it is important to consider that the 2004 enlargement only took place in May 2004. As the current analysis relies on annual data, observations regarding the year 2004 might only reflect partial accession effects. Nonetheless, in this study, 2004 is considered as the first post-accession year, given that several trade adjustments and effects were already in place at that time.

**Sectoral employment and Trade exposure**

As to explore the relation between labour market and trade flows resulting from EU accession, an additional model was developed, using a sector-level panel dataset which combines employment with sectoral trade data. This model allows for the exploitation of variation across economic activities, due to the segregation of sector data. As such, it is different from the two previous frameworks, which focused on trade flows between Poland and its trading partners.

This specification combines Poland's sectoral employment data with its trade data. The used panel covers 16 sectors over the period 1999-2009, providing a total of 176 observations. However, the sector corresponding to "extraterritorial organization and bodies" presents zero employment throughout the analysed period. There are, therefore, 166 valid observations as observations with zero employment cannot be logarithmically transformed for the dependent variable.

Following the specification defined in the methodology, this model starts by measuring the sectors' pre-accession exposure to European integration, through an exposure indicator that utilizes sectoral trade data for 2003 which is interacted with a post-2004 indicator.

The results are presented in Table 8:

*Table 8. DiD Model – Effect of EU membership on Poland's employment, by sector.*

| | Sector FE only | Sector FE + Year FE |
|---|---|---|
| | No Year FE | Year FE |
| exposure_post | 0.207** | -0.222* |
| | (0.0846) | (0.107) |
| Constant | 5.982*** | 5.937*** |
| | (0.00157) | (0.0284) |
| Observations | 166 | 166 |
| Within R-squared | 0.00675 | 0.456 |

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The first specification, and the positive and statistically significant coefficient of the main explanatory variable, indicates a positive association between pre-accession trade exposure and post-accession employment performance. However, the second specification, with year fixed effects, presents a negative and statistically significant coefficient, at the 10% level. This change indicates that the positive relation observed in the first specification was driven by aggregate economic trends affecting all sectors after 2004, rather than isolated effects of trade exposure and EU accession. One must, as such, prefer the model that includes year fixed effects, which suggests that the most exposed sectors to EU trade before 2004 experienced less favourable employment trends after accession.

This result indicates that the most exposed sectors to EU trade before 2004 did not experience stronger employment growth when compared to the less exposed sectors. This does not, however, state that European integration reduced unemployment. The coefficient captures a relative difference in employment performance across sectors with different levels of pre-accession trade. Therefore, the negative coefficient implies that employment in highly exposed sectors evolved less favourably after 2004, relative to the more exposed sectors. Conversely, other sectors might have had employment reductions due to multiple factors such as migration flows or productivity gains resulting from technological upgrades. As a result, trade and output might have increased in a manner that is not proportional to the increase in labour demand.

The previously mentioned findings gain relevance given the fact that the manufacturing sector accounted for the largest share of pre-accession trade exposure and, at the same time, was among the most affected sectors by foreign direct investment, technological upgrades and

integration into European value chains, as the Organization for Economic Co-operation and

Development (OECD) (2025) has previously stated. This might imply that EU accession gains might have been incorporated through productivity growth rather than employment increases.

The results provide evidence that the effects of economic integration on the labour market were different across sectors, depending on their degree of exposure to European markets before 2004. It is, moreover, important to consider the effects of sectoral heterogeneity when assessing the consequences of enlargement processes on a sector-panel data model.

## 4. DISCUSSION OF RESULTS

The obtained results allow for a better, yet to be developed, understanding of EU-related trade and employment dynamics regarding Poland's European Union accession.

The three gravity models, developed for several types of trade flows – total trade, exports and imports – indicate the statistically insignificance of the EU dummy variable. Albeit being counterintuitive, this outcome is in line with literature. It highlights the conclusions of Baier and Bergstrand that estimated effects of trade agreements are often underestimated due to endogeneity of trade policy variables and the existence of time-invariant heterogeneity between country-pairs that is not accounted for in the model.

The gravity models utilized in this work make use of an extended period and all of them include country-pair and time fixed effects. As such, the impact, and subsequent variation of trade flows, related to EU accession are likely to have been absorbed by these controls, instead of being effectively non-existent.

This interpretation is verified through a variable fixed-effects model which was developed as a robustness check. In this context, the EU dummy was omitted entirely due to collinearity, after the inclusion of country-pair and time fixed effects.

Results are presented in Table 9:

*Table 9. Robustness Check - Fixed Effects Specification*

| | (1) |
|---|---|
| EU Dummy | Omitted |
| ln GDP Poland | 1.547*** |
| | (0.166) |
| ln GDP Partner | 0.586** |
| | (0.133) |
| Observations | 3,426 |
| Groups | 187 |
| Within R-squared | 0.469 |
| Pair Fixed Effects | Yes |
| Year Fixed Effects | Yes |

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

This highlights the previously mentioned limitation of integration effects being largely absorbed by pair-specific and time components in models that have a broad panel. Consequently, the models cannot isolate the effect of EU membership from the pair-specific and time-specific components already captured by the fixed effects. This is in line with Piermartini and Yotov (2016) statements that, although pair fixed effects address endogeneity problems, they will also tend to absorb gradual policy impacts that take place over long periods of time.

Additionally, as stated before, Poland's effective integration into the European Union began prior to 2004, partially causing the EU dummy to capture standard average trade differences instead of the desired accession impact.

To counter the problem with the isolation of such effects, the difference-in-differences models are estimated, narrowing the time-window for the analysis and comparing trade flows to EU and non-EU members, before and after 2004.

The estimated DiD for total trade flows does not allow for the establishment of a statistically significant relationship between Poland's EU accession and relative changes in trade flows dynamics with EU members. Despite presenting a positive interaction coefficient of 0.085, which suggests trade with EU members increased more than trade with non-EU members such interaction does not hold statistical value within this framework. However, this result is consistent with the idea that Poland's trade integration was already virtually effective at the time of formal accession, due to the Europe Agreements and consequent removal of trade barriers.

The DiD for exports presents a positive, statistically significant coefficient of 0.251, indicating that after Poland's accession, its exports to EU members were approximately 28.5% larger than to non-EU members. This is consistent with Hornok's findings that the 2004 enlargement generated trade creation in the years following its process. These results are also in line with Gilbert and Muchová (2018) observations that accession economies witnessed an increase in intra-EU trading, having been the primary drivers of export gains.

It is, however, important to dwell on the asymmetry between the DiD for export flows' result and the one for import flows. Contrary to the export's DiD, the import's model yields a low and statistically insignificant coefficient. It is possible that imports behave in such manner since Poland's economic integration was asymmetrically driven by its role as an exporter of intermediate goods such as automotive parts. With Poland's EU accession, this reality was potentiated rather than alleviated, due to the allocation of considerable amounts of FDI (Pavlínek, 2020). The fact that no significant import effect is witnessed might indicate that Poland's import exposure was already substantial before its European accession in 2004.

The event-study results do not reveal statistically significant differences between EU and non-EU members regarding total trade, exports or imports, before Polish accession. As such, it is possible to conclude that the parallel trends assumption is met across all three specifications and, consequently, the validity of the difference-in-differences is supported. The fact that the event-study coefficients should only be interpreted for a validity exercise is noteworthy, since none of the interaction terms is statistically significant. Moreover, Rambachan and Roth (2022) argue that parallel trends tests should not be posed as a binary validity test. Therefore, the authors recommend that DiD results should be interpreted through robustness and sensitivity analysis when the assumption is not verified. In this case, the detected pre-treatment differences may reflect prior trade agreements and previous integration effects. In this case, the fact that all coefficients are statistically insignificant is consistent with the parallel trends' assumption, although it cannot stat that the assumption holds with certainty.

Finally, the ultimate stage of the empirical analysis intended to assess the relation between Poland's integration into the European Union and potential labour market variations through two specifications that focused on sector exposure and employment. The first specification, without year fixed effects, yields a positive and statistically significant coefficient for the interaction between pre-accession EU trade exposure and the post-2004 indicator. This suggests the sectors that were more exposed to EU trade witnessed employment growth at a faster rate than the ones that were less exposed.

Nonetheless, once the second specification is developed, including year fixed effects, the coefficient becomes negative, while remaining statistically significant. This reversal in the coefficient sign indicates that the positive relation that was observed in the first specification was driven by general economy growth trends after 2004 instead of EU exposure effects. As such, the second – and preferred - specification results suggest that the most sectors which were more exposed to EU trade before 2004 witnessed relatively less favourable dynamics regarding employment behaviour when compared to less exposed sectors.

This result is in line with two different factors exposed in literature. As noted by Havlik (2001), CEE economies observed productivity gains which were not entirely reflected in employment levels. These economies had major technological upgrades, followed by increases in workers' output. Moreover, when addressing Poland, specifically, it is important to consider that accession gains were incorporated through substantial amounts foreign direct investment inflows which accelerated said technological upgrades productivity, reduced labour intensity of production (Pavlínek, 2020). Moreover, labour supply might have been influenced by mass migrations towards western European countries such as the United Kingdom and Germany, thus reducing labour market pressures and, consequently, Poland's unemployment rate at the time following accession (Iglicka, 2008)

## 5. CONCLUSIONS

This work analyses the impact of Poland's accession to the European Union on its trade flows and labour market dynamics, addressing an existing gap in literature, regarding the relationship between economic integration of a CEE country and its employment.

Three complementary stages were developed. Firstly, gravity models were estimated to assess the determinants of bilateral trade flows – total, exports and imports. Secondly, a difference-in-differences framework is developed as to isolate the accession effect on trade, establishing a comparison between EU and non-EU members' trade flows. Finally, a sectoral fixed-effects model is utilized to investigate the impact of European Union integration on the sectors that were more exposed to EU trade prior to 2004.

Although the gravity models confirm the relevance of market size as a determinant of trade flows, with all specifications presenting the coefficient of the trading partners' GDP as statistically significant and positive, the EU dummy was statistically insignificant in all three specifications. Albeit being counterintuitive, this is consistent with Baier and Bergstrand

(2007) position that, in the presence of country-pair and time fixed effects, in long panels, the variation associated with EU accession tends to be absorbed by such pair-specific and time-specific components. This is verifiable through the robustness check, where the EU dummy is omitted due to collinearity. Additionally, the fact that Poland's European integration was, in fact, initiated before its formal accession in 2004, it is important to consider that the used EU dummy might fail to capture such effects.

The difference-in-differences models reveal an uneven accession effect, depending on the analysed trade flows. Poland's exports to European Union members were 28.5% higher when compared to exports to non-European Union members, following accession. This is consistent with Hornok's (2010) trade creation works and with Gilbert and Muchová's (2018) findings that state an increase in intra-EU exports' share. Conversely, the developed models for import and total flows do not show a statistically significant effect for the EU membership dummy. This reveals Poland's trade integration as being asymmetric, which is in line with Pavlínek's (2020) statements of Poland's enhanced position as an intermediate good exporter after substantial amounts of FDI, following its integration.

These results must, however, be interpreted with caution, as the parallel trends assumption is only met for exports and, to a lesser extent, total trade flows. A careful analysis is, therefore, necessary when interpreting the DiD results for imports, as it may incorporate preexisting differences originating in prior trade agreements such as the Europe Agreements.

The sectoral employment model examined the relationship between trade integration and employment. The sectoral fixed-effects model indicates that sectors that were more exposed to EU trade before accession experienced a, relative, more positive employment performance. Nonetheless, once year fixed effects are included, the interaction between pre-accession EU trade and the post-2004 indicator presents a negative coefficient, suggesting that the most exposed sectors before 2004 experienced less favourable employment dynamics when compared to the less exposed ones. This is in line with existing literature which states that integration gains were manifested through productivity growth and capital inflows rather than proportional increases in labour demand. Additionally, mass migration flows towards Western countries may have reduced Polish unemployment pressures due to the consequent reduction in labour supply.

Altogether, the present study presents significant evidence on the contribution of the European Union to trade creation and on the reorientation of Polish exports towards European

markets. There is, however, limited evidence that such trade gains present a simple, positive, relationship with employment growth. In fact, Poland's European integration seems to have generated positive impacts on employment dynamics through technological advances and consequent productivity gains allied with a relief on labour market pressures due to mass migrations to the west.

Several limitations should be acknowledged. The fact that the analysis relies on aggregate bilateral trade data may entail sector-wise heterogeneity. Additionally, although the event-study model indicates that the parallel trends assumption is met, the absence of statistically significant coefficients suggests that the impact of accession should be interpreted with caution.

Future research on this subject would benefit from a more detailed analysis of sector-specific behaviours, utilizing firm-level data or examining integration effects across Polish regions, skill groups our occupations. It is equally important to dwell on the role of global value chains, Poland's position in such chains and the impact of foreign direct investment in labour market dynamics.

In sum, the obtained evidence suggests that Poland's European Union accession is related with changes in trade patterns, particularly its exports to EU members. Nonetheless, the consequences of such process in employment behaviour seem to be heterogeneous and would potentially be better understood at a sectoral level.

Poland serves as an example of the European Union integration impact on trade gains and productivity, despite producing heterogeneous labour market outputs.

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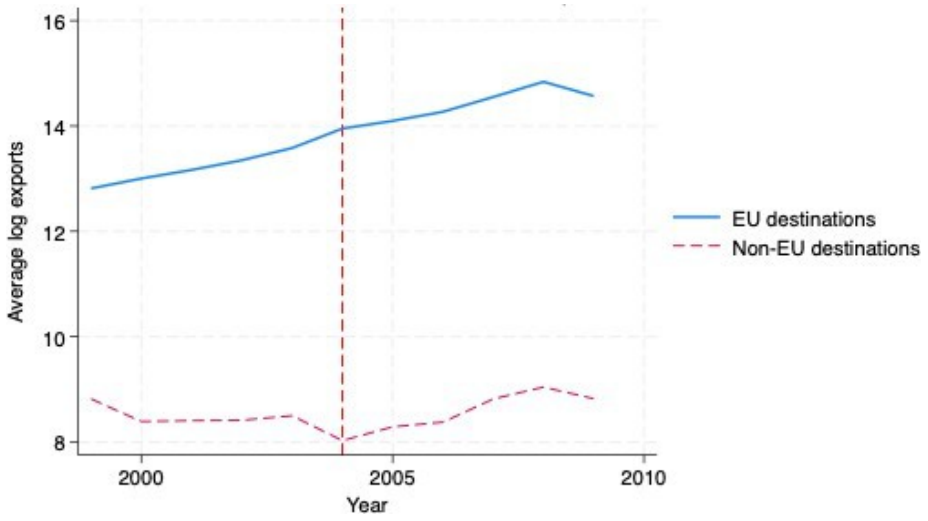
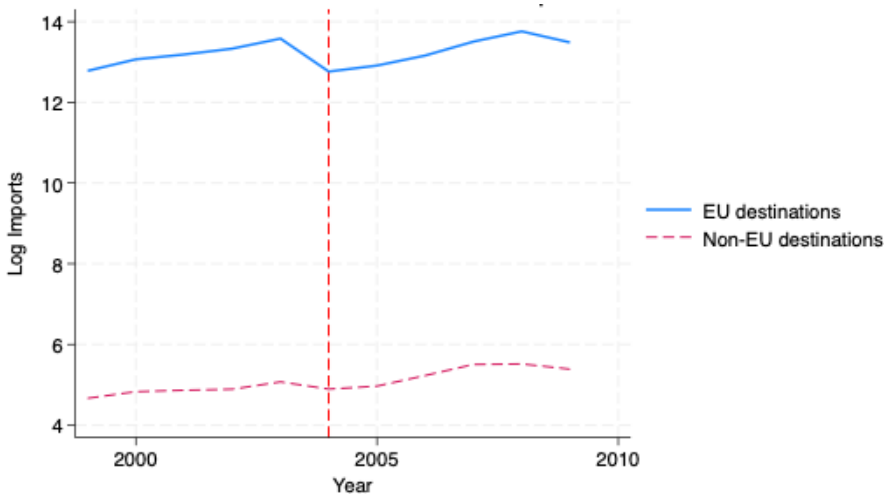
**Appendix**

*Appendix I - Evolution of Polish Exports (1999–2009)*




*Appendix II - Evolution of Polish Import Flows (1999–2009)*