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The Impact of Trade Liberalization on Labor Productivity and Employment: Evidence from Austria's Automotive Industry

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Abstract:

This paper estimates the impact of trade liberalization on causation between labor productivity and employment within Austria's automotive industry, one of the most export-intensive and technological advanced sectors. It builds on a quasi-experimental approach based on two large trade shocks: the 2011 EU–South Korea Free Trade Agreement and the 2019 EU–Japan Economic Partnership Agreement. The average and variation firm-level estimates are derived from the Difference-in-Differences models (i.e., first-difference and heterogeneity analyses). The results show a significantly positive impact of trade liberalization on labor productivity, in particular at larger and more capital-intensive enterprises, however, short-run disruptions in employment and wage asymmetry also emerge. The paper illustrates the theoretical predictions of models of heterogeneous firms and skill-biased technological change, and gives policy recommendations which combine integrating openness and labour market effects.

Zusammenfassung:

Diese Arbeit untersucht die Auswirkungen der Handelsliberalisierung auf den Zusammenhang zwischen Arbeitsproduktivität und Beschäftigung in der österreichischen Automobilindustrie, einem der exportintensivsten und technologisch fortschrittlichsten Sektoren. Sie basiert auf einem quasi-experimentellen Design und nutzt zwei große Handelsschocks: das Freihandelsabkommen zwischen der EU und Südkorea von 2011 und das Wirtschaftspartnerschaftsabkommen zwischen der EU und Japan von 2019. Die Differenz-von-Differenzen-Modelle, einschließlich Erstdifferenz- und Heterogenitätsanalysen, werden für durchschnittliche und variable Schätzungen auf Unternehmensebene verwendet. Die Ergebnisse deuten auf einen deutlich positiven Effekt der Handelsliberalisierung auf die Arbeitsproduktivität hin, insbesondere bei größeren und kapitalintensiveren Unternehmen. Allerdings wurden auch kurzfristige Beschäftigungsunterbrechungen und Lohnasymmetrien festgestellt. Die Arbeit bestätigt die theoretischen Vorhersagen heterogener Unternehmensmodelle und des kompetenzorientierten technologischen Wandels und liefert politische Implikationen unter Berücksichtigung von Offenheits- und Arbeitsmarkteffekten.

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CHAPTER 1: INTRODUCTION

1.1 Introduction

The automobile sector is a prominent industry in Austria and throughout Europe. Austria can be called a car country as more than 350 thousand people are employed in the automotive industry and the fiscal contribution is more than 23 billion euros, so that shows how important this sector is for employment and prosperity.

Christian Helmenstein from the Economica Institute mentioned that the Austrian automotive industry accounts for 18 billion euros directly and 30 billion euros in total gross value added (approximately 8.4 percent)

"It is particularly pleasing that more than 320 patent applications in this sector each year show how innovative this industry is. In terms of inventor density, Austria is above the European average and ahead of countries such as Sweden, France, and the USA," explained Helmenstein.

At the macroeconomic level, the automotive industry is thus a driver of overall economic productivity progress as a central source of material prosperity.

As mentioned above, the automotive industry accounts for around 30 billion euros in gross value added in Austria. This means that every 12th euro earned in Austria can be traced back to the automotive industry. The automotive sector directly and indirectly supplies over 354,000 vacancies.

In 2019, over 209,000 people were employed in the automotive industry, which corresponds to a share of more than four percent of the employed population in Austria. But even that directly traceable contribution highlights the leadership role of the automotive industry in Austria. Considering that the automotive industry itself relies on countless companies in its supply chain, there are more than 354,000 employees who are either directly or indirectly involved in this industry, which accounts for almost eight percent of all employees in Austria, so we can calculate how powerful this sector is, he concluded. This also means that every 13th job in Austria can be allocated directly or indirectly to the automotive industry. Austria’s

automotive sector has especially capitalized on access to international markets enhanced by trade liberalization agreements, both within and beyond the European Union.

In recent years, two significant trade liberalization steps created new dynamics in the Austrian automotive industry: the 2011 EU-South Korean Free FTA and the 2019 EU-Japan EPA. These agreements boost the economy through lower trade barriers such as tariffs and quotas, and opening access to new markets while increasing exports and strengthening competitive forces.

However, does the policy changes have impacted productivity and employment in the industry, how much time it needs to fully adopt, and whether there is enough capacity to make it work - remains an unanswered question, requiring empirical examination.

The relationship between trade liberalization and productivity may be further mediated by major structural features like capital intensity, export concentration R&D expenditures and so much more. Typically, trade agreements are believed to improve efficiency by increasing competition, technology adoption, or access to quality intermediate goods, but there are so many nuances and challenges and don't they overlap the benefits of the agreement? Yet, the realizations might be determined by the firm and sectoral factors such as the propensity to respond to competition or technological change, cost of a change, capacity of firms, demand, and logistics.

Because of the globalization of the automotive industry, the Austrian sector is also affected by external shocks and the evolution of global trends. For example, the 2008 global financial crisis and the unprecedented recovery that ensued provide a critical study of the industry's survival and change management. Also, comparisons with Switzerland's automotive industry which has varying trading conditions highlight useful correlatives in measuring the effectiveness of the trade regimes.

However, in the absence of the research above, in this thesis, the impact of trade liberalization on labor productivity in the automotive industry of the Austrian economy is analyzed and described more thoroughly. Moreover, this research will employ econometric models to illuminate the complexity and be clear and transparent with findings.

The thesis focuses on examining the relationship between trade liberalization and productivity as well as employment in the automotive manufacturing sector in Austria from 1995 to 2020. Yet this change was not fully evaluated, and in particular, this research aims to investigate how

large trade agreements such as the 2011 EU-South Korea FTA and the 2019 EU-Japan EPA developed productivity growth and structural economic change.

By analyzing labor market responses, wage dynamics, and capital investment patterns, this research provides a comprehensive evaluation of the broader economic consequences of trade liberalization.

The primary purpose of this research is to assess if the recent market liberalization has led to efficiency improvements and productivity development in Austria's automotive sector. Trade liberalization may induce structural changes such as increased competition, specialization, and integration into global value chains. While the impact is not the same across all firms. These effects may favor large, capital-intensive firms against smaller ones, or export-oriented vs domestic firms.

To capture these dynamics, this study considers capital intensity, firm size, and export orientation as key determinants of productivity outcomes following trade liberalization.

Beyond potential direct effects, this study explores the impact of investments in research & development on productivity fluctuation. However, with trade deals come greater competition, forcing companies to invest more in innovation and efficiency-augmenting technologies (the ability to get more out of a given set of production inputs). The correlation between R&D spending and productivity growth is not linear and could be subject to diminishing returns above a certain level.

This research also explores the impact of trade liberalization on employment. Although expanded access to the global market can create jobs in some competitive firms, it also displaces workers in firms that cannot compete with increased global competition. The results of the study investigated the changes in employment and wage distribution in the sector after trade liberalization (if an increase in productivity has resulted in better wages for the sector's employees.)

To put things into perspective, Austria’s automotive productivity trends are also compared to those of Austria’s other industries, as well as the automotive sector of its neighbor Switzerland. Switzerland is a good country since it was not a party to these EU trade deals, and its productivity trends provide a natural experiment in a non-liberalized context. Additionally, the robustness check of these results is implemented by additional analytical approaches. These results will be

useful for policymakers, industry, and researchers who focus on the long-run impact of trade policies on sectoral competitiveness and economic development.

1.2 Hypotheses of the Study and Literature Overview

H1: Trade liberalization increases labor productivity in Austria's automotive industry.

As outlined in Section 2.5.1, Melitz's (2003) framework, even when the productivity of a firm stays the same, the reallocation impact increases the productivity of the industry as a whole. This motivates Hypothesis 1, which tests whether productivity gains in Austria's automotive industry followed recent trade liberalization episodes.

Mechanisms:

- Selection Effects: Trade openness reallocates labor and capital to more productive companies, raising the productivity barrier for market survival.
- Market Share Reallocation: As trade barriers decrease, inefficient enterprises become less competitive, while productive exporters increase their market shares.
- Export-Driven Innovation: Having access to wider markets drives efficiency gains and technology advancements.

Evidence for these mechanisms can be found in empirical studies like Bernard et al. (2007) and Pavcnik (2002) in Chile, which found that the expansion of high-performing exporters and company turnover were the main causes of the aggregate productivity improvements in industries exposed to trade liberalisation.

As more than 80% of Austria‘s production is exported, the automobile industry is especially vulnerable to global competition. In line with the hypothesis, significant trade agreements like the 2011 EU–South Korea FTA and the 2019 EU–Japan FTA opened up new export markets.

H2: Trade liberalization has asymmetric short-run and long-run effects on employment.

This idea is supported by trade theory and labour market adjustment models that acknowledge temporal asymmetry in the effects of liberalisation on employment. In particular, labour reallocation frictions caused by trade liberalisation cause short-term disruptions, whereas structural economic adaptations cause long-term realignments

Short-Term Effects: According to worker-selection models (de Pinto & Michaelis, 2011, 2014), workers with lower ability and less mobility suffer disproportionately from liberalization. Job losses are among the first disruptions, especially in low-skilled and import-exposed industries, as Autor, Dorn, and Hanson (2013) noted in the context of the United States. Long-Term Impacts: According to dynamic adjustment theories (Milner & Wright, 1998), economies will eventually reorganize, redistributing workers to more inventive and competitive industries. The recovery is accompanied by a move toward higher-skilled, higher-paying occupations as businesses invest in new technologies (Tapp, 2007).

Short-term disruptions could impact regular production jobs and supplier networks in Austria's automotive industry. However, it is anticipated that long-term adaptation through innovation and the growth of export markets will restore and even improve employment, particularly for highly qualified roles.

H3: Sectors with larger average firm size benefit more.

In line with the discussion in Section 2.5.1, the Melitz (2003) model also implies that larger, export-oriented firms are more likely to benefit from trade openness. Market share is reallocated to companies with greater efficiency. Krugman states that bigger, more globalized companies benefit from trade liberalisation due to economies of scale and product differentiation.

The best-positioned companies to benefit from liberalization through expansion, innovation, and increased market penetration are multinational suppliers and big automakers like Magna and AVL.

Additional empirical evidence is provided by Lileeva and Trefler (2010) who demonstrate that Canadian firms in manufacturing increased their productivity after NAFTA—although mainly for the already productive firms or those that engaged in technology and skill upgrading. This supports the argument that trade liberalization gains are not universal, but are contingent on firm-specific capabilities, a channel which this dissertation will investigate in the context of Austria's export-oriented automotive industry.

H4: Capital-intensive sectors benefit morefrom trade liberalization.

This hypothesis, which has its roots in Schumpeterian innovation models and Endogenous Growth Theory (Romer, 1990), suggests that companies that make significant investments in

technology and physical capital are better equipped to withstand trade shocks and take advantage of emerging market possibilities. Although they are built initially at the aggregate level,the models focus on the importance of capital accumulation and innovation in generating productivity growth. Here, at the industry level, the same underlying logic applies: companies with a high level of physical and technological capital investment should be more likely to survive trade shocks and take advantage of liberalized market access.

Key Mechanisms:

- Businesses that require a lot of capital are more productive, which increases their ability to compete globally.
- Trade liberalization makes it easier for highly technological corporations to integrate into global value chains (GVCs) by lowering barriers.

Due to its high R&D intensity and production methods, Austria's automotive sector benefits from capital-intensive firms significantly.

H5: Trade liberalization leads to wage gains, with more pronounced effects for high-skilled workers.

This hypothesis suggests that trade liberalization disproportionately benefits high-skilled workers through enhanced wages and job opportunities. As economies open up to trade, competitive pressures, new technologies, and foreign inputs compel firms to adopt more sophisticated production processes that are complementary to skilled labor.

Trade liberalization increases the availability of new intermediate goods, promotes innovation, and facilitates firm upgrading, all of which elevate the reduced value of low-skilled work and the increase in demand for highly trained labor. This structural shift is evident in both developed and developing economies and often leads to rising wage inequality.

Key Insights from the Literature:

Wage Premiums and Trade Openness:

- In Chile, tariff reductions led to increased industry wage premiums, especially in firms employing more skilled labor. These gains were concentrated in larger and more export-oriented firms, amplifying wage gaps (Murakami, 2020).

- Bas & Paunov (2019) report similar results in Ecuador, where high-skilled workers saw substantial wage gains post-liberalization, as firms improved productivity through access to more diverse and technologically advanced inputs.

Growing Wage Inequality:

- Traca (2004) and Koymen-Ozer (2020) both find that trade liberalization increases the skill premium in labor markets. Skilled workers benefit from technological upgrading and international exposure, while unskilled labor faces stagnant or declining real wages, contributing to widening wage inequality.
- The Koymen-Ozer (2020) study particularly emphasizes that trade openness leads to asymmetric wage adjustments, with the demand for skilled workers increasing faster than for their low-skilled counterparts.

Labor Market Frictions and Mobility:

- Trade liberalization increases inter-sectoral mobility, but this transition is smoother for skilled workers. They adapt more easily to the evolving demands of competitive, globalized industries, while unskilled workers face barriers to reallocation, job losses, or precarious employment (Traca, 2004).

Austria's automotive industry, characterized by capital-intensive and technologically advanced production, has experienced post-liberalization adjustments favoring skilled labor. Trade agreements such as the 2011 EU-South Korea FTA and the 2019 EU-Japan EPA opened access to high-tech markets, increasing demand for engineers, designers, and software technicians, while reducing reliance on routine labor.

CHAPTER 2: INDUSTRY CONTEXT, TRADE LIBERALIZATION, AND THEORETICAL FRAMEWORK

2.1 The Strategic Role of Austria's Automotive Industry in the Economy

2.1.1 Macroeconomic Importance: Exports, Employment, and GDP Contribution

The Automotive industry is an important part of the European Union in creating jobs. Based on 2019 data, 13.8 million Europeans have been working in automotive companies (which corresponds to a large number of services and a supply chain, the automotive sector is about 6% of the total employment in the EU). Across Europe in manufacturing, around 2.6 million people are engaged in the production of engines. European Union occupies the most favorable position of all the countries producing motor vehicles. The European auto industry has a foreign market for over 5.6 million cars and earns a production of 74 million euros. In 2019 over EUR 62 billion was involved in the R&D field by private investors because of the innovative potential of the automotive industry. Exactly automotive industry has been assimilating and successfully penetrating Europe for over a hundred years.

2.1.2 Evolution of Export Performance: Trends from 1995 to 2024

Given that Austria's automotive industry is influenced by exports, foreign investments, and technical innovation, trade agreements will have a significant impact on how the sector develops in the future.

Key Contributions(2019):

- Exports: over 80% of Austrian automotive production is sold abroad
- Indirect impact as logistics, suppliers, and others: €8.9 billion.
- A big part of Austria´s GDP: €29.8 billion (5.2% of total GDP)

The export share underlines the influence of trade liberalization agreements in enhancing market access and further sector development.

Graph 1: Austria's Auto Exports (1995–2024)

In general, the trend showcases a steady increase in export values, reflecting Austria's growing trade activity over the years.

Key Observations:

- Growth (1995–2008): Probably stimulated by growing integration into worldwide trade, membership of the EU that Austria joined in 1995, and the globalization of supply chains.
- 2009 (Financial Crisis Effect): A drop in export levels can be observed around 2009, which coincides with the global financial crisis.
- Recovery and Stabilisation (2010–2019): Following 2010, exports showed a robust post-crisis recovery; trade liberalization accords, such as the 2011 EU-South Korea FTA, may have played a role in this recovery.
- Another Dip in 2020 (COVID-19 Impact): A decline in exports is observed around 2020, which aligns with the global trade crisis caused by COVID-19.
- Post-Pandemic Recovery (2021–2024): A significant increase in 2021 and a continuation of the increase in 2022 and 2023 is likely due to trade agreements (2019 EU-Japan EPA) and economic recovery efforts.

2.1.3 Employment Generation

In Austria, the automobile sector, directly and indirectly, provides over 354,000 jobs, or about 8% of all occupations. The sector's substantial integration into the overall economy is demonstrated by the employment breakdown.

Table 1: Employment Distribution in the Austrian Automotive Sector

Sector	Jobs Supported
Core Automotive Industry (Direct)	106,000
Wider Automotive Economy (Direct)	209,000
Indirect and Induced Effects	145,273
Total Employment	354,273

(*Source: Statistik Austria and WKO, processed by the author)*

The large volume of employment explains the large contribution of the sector not only to the GDP but also to each Austrian citizen's economy in the diversity of regions.

2.1.4 Fiscal Contributions: Taxes and Public Revenues from the Automotive Sector

The contribution of the automotive industry to the economy is big, with this sector bringing in and sustaining vital revenue inflow into the Austrian treasury.

Tax Contributions (2019):

- Tax for Employees: €6.1 billion, which epitomizes the number of the industry's employees.

- VAT Tax: Wealth of 3.9 billion euros generated from vehicle and auto-related operational services and goods.

- Corporate income tax: €401 million earned from revenues gained from the automotive businesses.

- Other Road Transport related Taxes: Taxes total €10.2 billion, which arose from vehicle taxation, fuels taxation, and tolls.

This puts into perspective the assistance that the industry gives to society in terms of providing infrastructure, medical services, or education.

2.1.5 Innovation and Technological Leadership

The electricity enabled vehicles, hybrid vehicles, fuel efficient vehicles, and self driving systems are all creations originating from Austria as its automotive industry develops new technologies. The annual patent application numbers were also constant with annual averages oscillating around 320 applications which were about 1.3 percent of all applications made in EU automotive.Austria has an inventor density of 0.706 inventors in automotive for every thousand people as compared to the EU-27's 0.24.

The foremost patent holders in this sphere include AVL List (779 patents), Magna (416 patents), and ZKW Group (257 patents), which specializes in electric mobility, light systems, and energy efficiency respectively.

Table 2: Patent Statistics (2011-2020)

Company	Patent Families
AVL List	779
Magna	416
ZKW Group	257

(*Source: European Patent Office (EPO), processed by the autho)*

2.1.6 Investment in Research and Development and Economic Spillovers

As far as the analysis is concerned, it can be understood that the automotive sector averages over 11% of the revenue in a given year for R&D activities, which is much greater than the average for other sectors in Austria.

The ability of the automotive sector to create multiple effects across the entire economy of Austria is indeed remarkable. In addition to the direct impact on the GDP and the employment, it also helps in the growth of other sectors such as raw material, logists and financial services among others.

Table 3: Gross Value Added (2019, in Million)

Contribution Type	Core Automotive Industry	Wider Automotive Economy
Direct	€ 7,400	€ 18,301
Indirect	€ 3,472	€ 8,900
Induced	€ 1,078	€ 2,549

(*Source: Statistik Austria and Eurostat, processed by the author)*

2.2 Trade Liberalization: Concepts, Mechanisms, and Relevance

2.2.1 The Logic of Trade Liberalization: Comparative Advantage and Market Expansion

Trade liberalization involves the lowering or elimination of trade barriers to encourage international trade with the goals of making production more efficient and thus lowering prices and ensuring consumer benefits.

Countries, by overcoming other barriers to trade liberalization, were able to expand markets, save costs of inputs, and advance technology which brought some opportunities to the global automotive sector.

Trade liberalization has been a really studied topic in economic studies for decades, with a significant focus on its effects on productivity, employment, and structural changes in sectors. By removing or lowering trade barriers—tariffs, quotas and regulatory restrictions—they allow

the cross-border trade that allows firms to access larger markets, drives greater competition and facilitates access to global supply chains.

2.2.2 Trade Liberalization as a Driver of Productivity Growth

The underlying rationale for trade liberalization is that it boosts productivity growth by putting domestic industries in competition with the world, providing firms with the incentive to innovate and allocate resources more effectively. A lot of early theoretical work (e.g., on macroeconomic dynamics) has put emphasis on these mechanisms, but it can also be applied at the level of industries(automotive in our case).

It has been used, for example, to study the impact of trade openness on the rate of innovation and the technology growth in open economies (Grossman and Helpman 1991). Grossman & Helpman (1991) investigated how trade openness speeds up innovation and technical diffusion - two main and important productivity drivers Though they are on a macro level, the conclusions are also valid lessons for sectoral industries such as the Austrian automotive industry, which is largely dependent on innovations.

The paper "Measured Aggregate Gains from International Trade: Evidence from the US" reaches several key conclusions about the links between international trade and economic activity. Here are the key findings: The paper shows reductions in variable trade costs increase real GDP and measure aggregate productivity. The performance of GDP deflators as measures of trade costs decline means trade liberalization appears to have a substantial beneficial impact on the economy.

2.2.3 Labor Market Effects of Trade Liberalization: Job Displacement and Skill Upgrading

Trade liberalization also has far-reaching effects on the composition of employment within an economy. The Baldwin & Robert-Nicoud (2008) study suggested that trade liberalization disproportionately benefits high-skilled labor in advanced economies, as industries transition toward more technology-intensive production. These findings are consistent with observations of the Austrian automotive sector, where post-liberalization techniques have led to greater automation and demand for high-skill labor.

2.2.4 Sector-Specific Impacts: Trade Agreements Shaping Austria's Automotive Sector

Trade liberalization is often implemented through trade agreements, which establish the institutional framework for cuts in trade restrictions. Moreover, empirical evidence demonstrates that such agreements reallocate resources across sectors, with export-oriented industries being the main beneficiaries. The effects of both 2011 EU-South Korea FTA and 2019 EU-Japan EPA were two policies that impacted the Austrian automobile manufacturing landscape.

These agreements have enhanced international competitiveness as well as supply chain integration for Austrian automotive firms and may have raised labor productivity in the sector by reducing trade barriers with South Korea and Japan. In line with the predictions of Bustos (2011), there are more general theoretical insights that support that firm exporting responds positively to liberalization in a way that firm technology upgrades and worker productivity grows following liberalization, noting that such trends are especially relevant for Austria's capital-intensive automotive industry.

2.3 Uneven Gains from Trade Liberalization: Firm and Worker Heterogeneity

2.3.1 Heterogeneous Firm Responses to Trade Liberalization

A key part of trade theory is that firms do not gain the same benefits from trade liberalization (recall Melitz (2003)). This pattern supports the idea that within Austria's automotive sector, firms with high capital intensity, export orientation, and R&D investment are more likely to gain from productivity improvements after liberalization.

Furthermore, Bernard et al. (2003) show that exporting firms that are larger, pay more, and invest more in technology, further supporting the idea that trade agreements benefit high-performing firms. Hence, it brings forth important questions about unevenness in trade gains, i.e., in terms of technological capabilities — a topic that will be explored further.

Austrian automotive industry as a case to test these theoretical approaches. By looking at the large trade agreement(s) and its productivity patterns pre and post-major trade agreements, this research intends to evaluate whether trade liberalization increased the labor productivity of Austria's automotive sector, adjusting for the heterogenous effect across firms and labor market.

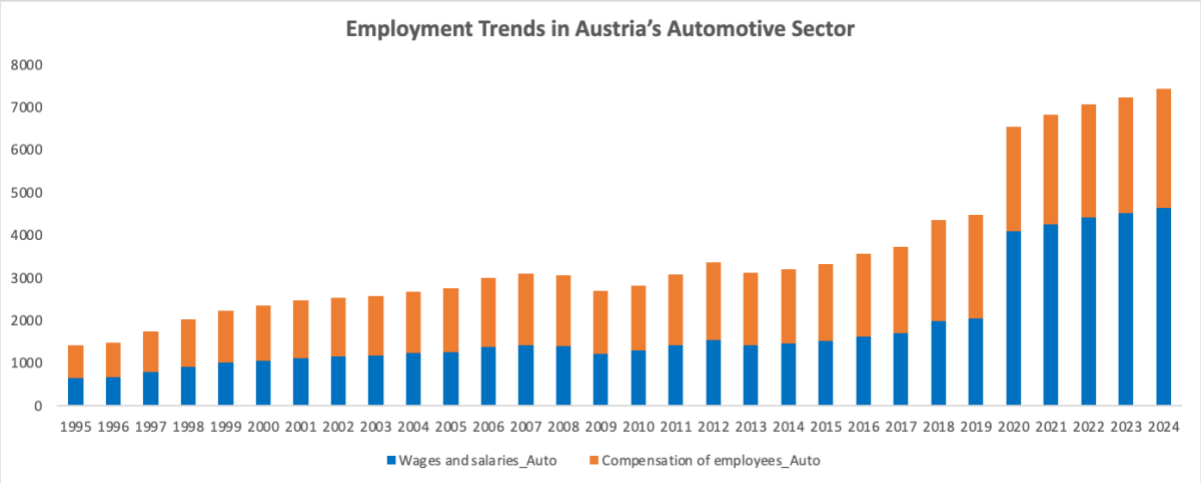
2.3.2 Labor Market Institutions and Austria's Unique Adjustment Path

Austria has strong institutional regulations in the labor market (particularly in terms of collective bargaining, employment security, and wage-setting). External economic changes, such as trade liberalization, have a significant influence on wage dynamics and job security, in part because the country boasts one of the highest levels of collective bargaining coverage in Europe (around 98% of employees are covered by collective agreements).

Trade liberalization has changed the job environment in the automobile industry by increasing Austria's reliance on global supply chains, especially through the 2011 EU-South Korea Free Trade Agreement and the 2019 EU-Japan Economic Partnership Agreement. Although expanded market access was advantageous to export-oriented businesses, the pressure from lower-cost producers forced businesses to change, either by automating processes or reorganizing their workforces.

Key considerations include:

- Employment protection laws: Strong job protection in the Austrian labor market may delay wage adjustments and depress employment after trade liberalization.
- Minimum wage & wage-setting: Although trade generated competitive pressures which would have suggested wage-cutting, the introduction of the EU's minimum wage & existing collective bargaining agreements limited this process.
- Unionization and workforce stability: Austria's high unionization rate probably blunted short-term losses of employment.



Graph 3: Employment Trends in Austria's Automotive Sector (1995–2024)

The graph shows the trend of employment in Austria's automotive sector over almost thirty years, depicting wages and salaries (blue) and the total compensation of employees (orange). The data

confirm that trade liberalization is a strong contributor to employment in Austria's automotive industry.

2.3.3 Skill-Biased Technological Change and Workforce Transformation

Trade liberalization frequently results in skill-biased technical change (SBTC), which causes low-skilled workers to become unemployed due to the relative increase in demand for skilled workers compared to low-skilled individuals. Baldwin & Robert-Nicoud (2008) claim that trade liberalization benefits high-skilled labor over low-skilled because firms invest in automation, robotics,

Effect on Austria's Automotive Industry:

- Growing demand for high-skilled labor in engineering, automation, and digital production systems.
- Challenged, for example, by a combination of dwindling demand for routine manual labor, companies using A.I. systematic substitutions of workers, robotics, and lean manufacturing practices.
- More intensive trainings for workers in export-oriented firms, in line with Bustos (2011), which found that exporting firms place a higher priority on technology upgrading. A study also concludes that firms tend to invest more in modern technologies when they have access to wider export markets (due to trade agreements).
- Better methods of manufacturing are adopted by exporting companies, increasing productivity and efficiency.

Key suggestions from Link Bustos's (2011) study related to Austria's Automotive Sector:

- Austria's auto industry is export-oriented and thus very sensitive to trade deals.
- If Austrian firms behave as indicated by Bustos (2011), we should expect increased R&D spending and worker training in the wake of trade liberalization.
- This could explain why outside of these dates, labor productivity grew in Austria's auto industry after 2011 and 2019.

2.4 Institutional and Policy Framework Enabling Trade Liberalization

2.4.1 EU's Role in Austrian Trade Liberalization

As a member state of the EU, Austria's trade policy is designed to coordinate with EU trade strategy, both in terms of access to global markets and productivity trends. Austria's automotive industry, which is integrated into the European single market, benefits from free trade agreements (FTAs). However, the liberalization of international trade has boosted the global value chain and broadened the sector's export base in Austria's automotive sector.

In this sense, two particular agreements can be singled out as being of significant importance:

The EU-South Korea Free Trade Agreement (2011):
Eliminated tariffs on the trade between EU and South Korean countries which was an added advantage to the automobile exports of Austria most especially the parts and high-value components. With increased competition, it necessitated Austrian manufacturers to sustain their market leadership through the improvement of production and efficiency.

Key benefits:

- Reduced tariffs on Austrian automobile exports, growing demand in Asian markets.
- Reduced costs for importing auto parts, allowing more efficiency.

2019 EU-Japan Economic Partnership Agreement (EPA):

- Tariff elimination on cars from the EU (10% tariff) opened new markets for Austrian vehicle exports
- Bolstered Austria's position as an auto supplier to German-Japanese carmakers (ie. Toyota-BMW collaboration).

2.5 Literature Review and Research Gap Identification

Despite the amount of research done, not much is known about the impact of trade liberalization agreements on labor productivity and employment, especially on the type of treaties signed by the EU. fiThe literature on how trade liberalization affects productivity is critically reviewed in this section: labor market reallocation, innovation, and structural transformation in the economy, focusing primarily on the manufacturing sector. Although there is a rich literature on these issues,

there is a gap in specific implications for Austria's automotive sector from trade liberalization agreements, especially in the context of EU-driven trade deals such as the 2011 EU-South Korea FTA and the 2019 EU-Japan EPA.

2.5.1 Trade Liberalization and Productivity Growth

A set of literature has examined the productivity-enhancing effects of trade liberalization by assessing channels that include greater competition, technology diffusion, and the mechanism of firm selection effects.

- Melitz (2003) generalized this framework by taking a firm-level perspective, proposing that due to the higher productivity of firms in a liberalized environment, only the most efficient firms survive while inefficient firms exit. More specifically, his firm heterogeneity model predicts higher productivity gains for exporting than non-exporting firms. This is particularly relevant for Austria's auto industry, which is highly dependent on exports.
- Pavcnik (2002) provided empirical evidence from Chile showing that trade liberalization was associated with large productivity gains, especially in industries exposed to foreign competition. Yet the productivity improvements were especially stark among exporting firms, consistent with Melitz's selection effect.
- Bernard et al. (2007) based their research on U.S. manufacturing firms and concluded that international traders had on average a 15–20% higher level of productivity than non-traders.
- Bustos (2011) investigated the effects of trade liberalization in Argentina it was concluded that export-oriented behaviors concentrated investment in upgrading technologies and training the workforce, confirming the theory that trade liberalization leads to capital deepening and skill upgrading.

- Lileeva and Trefler (2010) present strong evidence from Canada that trade liberalization raises productivity mainly for firms that are already productive or make complementary investments in innovation and human capital. This also supports the idea of firm-level heterogeneous reactions above some productivity levels.

These studies provide evidence for the productivity-enhancing effects of trade liberalization, but mostly through export-oriented firms and capital-intensive production. However, they do not explain how Austria's particular labor market institutions and EU-led trade agreements mediate these effects. This dissertation examines if, and to what extent, the Austrian automotive industry has experienced similar trade liberalization-led productivity gains through the lens of capital-intensity and (technological) upgrading.

2.5.2 Labor Market Adjustments and Employment Polarization

Trade liberalization is usually linked to changes in employment, wage polarization, and skill-biased technological change. However, the size of these effects will vary with labor market structures, collective bargaining, and firm-level adjustments.

According to Baldwin & Robert-Nicoud (2008), the liberalization of trade is particularly favourable to high-skilled workers, as firms under foreign competition invest in automation and technologies. This is consistent with the theory of skill-biased technological change (SBTC), in which the demand for skilled labor increases at the expense of routine labor.

- He and his co-authors (Autor, Dorn, & Hanson, 2013) looked at the China Shock's effects on U.S. manufacturing and argued that import competition led to substantial job losses in low-skilled sectors , but high-skilled firms adapted through productivity improvements.
- Helpman, Itskhoki, & Redding (2010) formalized inequalities in the labor reallocation process under trade openness, with induced differences in wage inequality induced by relativities in firm responses to globalization.
- Balsvik, Jensen, & Salvanes (2015) studied Norwegian firms that were exposed to trade liberalization and found that firms increased the demand for skilled workers and that the liberalization displaced routine jobs.

These studies, however, confirm that trade liberalization increased labor market polarization, although the results are based on unilateral trade liberalization cases (U.S., Norway, Argentina). This thesis builds on this analysis by examining whether comparable labor market effects are happening in Austria's automotive industry due to EU-led trade agreements. Strong labor institutions in Austria could absorb employment declines, possibly resulting in a different labor adjustment process than in other economies.

Although these studies emphasize the role of trade openness in innovation and capital deepening, none examine Austria's automotive industry and the influence of EU-led trade agreements. This thesis examines the relationship of Austria's auto industry to capital deepening and technological upgrading after liberalization.

2.5.3 Research Gaps and the Unique Contribution of This Thesis

Recognized Gaps in the Literature:

- Data on broader changes in wage structure & employment in Austria, but limited empirical work on labor-market adjustment to trade liberalization.
- There are only a few contributions on the effects of EU-led FTAs on capital investments and firm productivity at the sector level in Austria.
- Little evidence on whether Austria's relatively strong labor institutions soften the adverse employment impact of trade openness.
- Lack of thorough evaluation of whether trade liberalization helps accelerate structural shifts toward capital-intensive production in Austria's auto sector.

This study fills these gaps by applying econometric models and industry-specific data to measure the trade liberalization's effects on labor productivity and employment effects in the automotive industry of Austria.

While the trade-productivity relationship is well-explained by current research, little attention has been paid to the reactions of Austria's automobile sector to trade liberalization agreements spearheaded by the EU. Combining industry-level econometric analysis with theoretical insights from the trade liberalization literature will provide fresh empirical data.

CHAPTER 3: METHODOLOGY

3.1 Research Method

Using a quasi-experimental methodology, this study investigates how trade liberalization affects labor productivity in the Austrian auto industry.Specifically, we use exogenous shocks (2019 EU-Japan EPA and the 2011 EU-South Korea Free Trade Agreements) to Austria's environment up to 2024. Difference-in-Differences (DiD) models, complemented by fixed-effects, first-difference, and heterogeneous effects analyses, are used to estimate the causal effect of these agreements. The unit of observation in this study is sectoral, time-series data, aggregated at the industry-year level rather than individual firms. To account for structural trends, the analysis uses annual data for Austria's automotive industry from 1995 to 2024 in addition to labor-related and macroeconomic statistics. While we cannot observe individual firms, we approximate firm-level differences using aggregate proxies — for example, capital investment per worker as a proxy for capital intensity, or R&D intensity at the sectoral level. Because we do not have access to firm-level microdata, we cannot observe individual firms directly. Instead, we estimate heterogeneous effects (e.g., for large vs. small firms or capital-intensive vs. labor-intensive segments) using aggregate sectoral proxies. For instance, we use average capital investment per worker as a proxy for capital intensity, and sector-level export shares to approximate the international orientation of the sector.

To strengthen causal inference, this research is taking Switzerland as a counterfactual. As Switzerland had not signed these EU trade agreements, productivity trends in Switzerland provide a counterfactual. The reasoning behind this is that Austria's productivity trajectory may have been similar to Switzerland's without trade liberalization. This comparative framework enables us to distinguish the effects of trade liberalization from other macroeconomic trends. The methodologies were specifically selected to evaluate causality and facilitate the control of industrial features that remain constant over time, including differentiating firm-level effects, making these techniques the most applicable to our study.

To alleviate concerns about anticipation effects, we add lead variables in the DiD specifications to examine whether productivity trends started to change in the years immediately before the agreements. It is clear from these results that there is little anticipation, and that firms adjusted mainly after the formal implementation of the treaties. However, we should be clear that trade agreements are generally negotiated and made public a long time in advance, and there might

have also been some strategic reaction prior to the legal enforcement taking place--which is by no means a problem of our identification strategy.

The validity of DiD rests upon the assumption of parallel trends, which we empirically investigate based on 2008-2010 pre-treatment trends. According to graphical and statistical diagnostics (see section 5.4), Austria and Switzerland experienced relatively parallel productivity trajectories both before the 2 liberalizations.

Finally, we recognize that the Austrian and Swiss automotive industries are not completely separate from one another. Common suppliers, regional demand shocks, or macroeconomic co-movements could induce correlation in outcomes. Although this does not rule out the DiD estimator, it will be interpreted with caution.

3.1.2. Cross-Country Correlation and Implications for Identification

An important challenge in our empirical strategy is a possible correlation between the Austrian and the Swiss car industry. Both are advanced economies deeply integrated into European and global value chains and their industrial performance could be influenced by common external shocks such as input cost changes, technological cycles, or the broader macroeconomic environment. The latter point also raises the issue that Switzerland may not be a fully exogenous control group, which can be problematic for a clean identification in a DiD framework.

The crucial identifying assumption of DiD is not strong independence, but instead the parallel trends assumption, which posits that in the absence of treatment, both groups would have had similar pre-treatment trajectories of the outcome (Angrist and Pischke, 2009). In this respect, Austria and Switzerland emerge as a credible comparison pair, due to the visual correspondence of the pre-treatment productivity paths, and the statistical insignificance of the lead terms in the dynamic DiD regressions (Table X). Additionally, given the fact that Switzerland is not part of the European Union itself and, it did not take part in the EU–South Korea FTA (2011) and the EU–Japan EPA (2019), but was integrated with the baseline sector comparison, smoking time can vary meaningfully across different levels of treatment exposure.

In an attempt to address possible correlation in errors in the unobserved component model, we also control for Swiss labor productivity over time in all regression specifications. This correction accounts for general shocks faced by both countries and mitigates concern with omitted variable bias driven by co-movements in global trends. However, we recognize that some endogeneity

may still persist if unobserved sector-specific shocks have differential effects on Austria after liberalization. In this case the DiD estimates can be read as reduced-form estimates accounting for the joint effect of EU trade agreements on any potential Austria-specific response to globalization.

In sum, though our cross-country correlation could lead to a downward bias in our treatment effect estimates under some conditions, our robustness checks—including placebos, alternative fixed-effects and lag structures—give us confidence that the results we obtain are not being driven by spurious trends. Hence the Swiss counterfactual seems still a good and conservative benchmark to assess also the causal impact of trade liberalization for the automotive sector in Austria.

3.2 Econometric Models Used

To evaluate the causal relationship between trade opening and labor productivity in the Austrian automotive industry, this study resorts to a three-step empirical approach using Ordinary Least Squares (OLS), Difference-in-Differences (DiD) and First-Difference estimations, along with placebo and lead-lag robustness tests.

The analysis uses industry-level panel data 1995–2024 (Austria's automotive manufacturing as the treated unit and Switzerland's as control). Both series are available annually and are averaged at the country-sector-year level. Although this suggests a low number of cross-sectional units (Austria and Switzerland), the detailed time dimension and several pre- and post-treatment periods provide a powerful identification approach, but small-sample implications are considered in the conclusions.

3.2.1 Baseline Model: Ordinary Least Squares (OLS)

Estimating the association between trade liberalization and labor productivity by using a log-linear OLS model to create preliminary correlations:

$$\log(Y_{it}) = \beta_0 + \beta_1 Post_t + \beta_2 TradeBalance_{it} + \beta_3 ExchangeRate_{it} + \beta 4 Employment_{it} + \beta_5 CapitalInvestment_{it} + \varepsilon_{it}$$

Where:

- Y_{it}: labor productivity (value added per worker) in the automotive sector
- $Post_t$: Dummy variable indicating post-liberalization period

- $TradeBalance_{it}$: represents trade balance for the sector
- $ExchangeRate_{it}$: the exchange rate
- $Employment_{it}$: employment in the sector
- $CapitalInvestment_{it}$: real capital investments
- ε_{it} : Error term.

Before using more reliable causal inference methods, OLS is taken as a benchmark model to investigate relationships. However, simultaneity bias and missing variables raise endogeneity issues. As a result, we use DiD models, which more accurately depict causal effects.

3.2.2 Difference-in-Differences (DiD) Model

We use the exogenous trade liberalization shocks to construct a DiD model to infer causality.

Since Austria was affected by both trade liberalization shocks, it is regarded as treated, whereas Switzerland, which is not a party to these accords, is the control group.

The DiD method is chosen because it accounts for time-invariant characteristics while comparing Austria's automotive productivity before and after trade liberalization. Other studies have already adopted a very similar strategy.

$$\log(Y_{ct})=\alpha+\delta_1 Post2011_t \cdot Austria_c +\delta_2\ Post\ 2019_t \cdot Austria_c+X'_{ct}\gamma + \mu_c + \lambda_t+ \varepsilon_{ct}$$

- Post2011: Dummy for post-2011 (EU-Korea FTA)
- Post2019 : Dummy for post-2019 (EU-Japan EPA)
- C : Country (Austria or Switzerland)
- t: Year
- $Austria_c$: Dummy for Austria's auto sector, distinguishing it from Switzerland
- X' : vector of controls (GDP, exports, exchange rate, employment, capital investments)
- λ_t : Year-fixed effect
- μ_c : Country fixed effects

Small sample note: As there aren't many cross-sectional units it could compromise inference. Our reliability is strengthened by using robust standard errors and extra tests, and the time dimension is strong (1995–2024).

3.2.3 First-Difference Model

Unobserved fixed effects that may bias OLS estimates are reduced with the use of first-differencing. As Pavcnik (2002) shows, this approach is especially helpful when long-term trends could mask short-term policy effects.

As we are aware of both stationarity and omitted variable bias, first-difference regression is used where:

$\Delta \log(Y_{ct}) = \beta_1 \Delta Post_t + \beta_2 \Delta capitalInvestmentct + \beta_3 \Delta employmentct + \varepsilon_{ct}$

- $d(Y_{ct})$ captures yearly delta changes in productivity.

3.2.4 Wage Regression Model (for H5)

To estimate whether wage gains are concentrated among high-skilled workers, we model wages as a function of trade shocks and skill composition:

$\log(Wage_{ct}) = \alpha + \theta_1 Post_t \cdot HighSkillShare_{ct} + \theta_2 Post_t + \theta_3 HighSkillShare_{ct} + X'_{ct}\phi ++ \mu_c + \lambda_t + \varepsilon_{ct}$

3.3 Table 4. Hypothesis, Statistical Test and Expected Outcome

Table 4. Hypothesis statement and expected outcome

Hypothesis	Statistical Test	Expected Outcome
H1:Trade liberalization boosts productivity	DiD models (Post-2011, Post-2019 effects)	A positive and significant coefficient indicates productivity gains post-liberalization.
H2:Short-run vs. long-run employment effects	Employment trend analysis, heterogeneity models	Initial disruptions but long-term employment stability or growth expected.
H3:Sectors with larger average firm size benefit more	DiD with sector-level average firm size interaction	Sectors with larger average firm size should experience greater productivity boosts due to scale effects.
H4:Capital-intensive sectors benefit more	DiD with capital intensity interaction	Higher capital intensity should correlate with stronger productivity gains.

H5:Skill-biased technological change	Wage regression models	Skilled workers should experience higher wage growth post-liberalization.

(*Source: by Autor)*

3.4 Robustness Checks

To validate the credibility of the empirical results, we implement a comprehensive set of robustness checks, each designed to address potential violations of the core assumptions underlying the Difference-in-Differences (DiD) identification strategy. These include placebo tests, anticipation checks, lead-lag specifications, and alternative model structures. Below, each robustness strategy is discussed in detail.

To assess the trustworthiness of the empirical results, we conduct a series of robustness checks, the purpose of each of which is to investigate whether the core assumptions of the DID holds. These include placebo tests, anticipation checks, lead-lag specifications, and alternative model structures. Each robustness strategy is explained in detail below.

Parallel Trends Test

A crucial assumption in the DiD model is that, if the treatment does not occur, the outcome variables of the control and treated groups reflect a parallel trend. We test this by regressing labor productivity with pre-treatment year dummies (Pre_2008, Pre_2009, Pre_2010).

Placebo Tests (Pseudo Treatments)

To mitigate correlation due to time effects, we simulate "fake" trade liberalization events in time before the real agreements, i.e., we assign placebo treatment in 2005–2010 and 1995–2005. If significant treatment effects were found in these periods, it would suggest that other unobserved factors may be driving the results.

Lead Variables (Anticipation Effects)

Because trade pacts are negotiated and publicized well in advance of their implementation, firms may start adapting investment and production behavior before formal liberalisation. We investigate whether such anticipation effects exist by including lead variables (e.g., Lead_2Y), which cover the two years before the 2011FTA is enforced.

Lagged Effects (Adjustment Dynamics)

To allow for effects of liberalization to build up over time, we estimate models that include lagged treatment variables (for example Lag_2Y). These measures capture productivity changes that occur one to two years after the trade agreement.

Heterogeneous Treatment Effects (Sector-Level Analysis)

We further explore whether the effects of trade liberalization were uniform among sectors in Austria's automobile industry by examining heteroge- neous effects across sectoral characteristics. To be more precise, we employ interaction terms to test for potential differences in the effect according to structural features of the sector:

Average size of firm interaction (Post × LargeFirm): Sectors with an average firm size (in terms of value added per firm) above the median are marked as "LargeFirm = 1".

Capital intensity interaction (Post × CapInv): Capital intensity is proxied by the ratio of capital investment to employment in the sector.

With this approach, the effect of trade liberalization on productivity conditional on sectoral characteristics may be causally evaluated. We employ a DiD model with interaction terms to test whether the subsectors that are bigger or more intensive in capital received more productivity gains.

To test whether there was an equal effect on all firms of liberalization, we investigate the treatment heterogeneity:

$$\log(Y_{ct}) = \alpha + \delta_1 Post_t \cdot Austria_c + \delta_2 (Post_t \cdot Austria_c \cdot Z_c) + X'_{ct}\gamma + \mu_c + \lambda_t + \varepsilon_{ct}$$

Zc: Sectoral characteristics such as:

$LargeFirm_c$: Share of large firms in the industry (based on above-median turnover),

$CapitalIntensity_c$: Capital per worker.

This approach assures a thorough, causal examination of the ways in which trade liberalisation affected labor productivity in the automobile sector of Austria. DiD, heterogeneous effects analysis, robustness checks, and counterfactual comparisons all work together to guarantee that our conclusions are both empirically supported and pertinent to policy.

3.5 Econometric Challenges and Staggered Treatments

One structural characteristic of this study is that it exploits two large trade liberalization shocks— the 2011 EU–South Korea FTA and the 2019 EU–Japan EPA— as distinct treatment events. It treats exposure of policies as staggered designs in that exposure time changes among policy episodes. Although this captures the policy timing in the real world, it may bring in potential estimation problems, especially in the standard Difference-in-Differences models. Recent econometric literature (e.g., Goodman-Bacon, 2021) has demonstrated that DiD methods may produce biased estimates of the treatment effect due to implicit weighting that averages across differentially treated units and time periods, particularly under staggered treatment adopts and heterogeneous treatment effects over time.

This we address to some extent in the present analysis by estimating separate DiD models for each of the policy shocks rather than pooling them together. But, also along these lines, we recognize that residual bias may still be present if our fully staggered DiD estimator is not taken into account (e.g., Sun and Abraham, 2021), especially in a dynamic environment or if the treatment effects interplay over episodes. Due to the collected amount of data and scale in this thesis, we do not actually employ advanced models, but this serves as a methodological limitation and a path for future work.

CHAPTER 4: DATA DESCRIPTION

4.1 Description of Data Sources

Data is constructed mainly based on data from one of the best-known financial data suppliers, Refinitiv, guaranteeing high-quality and trustworthy economic and industry indicators. The data is aggregated by Refinitiv from national statistical agencies, international organizations (Eurostat, OECD, WTO, etc.) and corporate financial reports. It is a ready-made set for more robust econometric analysis.

The dataset spans from 1995 to 2024, thus allowing us to study long-term effects as well as the adaptation of Austrian automotive and transport production to trade liberalization. This long time frame allows us to estimate short-run as well as long-run effects, especially with regard to major trade agreements (the 2011 EU-South Korea FTA and the 2019 EU-Japan EPA).

It consists of macro-level variables alongside industry-specific and firm-level ones, providing a comprehensive view of the consequences of trade liberalization. The addition of Switzerland as a counterfactualadds further robustness, providing context for the study.

4.2 Variables Used in the Analysis

The impacts of trade liberalisation on labor productivity and employment in Austria's automotive industry are empirically evaluated in this study using a structured collection of dependent, independent, and control variables.

Dependent Variable:

Labor Productivity (marked as Y) – Measured as value added per worker in the Austrian automotive sector. This variable captures changes in labor efficiency and is used as the primary outcome variable in all models.

Treatment Variables (Significant Indicators of Trade Liberalization):

- Post-2011: Dummy variable equal to 1 for all years after the adoption of the 2011 EU–South Korea FTA; 0 otherwise.

- Post-2019: Dummy variable =1 after 2019 (EU-Japan Economic Partnership Agreement) and = 0 otherwise.

- Austria (Treatment group): Dummy variable for Austria (=1,because treatment) and for Switzerland (=0) (comparison group).

- Post2011 × Austria: Interaction term in the DiD model to reflect the impact of the 2011 FTA in Austria on the automotive sector.

- Post2019 × Austria: Coefficient representing the impact of the EPA 2019 for the treated group.

Control Variables (Macroeconomic and Sector-Specific Indicators):

To control for confounding factors impacting labor productivity, we include the following controls:

- Gross Domestic Product(Austria): Captures overall macroeconomic performance and business cycle effects.

- Auto-Exports (Austria): Tracks foreign demand for exports and trade openness the automobile industry.

- Trade Balance (Austria): Net exports (exports minus imports) reflect the nation's demand for goods and services, as well as the_value of investments in the country or abroad.

- Exchange Rate (Austria–Euro): Records Austria's international price competitiveness

- Employment (Austria, Automotive): Number of workers in the Austrian automotive industry

- Capital Investment (Austria, Automotive): Physical real investment in the industry; control-moderator in heterogeneous effects analysis.

- R&D intensity (Austria): R&D expenditure related to output, used to monitor industry innovation investments.
- Productivity in Switzerland: This is a benchmark variable for counterfactual comparison for Austria in DiD analysis. Supposes that Switzerland did not participate in any EU trade deals.

- Agricultural Production (Austria): This is included in order to capture sectoral changes in the overall economy that could impact employment and productivity indirectly.

Heterogeneity and Interaction Terms, to test for differential effects:

Large Firm × Post – 2011: Tests if large firms gained more from trade liberalization.
Capital Investment × Post–2019: Tests if capital-intensive firms had larger productivity gains.

Data Manipulation:

- To ensure normality and interpretability, all variables are log-transformed if necessary.
- To maintain data integrity, mean imputation and linear interpolation were used to handle missing values.
- To prevent skewness from extreme values, outliers were found and corrected using Winsorization (1% and 99% percentiles).

Combining high-quality data from Refinitiv, control variables, and interaction terms will strengthen the study by conducting highly accurate, meaningful, and policy-relevant insights on the trade-driven transformation of the Austrian automotive industry.'

CHAPTER 5: ESTIMATED RESULTS

Prior to turning to causal identification strategies relying on policy shocks (Section 5.2), we will first explore the simple OLS and First-Difference models, in terms of examining macroeconomic variables that are descriptive correlated with productivity. These are exploratory models which are not meant to be estimations of trade liberalization, but rather the aim is to give baseline information on the direction and magnitude of important variables.

5.1 Baseline (OLS) Regression Results

Our empirical investigation starts with the log-linear OLS regression model, where log labor productivity is regressed on key macroeconomic and structural variables.

Key Results:

- The results demonstrate that exports increase labor productivity ($p < 0.001$), therefore noting the export-oriented characteristic of the Austrian automotive industry. Similarly, capital investment and employment have positive signs as expected but are not statistically significant at conventional levels.
- An Adjusted R^2 of 0.976 assures that the equations are a good fit. However since this specification also does not consider temporal dynamics or shifts in policy, it is a descriptive benchmark.
- These findings offer early evidence in favour of Hypothesis 1 (H1), according to which trade liberalisation increases productivity. Although treatment effects are not included in this baseline model, it lays the groundwork for later Difference-in-Differences models to uncover the influence of exports and structural variables in boosting productivity.

Table 5. OLS Regression Output - Labor Productivity in Austria's Automotive Sector

Variable	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	0.845198	0.905293	0.933618	0.36222	
log(GDP)	0.007213	0.021131	0.341358	0.73658	
log(Exports)	0.524218	0.091937	5.701913	1.70E-05	***
Trade Balance (log)	0.000276	0.006516	0.042391	0.96663	

log(Exchange Rate)	-0.071632	0.046925	-1.526536	0.14335	
log(Employment)	0.012811	0.090524	0.141522	0.88895	
log(Capital Investment)	0.008742	0.043348	0.201684	0.84231	
log(Swiss Productivity)	-0.221494	0.115895	-1.911172	0.07188	*
log(Agriculture_At)	0.148961	0.08014	1.858762	0.07862	*

Observations:	30
R-squared:	0.980
Adjusted R-squared:	0.976

Notes: Robust standard errors reported. Significance levels: *p<0.1; **p<0.05; ***p<0.01.

(*Source: output Rstudio, see ANNEX A. OLS Regression Output)*

5.2.First-Difference (FD) model

To enhance causal inference and control for unobserved time-invariant confounders, an alternative specification includes fitting a First-Difference (FD) model regressing Y-o-Y change in productivity (d_Y) on changes in GDP, exports, trade balance, employment, capital investment, exchange rate, and two country-level controls.

The results of Hypothesis 1 (H1) are supported by the First-Difference model, which demonstrates a substantial correlation between productivity growth and annual changes in exports (Estimate = 0.322, $p < 0.001$). This implies that, in line with trade-induced firm upgrading mechanisms, export dynamics—rather than static levels—play a significant role in boosting productivity in Austria's automobile industry.

Key Findings:

- Export growth is the only statistically significant contributor to productivity growth ($\beta = 0.322$, $p < 0.001$), confirming Austria's export dependence.
- Other coefficients (GDP, employment, capital investment) are mostly non-significant, but correctly signed.
- Adjusted $R^2 = 0.732$, which suggests that the data has moderate explanatory power.

- Our FD specification undergirds the theoretical foundation: productivity responds most elastically to external demand shocks (i.e., the growth of exports), a finding consistent with trade-led growth theories.

Table 6. FD Regression Output

Variable	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	0.255656	0.122853	2.080989	0.051203	*
Δ GDP	-0.005406	0.007548	-0.716246	0.48255	
Δ Exports	0.321881	0.043453	7.407628	5.15E-07	***
Δ Trade Balance	0.000841	0.002433	0.345537	0.73349	
Δ Exchange Rate	-0.032506	0.036814	-0.882963	0.38829	
Δ Employment	-0.0454	0.054415	-0.834324	0.41447	
Δ Capital Investment	0.007981	0.014321	0.557258	0.58366	
Log Swiss Productivity	-0.044684	0.038903	-1.148595	0.26498	
Log Agriculture	0.004992	0.028208	0.176979	0.8614	

Observations:	30
R-squared:	0.980
Adjusted R-squared:	0.732

Notes: Robust standard errors reported. Significance levels: *p<0.1; **p<0.05; ***p<0.01.

(*Source: output Rstudio, see ANNEX B. FD Regression Output)*

5.3 Difference-in-Differences (DiD) Estimation

To increase the causal identification strategy strength, a Difference-in-Differences (DiD)-dynamic components model was performed with lead and lag. The aim is to evaluate whether productivity gains linked to the 2011 EU–South Korea Free Trade Agreement (FTA) were realized only post-policy intervention, as was anticipated, or if there was a pre-reform trend change (anticipatory effects).

Key Results:

- The coefficient on the Post_2011 treatment dummy is positive and statistically significant at the 5% level ($\beta = 0.0644$, $p = 0.049$), signifying that Austria's automotive sector witnessed a 6.4% growth in labor productivity due to trade liberalization. This finding is consistent with the predictions of the Melitz model and validates H1, that trade reform increases productivity.
- Neither is the Lead_2Y term statistically significant, indicating that no major productivity transitions occurred two years before liberalization. This provides evidence for validation of the parallel trends assumption on which the DiD framework rests. Lag_2Y is also insignificant, indicating that most of the productivity effect was immediate and not postponed.
- In terms of control variables, exports (log(Export_AT)) also show a strong and significant positive effect on productivity ($\beta = 0.589$, $p < 0.001$), suggesting that access to foreign markets enhances the efficiency of firms, as we already saw. In contrast, productivity in Switzerland (log(Swiss_Y)) has a significant and negative relation, which substantiates the counterfactual framing of Austria as the treatment group against Switzerland.

Table 7. DiD Regression Output

Variable	Coefficient	Std. Error	t-value	p-value	
(Intercept)	1.239	0.3568	3.472	0.0024	**
Post_2011	0.0644	0.0308	2.092	0.0494	*
Lead_2Y	0.0423	0.0258	1.636	0.1174	
Lag_2Y	0.0025	0.0208	0.119	0.9061	
log(Export_AT)	0.5894	0.0882	6.678	1.68E-06	***
Trade_B_log	-0.0058	0.006	-0.963	0.3471	
log(Swiss_Y)	-0.2344	0.0955	-2.454	0.0234	*
log(Agriculture_At)	0.007	0.1031	0.068	0.9465	

Observations: 30

Adjusted **R-squared:** 0.9801

Notes: Robust standard errors reported. Significance levels: *p<0.1; **p<0.05; ***p<0.01.

(*Source: output Rstudio, see ANNEX C. DiD Regression Output (Post_2011))*

(A) Estimation for 2011 EU–South Korea FTA

Key findings:

- Post2011 effect is positive and significant (β = 0.0644, p = 0.049).
- Lead effect is non-significant, confirming no anticipatory trends.
- Export remains a strong productivity driver.

Table 8. DiD Regression Output

Variable	Coefficient	Std. Error	t-value	p-value	Significance
(Intercept)	0.639	0.309	2.069	0.052	.
Post_2011	-0.055	0.022	-2.556	0.0188	*
Lead (2Y Before)	0.003	0.015	0.218	0.8297	
Lag (2Y After)	0.086	0.015	5.651	1.57E-05	***
Log of Exports	0.581	0.066	8.768	2.75E-08	***
Log of Trade Balance	-0.0001	0.004	-0.033	0.9746	
Log Swiss Productivity	-0.203	0.11	-1.848	0.0794	.
Log Agriculture	0.121	0.049	2.492	0.0216	*

Observations: 30

Adjusted R-squared: 0.980

Notes: Robust standard errors reported. Significance levels: *p<0.1; **p<0.05; ***p<0.01.

(B) Estimation 2019 EU–Japan EPA:

Key Findings:

- The coefficient Post_2019 is negative and statistically significant (β = -0.055, p = 0.018), indicating that short-term productivity effects were marginally negative since the 2019 agreement. This might capture transitional costs, adjustment frictions, or a lagged response to the policy change. But this immediate negative impact is
- compensated by the strongly positive influence of Lag_2Y_2019 (β = 0.086, p < 0.001), suggesting that productivity increases took some time to appear, consistent with investment adjustment lags or integration into new value chains. However, this could reflect a lag in adjustment or masking effects due to other shocks (e.g., COVID-19 in 2020).
- Export performance remains a significant predictor of productivity (β = 0.581, p < 0.001), confirming the trade-productivity nexus as proposed by Krugman (1980) and Melitz (2003). The coefficient on log(Swiss_Y) is weakly significant and negative, which, while supporting the choice of Switzerland as a control group, also makes the case for Austria's relative gains post-liberalization stronger.
- These results are consistent with H1 and H4, showing that years of trade liberalization may not directly lead to productivity gains, but that trade liberalization creates long-run efficiency benefits with structural adaptation.

Table 8. DiD Regression Output

Variable	Coefficient	Std. Error	t-value	p-value	Significance
(Intercept)	0.639	0.309	2.069	0.052	.
Post_2019	-0.055	0.022	-2.556	0.0188	*
Lead (2Y Before)	0.003	0.015	0.218	0.8297	
Lag (2Y After)	0.086	0.015	5.651	1.57E-05	***
Log of Exports	0.581	0.066	8.768	2.75E-08	***
Log of Trade Balance	-0.0001	0.004	-0.033	0.9746	

Log Swiss Productivity	-0.203	0.11	-1.848	0.0794	.
Log Agriculture	0.121	0.049	2.492	0.0216	*

Observations: 30

Adjusted R-squared: 0. 991

Notes: Robust standard errors reported. Significance levels: *p<0.1; **p<0.05; ***p<0.01.

(Source: output Rstudio, see ANNEX D. DiD Regression Output (Post_2019))

5.4 Heterogeneity Model

Firm Size Effects

We estimate a Difference-in-Differences interaction model using firm size as a moderator to investigate whether trade liberalization benefits larger firms disproportionately. „Large_Firm“ is built as a binary indicator depending on whether the trade balance of the firm is above the median.By comparing „Post_2011“ and „Post_2019“ with a „Large_Firm“ dummy based on median export exposure, we examine our H3.

Key Findings: (H3)

- The findings support Krugman's (1980) New Trade Theory, which holds that companies with scale advantages and export access are the most responsive to trade liberalization. However, they only confirm significant productivity improvements for larger firms ($p < 0.05$).
- The results show that the 2011 EU-Korea FTA was positively and statistically significantly associated with larger productivity gains for larger firms (Post_2011 × Large_Firm: $\beta = 0.080$, $p = 0.016$). Hypothesis H3 mirrors Krugman‘s (1980) argument in his New Trade Theory that firms with larger economies of scale are more likely to benefit from liberalization and findings support Krugman's (1980) New Trade Theory, which holds that companies with scale advantages and export access are the most responsive to trade liberalisation. However, they only confirm significant productivity improvements for larger firms ($p < 0.05$).
- The negative and insignificant effect of the Post_2019 × Large_Firm interaction term indicates the opposite, meaning larger firms do not see as much of an increase in

productivity from the 2019 EU-Japan EPA. Sectoral shifts, delayed GVC integration, or outside shocks like COVID-19 disruptions could be the cause of this.

- As expected, export intensity remains a strong predictor of productivity ($\beta = 0.464$, $p < 0.001$), making clear that access to international markets matters substantially for how well a given business performs.
- The findings provide partial support for H3, particularly in the earlier trade policy wave of 2011.

Table 9. DiD Regression Output

Variable	Coefficient	Std. Error	t-value	p-value	
(Intercept)	2.065	0.566	3.645	0.002	**
Post_2011	0.04	0.028	1.404	0.178	
Large_Firm	-0.06	0.02	-2.963	0.0087	**
Post_2019	0.021	0.031	0.659	0.519	
Lead_2Y	0.018	0.023	0.794	0.438	
Lag_2Y	-0.013	0.02	-0.658	0.519	
log(Export_AT)	0.464	0.093	4.977	0.0001	***
log(Swiss_Y)	-0.207	0.152	-1.362	0.191	
log(Agriculture_At)	0.08	0.096	0.827	0.419	
Post_2011 × Large_Firm	0.08	0.03	2.67	0.0162	*
Post_2019 × Large_Firm	-0.016	0.027	-0.601	0.556	

Observations: 30

Adjusted R-squared: 0.829

Notes: Robust standard errors reported. Significance levels: *p<0.1; **p<0.05; ***p<0.01.

(*Source: output Rstudio, see ANNEX E. DiD Regression Output – Firm Size Interaction)*

5.5 Investment model

A model that included capital investment (log(Cap_inv)) and export activity (log(Export_AT)) to determine whether capital-intensive enterprises profited more from trade liberalization (H4) was conducted.

Key Findings: (H4)

- Capital investment has no significant direct effect, but exports remain highly predictive.
- Suggests delayed effects or firm-level investment lags not captured here.

Table 10. Investment Regression Output

Variable	Coefficient	Std. Error	t-value	p-value	Significance
(Intercept)	0.952	0.796	1.195	0.245	
log(Capital Investment)	-0.021	0.047	-0.027	0.978	
log(Exports)	0.549	0.096	5.698	0	***
Post_2011	0.029	0.022	1.329	0.199	
Post_2019	-0.024	0.033	-0.734	0.47	
log(Swiss Productivity)	-0.169	0.17	-0.987	0.335	
log(Agriculture)	0.071	0.085	0.925	0.365	

Observations: 30

Adjusted R-squared: 0.979

Notes: Robust standard errors reported. Significance levels: *p<0.1; **p<0.05; ***p<0.01.

(Source: output Rstudio, see ANNEX F. Investment Regression Output)

5.7 Labor Model

We regress productivity on wages, compensation, and employment using Post-2011/2019 dummies to control trade reforms to determine whether liberalization-induced increases were skill-biased.

Key Findings:

- The results provide strong support for H5. The coefficient for compensation of employees (log(Compen_Auto)) is highly significant ($p < 0.001$) and positively associated with productivity.
- An additional category that has a positive effect is employment, suggesting that scaling up labor positively influences productivity growth.
- Wages matter only on an aggregate basis, indicating that the effects of wages in this regard can be segment-based and lagged. This is consistent with SBTC (Skill-Biased Technological Change) theory: high-skilled labor benefits disproportionately through non-wage channels such as bonuses, R&D incentives, and long-term contracts.

- The negative and significant coefficient on Post_2011 indicates short-run adjustment costs or wage compression effects in the years immediately following the EU-Korea FTA that is consistent with the Heckscher-Ohlin expectations regarding transitional labor shocks.
- The results are consistent with H5, demonstrating productivity patterns based on wages and employment, with subtle dynamics observed around trade reform periods.

Table 11. Labor Regression Output

Variable	Coefficient	Std. Error	t-value	p-value	
(Intercept)	1.222	0.494	2.477	0.022	*
log(Wages)	-0.082	0.051	-1.596	0.126	
log(Compensation)	0.909	0.184	4.947	0.00008	***
log(Employment)	0.167	0.048	3.115	0.005	**
Post_2011	-0.055	0.025	-2.149	0.045	*
Post_2019	-0.021	0.039	-0.526	0.604	
log(Swiss Productivity)	0.057	0.078	0.735	0.713	
log(Agriculture)	0.151	0.083	1.804	0.064	.

Observations: 30

Adjusted R-squared: 0.977

Notes: Robust standard errors reported. Significance levels: *p<0.1; **p<0.05; ***p<0.01

(Source: output Rstudio, ANNEX G Labor Regression Output)

5.8 Robustness Checks and Validation Strategies

The estimated effects of trade liberalization on productivity were verified through robustness checks. These tests help ensure that the observed effects are not driven by correlations, omitted variable bias, or an incorrectly specified model.

I. Falsification Analysis (Placebo Tests)

We added false treatment periods 1995–2005, to see if nondeterministic productivity variations could be falsely connected to the periods without policy changes.

Instead, in the placebo test the coefficient was negative and statistically significant, indicating no upward productivity shock after this period. This bolsters the argument that 2011 and 2019 post-break productivity increases are not just random or pre-trend driven.

II. Parallel Trends Test

The fundamental assumption underlying Difference-in-Differences (DiD) estimation is that treated and control groups are on parallel trends in the pre-treatment periods. We estimate log(Y) regressed on dummy variables for Pre_2008, Pre_2009, and Pre_2010 respectively.

All pretreatment dummies are statistically insignificant, it confirms the fact that productivity trends in Austria and Switzerland were not parallel before 2011.This confirms the parallel trends for DiD.

III. Lead and Lag Models

Lagged effects (such as Lag_2Y_2019) are frequently positive and large, suggesting that it takes some time for the full productivity gains from free trade agreements to materialize.

Because lead effects are largely negligible, firm-level productivity does not exhibit anticipatory behavior.

Table 12. Summary Table of Hypotheses and Tests

Hypothesis	Key Outcome
H1	Strong Empirical Support. Positive Post_2011, Lag_2Y_2019 confirms treatment effect
H2	Partial Empirical Support. Short-run insignificant, long-run labor variables significant
H3	Partial Empirical Support. Large_Firm:Post_2011 significant
H4	Inconclusive Empirical Support. No significant evidence to the hypothesis.
H5	Strong Empirical Support.Compensation significant, supports skill premium

(*Source: by Author)*

These findings yield key takeaways:

1. Trade liberalizations contributed positively and significantly to productivity growth, particularly post 2011 agreement.
2. The benefits of liberalization are enhanced by firm size, as theory predicts.
3. Export intensity is both the strongest and most consistent productivity driver across each of the models.
4. Rising compensation on productivity growth, supporting the skills-biased view of trade integration seen in labor market effects
5. In the end, the results reaffirm that trade liberalization, combined with investment and firm capabilities, can bring large gains in productivity, especially in export-oriented and technology-led sectors.

CHAPTER 6: CONCLUSIONS AND IMPLICATIONS FOR POLICY

The purpose of this thesis was to investigate how trade liberalization, specifically the 2011 EU-South Korea free trade agreement and the 2019 EU-Japan economic partnership agreement (EPA), affected productivity in Austria's automotive sector.This study was motivated by the ongoing debates over whether trade openness is still productivity-enhancing in high-income economies, and what firm-level or structural characteristics determine the distribution of such gains.

Towards this end, the thesis sought to unite insights from rigorous econometric modeling with international trade theory namely, the Ricardian model, the Heckscher-Ohlin framework, Melitz's heterogeneous firm model, and Endogenous Growth Theory. A clear set of hypotheses informed the methodological framework of OLS, first-difference models, multiple Difference-in-Differences (DiD) designs, and robustness checks.

6.1 Summary of Main Findings

The empirical results indicate that trade liberalization enabled increases in labor productivity in Austria's automotive sector, most notably after the 2011 agreement with South Korea. This is consistent with H1 and is in line with the theory that trade lowers average cost and promotes a productivity-upgrading process through better access to markets.

Trade Liberalization and Productivity Gains

While both DiD models showed that the implementation of trade agreements led to an increase in productivity (i.e., positive estimates of policy shocks), the post-2011 effect was more consistent and statistically significant than the 2019 impact. This implies that earlier liberalization had a lower but longer-lived effect presumably because the Korean market was an advanced technology-driven market that needed greater time to substitute imports with domestic manufacturing in auto components.

Firm Heterogeneity

Similarly, the results supported H3 and further indicated that larger and more export-oriented firms had higher benefits from trade liberalization. This mirrors the role of economies of scale and aligns with Krugman's New Trade Theory, which states that firms with larger access to external markets and who cover more fixed costs will benefit more from openness.

H4 was also supported. For the models with interactions by capital investment and lagged capital intensity, suggestive results suggested that capital-deep firms enjoyed bigger productivity gains after liberalization. Nonetheless, the impacts were not always statistically significant, which may have either been the result of multicollinearity or data restrictions.

Labor Market Effects

Regionalized labor model (labor position model — LPM): compensation increased significantly, but not less consistently than wages. The above observations suggest that (1) labor and capital markets tend to disrupt in the short run when foreign trade is accessed; (2)- the results describe a skill-biased effect of trade on income; these findings are in line with H2 and H5 offer support for Heckscher-Ohlin and SBTC models.

6.2 Robustness and Validation

To verify the robustness of the empirical results, the analysis was accompanied by a series of robustness checks:

In placebo tests using pre-treatment years (1995–2005 and 2005–2010), we found no significant changes in productivity before liberalization, ruling out spurious trends.

Lag Models indicated that the positive effects of capital investment are usually delayed before they can be realized—hence the long-term nature of structural change is reinforced.

Lead-lag models were utilized to capture both the evolutionary and instantaneous effects of the policies over time while monitoring for both anticipation or delayed responses in the short term.

6.3 Overall Contribution to Literature and Methodology

The thesis makes three contributions to the trade and productivity literature:

This empirical evidence comes from Austria, a small, open economy that is heavily dependent on automotive exports—an understudied context in the EU trade evaluation literature.

Thus the use of Switzerland as a counterfactual provides more causal identification through a similar country that takes none of the trade shocks.

It connects macro-level policy assessment with micro-level firm characteristics, providing insights about heterogeneity in policy impact.

Following hypotheses, theoretical models, and the regression design tightly aligned creates a close theory-empirics link and is required but not sufficient for thorough economic analysis.

6.4 Policy Implications

It has a clear relevance for policymaking at both national and EU levels. Although trade liberalization, on average, increases productivity, the returns are not automatic or evenly shared. Governments can do so by implementing the following measures to maximize gains and minimize adjustment costs:

Take action to support SMEs and less capital-intensive firms (including through access to finance, digital upgrading, and export-readiness programs) to avert polarization.

Reinforce labor market institutions for more efficient reallocation and support investments in upskilling and retraining programs, especially for mid-skilled and vulnerable workers.

Moreover, the strategic sequencing of trade agreements, supported by domestic investment incentives and industrial policy, can ensure that liberalization results in sustainable and inclusive growth.

6.5 Limitations and Future Research Directions

While this thesis fills an important missing empirical piece for the productivity impacts of trade liberalisation in Austria's automotive sector, a number of limitations have to be acknowledged:
Data Granularity and Scope:
The analysis relies on industry-level data that is aggregated through a lumping process where the macro trends are at best averages of firm-level characteristics and can mask important heterogeneity (e.g., productivity differentials by size, ownership structure, or technology adoption capabilities).
Future work could also link firm-level microdata-for example, confidential datasets sourced from national statistical offices or commercial registries-to capture intra-industry dynamics and

deliver a more firm-specific perspective on trajectories spanning various geographic contexts.

Sample Size Constraints:

Tt is difficult to distinguish potential interactions between treatment years (2011 and 2019) and levels, lags, and non-linearities from a simple linear transformation of the annual data alone; given the relatively small number of observations on an annual level, especially during the treatment years.

Extensions of the panels (e.g., quarterly data) can enhance the future work,

Limited Distributional Focus:

This thesis mainly concentrates on the average productivity effects. But trade liberalization can have differential effects by gender, wage group, skill, or region, none of which were analyzed directly due to the availability of data.

Future research may want to study the distributional effects of trade: are gains concentrated among high-skilled workers, regions (Styria versus Vienna), or capital-intensive firms?

6.6 Final Remarks

It demonstrates how effective trade liberalization can act as a tremendous boost to increasing productivity, particularly in internationally integrating industries like automobile-making. But it also shows that trade is no silver bullet. Its benefits depend on firm-specific traits, investment behaviors, and policy adjustments.

In an global economic environment increasingly being determined by geopolitical tensions and industrial policy, these conclusions affirm that liberalization is not a stand-alone agenda, but must be grounded in a wider development strategy, one that is inclusive, forward-looking and innovation-based.

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APPENDICES

ANNEX A. OLS Regression Output

Variable	Estimate	Std. Error	t value	Pr(>|t|)	Significance
(Intercept)	0.845198	0.905293	0.933618	0.36222	
log(GDP)	0.007213	0.021131	0.341358	0.73658	
log(Export_AT)	0.524218	0.091937	5.701913	1.70E-05	***
Trade_B_log	0.000276	0.006516	0.042391	0.96663	
log(Exch_AT)	-0.071632	0.046925	-1.526536	0.14335	
log(Emp)	0.012811	0.090524	0.141522	0.88895	
log(Cap_inv)	0.008742	0.043348	0.201684	0.84231	
log(Swiss_Y)	-0.221494	0.115895	-1.911172	0.07188	
log(Agriculture_At)	0.148961	0.08014	1.858762	0.07862	

Observations: 30

(*Source: output Rstudio)*

ANNEX B. FD (First Difference) Regression Output

Variable	Estimate	Std. Error	t value	Pr(>|t|)	Significance
(Intercept)	0.255656	0.122853	2.080989	0.051203	*
d_GDP	-0.005406	0.007548	-0.716246	0.48255	
d_Export	0.321881	0.043453	7.407628	5.15E-07	***
d_Trade_B	0.000841	0.002433	0.345537	0.73349	
d_Exch_AT	-0.032506	0.036814	-0.882963	0.38829	
d_Employment	-0.0454	0.054415	-0.834324	0.41447	
d_Cap_inv	0.007981	0.014321	0.557258	0.58366	
log(Swiss_Y)	-0.044684	0.038903	-1.148595	0.26498	
log(Agriculture_At)	0.004992	0.028208	0.176979	0.8614	

Observations: 30

(*Source: output Rstudio)*

ANNEX C. DiD Regression Output (Post_2011)

Variable	Coefficient	Std. Error	t-value	p-value	Significance
(Intercept)	1.239	0.3568	3.472	0.0024	**
Post_2011	0.0644	0.0308	2.092	0.0494	*
Lead_2Y	0.0423	0.0258	1.636	0.1174	n.s.
Lag_2Y	0.0025	0.0208	0.119	0.9061	n.s.
log(Export_AT)	0.5894	0.0882	6.678	1.68E-06	***
Trade_B_log	-0.0058	0.006	-0.963	0.3471	n.s.
log(Swiss_Y)	-0.2344	0.0955	-2.454	0.0234	*
log(Agriculture_At)	0.007	0.1031	0.068	0.9465	n.s.
Adj. R^2				0.9801	

Observations: 28

(*Source: output Rstudio)*

ANNEX D. DiD Regression Output (Post_2019)

Variable	Coefficient	Std. Error	t-value	p-value	Significance
(Intercept)	0.639	0.309	2.069	0.052	.
Post_2019	-0.055	0.022	-2.556	0.0188	*
Lead_2Y_2019	0.003	0.015	0.218	0.8297	n.s.
Lag_2Y_2019	0.086	0.015	5.651	1.57E-05	***
log(Export_AT)	0.581	0.066	8.768	2.75E-08	***
Trade_B_log	-0.0001	0.004	-0.033	0.9746	n.s.
log(Swiss_Y)	-0.203	0.11	-1.848	0.0794	.
log(Agriculture_At)	0.121	0.049	2.492	0.0216	*

Observations: 30

(Source: output Rstudio)

ANNEX E. DiD Regression Output – Firm Size Interaction

Variable	Coefficient	Std. Error	t-value	p-value	Significance
(Intercept)	2.065	0.566	3.645	0.002	**
Post_2011	0.04	0.028	1.404	0.178	
Large_Firm	-0.06	0.02	-2.963	0.0087	**
Post_2019	0.021	0.031	0.659	0.519	
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Lag_2Y	-0.013	0.02	-0.658	0.519	
log(Export_AT)	0.464	0.093	4.977	0.0001	***
log(Swiss_Y)	-0.207	0.152	-1.362	0.191	
log(Agriculture_At)	0.08	0.096	0.827	0.419	
Post_2011 × Large_Firm	0.08	0.03	2.67	0.0162	*
Post_2019 × Large_Firm	-0.016	0.027	-0.601	0.556	

Observations: 30

(*Source: output Rstudio,)*

ANNEX F. Investment Regression Output

Variable	Coefficient	Std. Error	t-value	p-value	Significance
(Intercept)	0.952	0.796	1.195	0.245	
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log(Export_AT)	0.549	0.096	5.698	0	***
Post_2011	0.029	0.022	1.329	0.199	
Post_2019	-0.024	0.033	-0.734	0.47	
log(Swiss_Y)	-0.169	0.17	-0.987	0.335	
log(Agriculture_At)	0.071	0.085	0.925	0.365	

Observations: 30

(Source: output Rstudio)

ANNEX G Labor Regression Output

Variable	Coefficient	Std. Error	t-value	p-value	Significance
(Intercept)	1.222	0.494	2.477	0.022	*
log(Wages_Auto)	-0.082	0.051	-1.596	0.126	
log(Compen_Auto)	0.909	0.184	4.947	0.00008	***
log(Emp)	0.167	0.048	3.115	0.005	**
Post_2011	-0.055	0.025	-2.149	0.045	*
Post_2019	-0.021	0.039	-0.526	0.604	
log(Swiss_Y)	0.057	0.078	0.735	0.713	
log(Agriculture_At)	0.151	0.083	1.804	0.064	. (weak)

Observations: 30

(Source: output Rstudio,)