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Bachelor's Programme in Economics

Implications of Emerging Challenges in Trade Between the U.S. and Europe

How do tariffs and exchange rate fluctuations between the U.S. and Europe affect the pricing and revenue of European pharmaceutical companies?

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Abstract

This thesis examines how potential tariffs and exchange rate fluctuations between the United States and Europe could impact the pricing strategies, revenue generation, and welfare implications for European pharmaceutical companies. The study is motivated by increasing trade policy uncertainty in 2025, under the Trump administration. Trump has threatened to impose broader tariffs on European imports, possibly including pharmaceutical products.

As a literature review, this thesis utilizes economic theory focusing on the heterogeneous firm model by Melitz and Redding (2014). The economic model is integrated with identified pharmaceutical industry-specific characteristics in the U.S. such as patent protection, price discrimination between countries and the role of Pharmacy Benefit Managers. Findings suggest that patented medicines, due to their inelastic demand and market power, allow firms to pass tariff costs onto customers. Off-patent medicines face greater competition and are more vulnerable to revenue losses under tariffs.

Findings in the thesis further highlight the contribution of currency appreciation and firm productivity in offsetting some of the negative effects of tariffs. However, overall welfare is expected to decline due to reduced access, increased price index and weakened incentives for the firms to innovate. The thesis contributes to understanding how international trade disruptions intersect with pharmaceutical market structures and emphasizes the public health dimension of trade policy decisions.

Keywords tariffs, exchange rates, pharmaceutical companies, price discrimination, patents

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Tiivistelmä

Tämä kandidaatintutkielma tarkastelee mahdollisten tullien ja valuuttakurssivaihteluiden vaikutusta Yhdysvaltojen ja Euroopan välillä eurooppalaisten lääkeyritysten hinnoitteluun, liikevaihtoon ja hyvinvointivaikutuksiin. Motivaatio tutkimukselle on peräisin alkuvuonna 2025 kasvaneesta kauppapoliittisesta epävarmuudesta, joka johtuu Trumpin hallinnon uhkauksista asettaa tullit Euroopan vientituotteille Yhdysvaltoihin. Nämä tullit sisältäisivät myös lääketuotteet.

Tutkielma on kirjallisuuskatsaus, jossa hyödynnetään talousteoriaa Melitzin ja Reddingin (2014) heterogeenisten yritysten mallilla. Malli yhdistetään Yhdysvaltojen lääkemarkkinoiden erityispiirteisiin, kuten patentteihin, maiden väliseen hintadiskriminointiin ja apteekkietuuksien hallinnoijien (Pharmacy Benefit Managers) rooliin. Tulosten perusteella voidaan todeta, että patentoitujen lääkkeiden joustamaton kysyntä ja markkinavoima mahdollistavat tullikustannusten siirtämisen kuluttajille. Patenttisuojansa menettäneet lääkkeet taas kohtaavat merkittävää kilpailua ja ovat alttiimpia tulonmenetyksille tullien vaikutuksesta.

Tutkielman havainnot korostavat valuutan vahvistumisen ja yritysten tuottavuuden mahdollisuuksia lieventää tullien negatiivisia vaikutuksia. Tullien kokonaisvaikutukset hyvinvointiin ovat negatiivisia heikentyneen saatavuuden, nousseen hintaindeksin ja yritysten innovaatioiden vähenemisen takia. Tutkielma pyrkii ymmärtämään kansainvälisen kaupan häiriöiden ja lääkemarkkinoiden rakenteiden välisen yhteyden ja huomioimaan kauppapoliittisten päätösten vaikutusta kansanterveyteen.

Avainsanat tullit, valuuttakurssit, lääkeyritykset, hintadiskriminointi, patentit

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1 Introduction

This thesis predicts the possible outcomes in pricing and revenue for European pharmaceutical companies as the possibility of tariffs has increased in 2025 with the Trump administration in the U.S. Research in the thesis also includes the total welfare consequences if the tariffs are imposed. The study is conducted as a literature review.

The pharmaceutical industry plays a vital role in global healthcare by improving well-being and ensuring access to life-saving medicines. However, economic disruptions, such as tariffs and exchange rate fluctuations, can significantly impact the industry's pricing strategies and revenue streams. Trade barriers may reduce demand and hinder market access, ultimately affecting company profits and the welfare of individuals. Since profitability is essential for sustained investment in research and development (R&D), any financial instability in the sector could slow innovation and limit the availability of new treatments affecting both companies and customers.

Given the global nature of the pharmaceutical industry, international markets are critical for distributing medical innovations as widely as possible. Europe and the U.S. are key trade partners, with the U.S. accounting for over 40% of the global pharmaceutical market (EFPIA, 2023). Recent trade policies and economic uncertainties raise concerns about their potential effects on European pharmaceutical firms. Therefore, it is crucial to analyse the impact of tariffs and exchange rate fluctuations on pricing strategies, revenue generation, and overall welfare.

This study investigates the extent to which tariffs and exchange rate fluctuations between the U.S. and Europe affect the pricing strategies and revenue of European pharmaceutical firms. Specifically, the research addresses the following sub-questions: (1) Which industry-specific characteristics influence the pricing and revenue of pharmaceutical companies? (2) What types of tariffs and exchange rate fluctuations could occur between the U.S. and Europe? (3) In what ways do tariffs and exchange rate fluctuations impact European pharmaceutical exporters? This study aims to contribute to a deeper understanding of economic challenges faced by the pharmaceutical industry.

I will analyse the effects of the tariffs on the export countries and model it with a framework presented by Melitz et al. (2014), which provides a theoretical framework to analyse differences between companies and their reactions and export strategies to the tariffs. Using the economic theory about companies' reactions to trade barriers, I will utilize specific information about pharmaceutical companies. Revenue and pricing implications for European pharmaceutical companies exporting to the U.S are analyzed by considering the special features of the firms, such as the division of products into patented and other, branded and generic, categories, and their significant market share in U.S. exports. By utilizing special features of companies and international trade, as well as possible considering potential trade barriers, this thesis predicts the most likely outcomes in terms of revenue, pricing and welfare.

Motivation for this thesis is based on the return of the Trump administration in the U.S. Last time Trump was in charge in 2018 he implemented tariffs on specific European products. These did not include medicines, but in 2025 the possibility of tariffs on pharmaceutical is significant. The Trump administration aims to correct trade balance announcing a "fair and reciprocal plan" on trade (The White House, 2025). According to the White House statement the U.S. imports are too large compared to the exports. Additionally, the Trump administration has expressed dissatisfaction with U.S. pharmaceutical companies producing in Europe, due to looser legislation (O'Connor, 2025). These factors underline the possibility of tariffs on pharmaceuticals.

Since the tariffs did not include pharmaceutical products in 2018, there is no research about effects on European pharmaceutical firms. The previous Trump tariffs in 2018 have been widely researched even though the scope is generally on the prices and welfare of the import country. This thesis draws on the article “The impact of the 2018 Tariffs on Prices and Welfare” (Amiti, Redding et al., 2019), which offers an analysis of the most recent tariffs in the U.S.

The potential continuation of tariffs beyond the Trump administration remains an important consideration for future trade policy analysis. If the tariffs are particularly large and economically harmful, it is more likely that a subsequent U.S. administration will reverse them, especially if their negative effects on the U.S. economy become apparent. Also, clear negative welfare outcomes, such as crucial medicines’ increased prices, can contribute to the decision.

The thesis proceeds as follows. Firstly, in Chapter 2 “Special Features of Pharmaceutical Companies” I will explain the structure of the revenue and pricing for the companies also considering welfare and R&D of the companies. Additionally, I will analyse the global market structure for pharmaceuticals. This is a base for the future analysis when predicting the economic impacts of the trade barriers on pharmaceutical companies. In Chapter 3 “Emerging Challenges in Trade” I will analyse possible tariffs and exchange rate fluctuations based on economic models and discuss previous implications of tariffs. In Chapter 4 “Implications on Pharmaceutical Companies” focus is on combining previous chapters and I will make predictions based on specific features of pharmaceutical companies and possible tariff implications. Lastly, I will present conclusions of my research.

2 Special features of Pharmaceutical Companies

2.1 Pricing, Revenue, and Welfare

Pricing of pharmaceutical companies differs from other fields due to product separation into patented and off-patented medicines. Additionally, these can be divided into prescription and nonprescription drugs. These factors affect pricing strategies for pharmaceutical firms. Expensive R&D investments in new discoveries are funded by the revenue of pharmaceutical companies. Investments made in R&D affect welfare of individuals increasing lifespan and quality of life.

Medicines sold can be categorized into patented medicines and off-patented medicines, the latter including branded and generic medicines. Branded medicines are sold under company-specific names (e.g., Burana), whereas generic medicines are marketed under their chemical names (e.g., ibuprofen). As the active ingredient is the same across these products, they can be analyzed together regardless of the brand under which they are sold. Patented medicines are charged according to what the markets bear, offering also a temporary monopoly power. Once the patent expires, competitors can produce their own versions of the medicine at significantly lower prices, increasing market competition. As a result, the original manufacturer can no longer maintain the same pricing strategy as during the patent period. There are exceptions to this pricing model in countries where governments subsidize medicines. Then the prices of all medicines are negotiated between pharmaceutical companies and the government entities. (Ramagopalan, Diaz et al. 2024)

Innovations in the biomedical industry are driven by the market-based pricing for patented products. Expected financial returns are derived from two factors: the probability of success and financial value of success, which are key drivers for the innovations. Pricing the patented medicine must consider the whole portfolio of innovations of which only a few succeeded. Therefore, the profit cannot only be costs to develop this specific branded product. (Ramagopalan, Diaz et al. 2024)

Simanjuntak (2011) analyzed firms' lagged profitability, cash flow and R&D intensity, which influence the R&D expenditure of pharmaceutical companies. Using data from six large pharmaceutical companies in the U.S from 2003 to 2010 they found a positive and significant influence of these parameters on R&D expenditure. However, they admit that there are also other affecting factors, such as firm size and performance. Although the study is not peer-reviewed, the findings align with broader economic literature on R&D funding decisions.

Jaffe's research (1986) supports this connection in his seminal article by showing that firms' R&D output, measured by patents, profits, and market value, is positively associated with their technological position and the research activity of nearby firms in technology space. His findings suggest that firms with high R&D intensity benefit disproportionately from R&D spillovers, while firms with low R&D activity may even be negatively affected by others' innovation efforts. This strengthens the view that sustained R&D investment is not only dependent on internal profitability, but also on a firm's position within the broader technological ecosystem and the importance of R&D intensity. Jaffe's findings are applicable to the pharmaceutical industry, establishing Simanjuntak's view that firms must maintain both high profitability and consistent R&D investment to remain competitive in innovation-driven markets.

Simanjuntak's research found a positive relationship between R&D expenditures and profits. If the revenue is higher, there is an increase in R&D expenditures next year. This highlights the importance of the revenue to pharmaceutical companies, on which this thesis focuses. While profit is likely a more relevant metric when evaluating firms' R&D investment decisions, investment feasibility is closely tied to net earnings, this thesis focuses on revenue. The choice is motivated by the availability and comparability of revenue data across firms and products, especially in the context of international trade and tariff impacts. Revenue also provides a direct measure of market exposure and sales volume, which are essential for assessing the potential vulnerability of firms to trade policy changes, regardless of firm-specific cost structures.

A monopoly market position and excess revenues can be justified with R&D expenditures. If the patent price only covers the previous expenditures, there is no money to invest in new R&D. Therefore, with a positive relationship between the R&D expenditures and profitability (Simanjuntak 2011), pharmaceutical companies must set the prices to generate revenue that includes the possibility for investments in R&D.

The relationship between R&D expenditures and profits can be linked in three ways: (1) successful R&D can lead to increased profits, (2) profits serve as a source of funding for R&D investments, and (3) R&D investments are influenced by managers' expectations of future profits (Simanjuntak 2011). Their research on R&D intensity (ratio of a firm's R&D investment to its revenue) yielded important findings: the opportunity cost of investment capital was higher than the cash flow financing, and new drugs generated substantial cash flows that could be reinvested in R&D. These findings highlight the importance of revenue and pricing of medicines.

R&D investments in pharmaceutical companies lead to innovations of new pharmaceutical medicines. As discussed above, increased profits facilitate R&D investments, and successful R&D, in turn, contributes to further profit growth. This enables discovering new pharmaceutical medicines that increase social welfare of individuals increasing lifespan and quality of life (Cutler 2001). The value of increased life expectancy and decreased need for hospital treatment over the years have been remarkable and R&D costs have been significantly lower than the profit costs, when additional life-year is valued at $150,000 (Cutler 2001). In addition to enhancing individual well-being, R&D investments boost overall economic productivity, benefiting society.

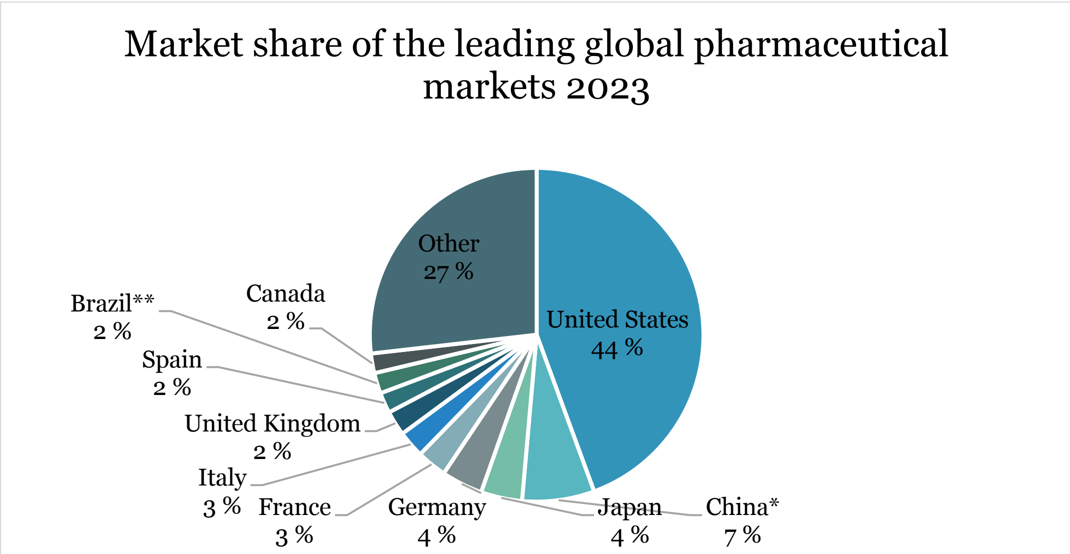
2.2 The U.S. Pharmaceutical Market

In 2023, the United States accounted for 44% of global pharmaceutical sales, as shown in Graph 1. Graph 2 compares pharmaceutical sales in the U.S. and Europe. In 2023 pharmaceutical sales were $678 billion and in Europe $248 billion, despite the U.S. having only 4.15% of the world's population in 2023 compared to 5.57% in Europe (World Bank, 2024). With a significant market share compared to any other country and a moderate population size, the U.S. has the leading average pharmaceutical spending per capita, reaching $1,560 in 2022 (Statista, 2024b).

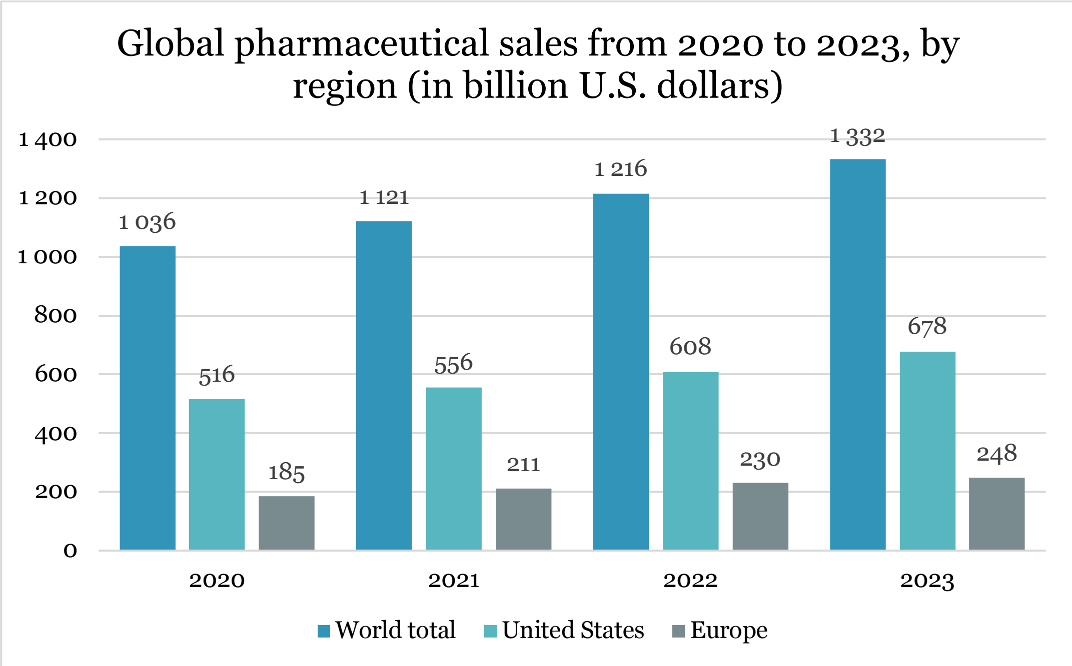
In 2016, the U.S spent an average of $1,443 per capita on pharmaceuticals, whereas other high-income countries spent between $466 to $939 (Papanicolas et al., 2018). According to the research, the difference in spending is explained by price regulations. While other countries negotiate and regulate prices, in the U.S pharmaceutical companies have freedom to set prices independently.

Pharmaceutical prices in the U.S. are negotiated between pharmaceutical firms and Pharmacy Benefit Managers (PBMs), who act on behalf of employers and health plans (Tozzi, 2023). However, this negotiation process often favors pharmaceutical companies rather than consumers, contributing to the inflated prices seen in the U.S. compared to Europe. Additionally, countries exporting pharmaceuticals to the U.S. also negotiate prices with PBMs, yet the fragmented nature of the U.S. healthcare system and the absence of centralized price controls allow these companies to maintain higher prices in the U.S. than in the EU.

This results in price discrimination, where the U.S. consumers pay significantly higher prices for the same medications. Research by Papanicolas et al. (2018) emphasizes that these high pharmaceutical spending levels are not due to higher amount of drug consumption but rather pricing policies, which are a consequence of lack of price regulation and unique structure of healthcare and insurance system in the U.S. Markets in the U.S are clearly more profitable for pharmaceutical companies allowing them to price, in some cases, even double as the price in other countries. This profitability is further reinforced by factors such as patent protections, when PBMs have limited bargaining power and the willingness of insurers to cover high-cost drugs, all of which sustain the pricing power of pharmaceutical firms.



Graph 1. Market share of leading global pharmaceutical markets in 2023
The graph shows the market share distribution among the leading pharmaceutical markets worldwide in 2023.
Sources: IQVIA (2023); Statista (2024b)



Graph 2. Global pharmaceutical sales by region, 2020–2023
The graph presents global pharmaceutical sales from 2020 to 2023, broken down by region.
Sources: AstraZeneca (2023); Statista (2024a)

3 Emerging challenges in trade

3.1 Unrestrained Global Trade

Modern trade theory usually models international trade as an open economy framework containing free entry conditions in certain settings. These approaches based on firm heterogeneity highlight reallocating resources to more productive firms, altogether fostering economic growth and efficiency. (Melitz and Redding, 2014)

When modelling unrestrained worldwide trade, companies only face the fixed cost of exporting, which includes both fixed production costs and market access costs, such as advertising, distribution, and conforming to foreign regulations. In the theoretical model, export profits must exceed these fixed costs of exporting for the firm to profit from exporting. With this condition, trade markets work when only the most productive companies export. Without this fixed export cost all firms would export. In the model all firms serve their domestic market and only a subset of more productive firms export. (Melitz and Redding, 2014)

In free unrestrained trade firms maximize their profits from export. This can be converted into the profit equation for the firm exporting products from country i to country n. (Melitz and Redding, 2014)

$$\pi_{ni}(\varphi) = B_n \tau_{ni}^{1-\sigma} \varphi^{\sigma-1} - f_{ni} \ (1)$$

Equation 1. Profits from the export sales (Melitz and Redding 2014)

Where:

- $\pi_{ni}(\varphi)$ = Firm profit in the export market n, when its profitability is φ

- B_n = Market demand index in country n, which depends on total income and the price index of the country.

$$B_n = \frac{(\sigma-1)^{\sigma-1}}{\sigma^{\sigma}} X_n P_n^{\sigma-1}$$

Equation 2. Market demand index in country n (Melitz and Redding, 2014)

- X_n = total expenditure in country n,
- P_n = CES (Constant Elasticity of Substitution) price index in country n

- $\tau_{ni}^{1-\sigma}$ = trade costs relative to firm profitability
- $\varphi^{\sigma-1}$ = Firm productivity affects profits exponentially
- f_{ni} = Fixed export costs that the firm must pay to enter market n

In the theoretical framework modelling potential trade barriers, key parameters to focus on include σ (elasticity of substitution) and P_n (the price index in the destination country for exported products), which affect B_n (the market demand index). The market demand index reflects overall demand for differentiated products in country n, capturing how attractive the market is for the exporting firms. It takes account both the country's total income X_n and the price index P_n. If B_n is higher, demand for export products is higher due to greater purchasing power or lower price levels.

According to Melitz (2002) σ in the equation is elasticity of substitution, that measures the responsiveness of consumers' relative demand for different varieties of goods in response to changes in their relative prices. Higher σ implies that products are closer substitutes. Changes in σ affect the parameters in Equation 1. If σ is greater in $\tau_{ni}^{1-\sigma}$ trade costs relative to firm profitability are larger and greater σ means increased profit differences between companies in $\varphi^{\sigma-1}$.

Generally, greater elasticity of substitution results in more intense price competition, lower equilibrium prices and markups for the firms (Melitz, 2002). In that environment, firms have greater pressure to reduce costs, and only the most productive companies can remain competitive in both domestic and export markets. Moreover, higher σ increases the impact of trade barriers, as consumers are more likely to substitute away from higher priced products, that are subject to tariffs or other trade restrictions.

In an unrestrained global trade environment, market forces highlight the most competitive and profitable firms, ensuring optimal market efficiency. This competitive selection keeps prices aligned with market demand, preventing inefficiencies and artificial price distortions. Both companies and consumers benefit from price levels that reflect true market access costs.

For export-driven economies, this environment enhances production efficiency, as firms must continuously optimize operations to remain competitive. Meanwhile, import-dependent nations experience a favorable price index, benefiting consumers through lower prices while simultaneously incentivizing domestic firms to improve efficiency in response to global competition.

3.2 Past Actions and Future Implications of Trade Barriers

The trump administration has threatened trade barriers that pose a significant threat to Europe. About 25% tariffs are estimated on European import products to the U.S. These tariffs are estimated to be four times larger in extent than the last time Trump was in charge according to the Nardelli & Valero Bloomberg article from February 2025.

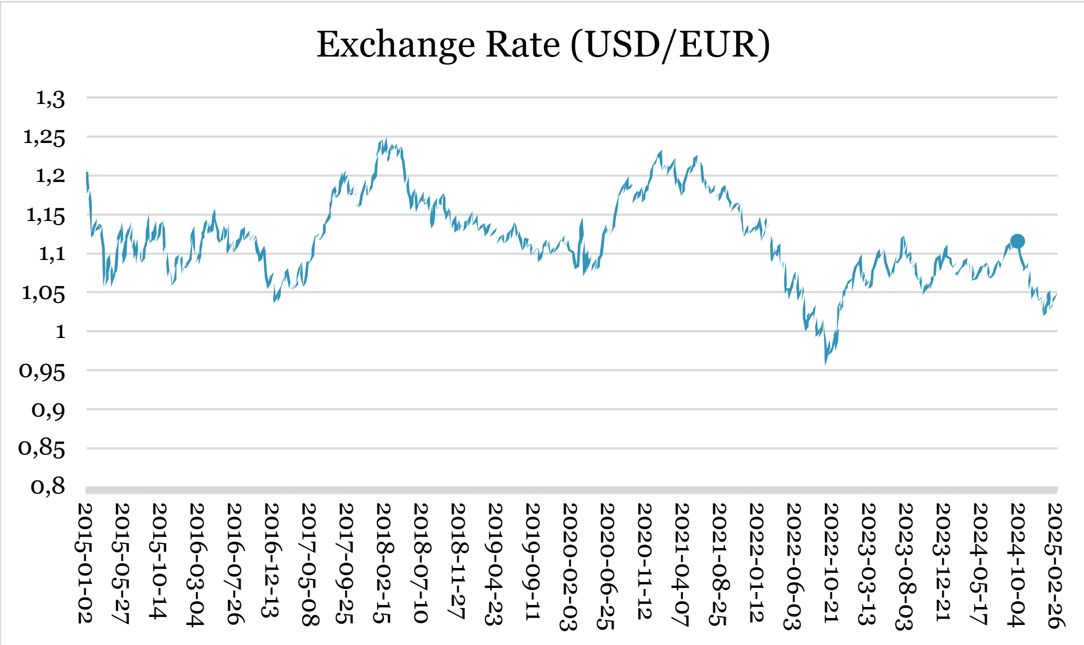
Economists have widely studied the effects of Trump's tariffs last time, in 2018. Research by Amiti et al. (2019) examines the impact of tariffs on U.S. prices and welfare and finds empirical evidence that import protection leads to real income losses. Research found remarkable cumulative deadweight cost, costs to domestic consumers and importers in the form of tariff revenue and costs of adjusting international supply chains. Research omits potentially large costs related to policy uncertainty, which are likely to be considerable and affect negatively equity markets of the import country and export countries.

Generally, tariffs are used to protect local industries. Tariffs make imports more expensive, directing consumers to buy local products with lower domestic prices. Tariffs are paid to their home countries, supporting the revenue of the country imposing tariffs (Siripurapu, A., & Berman, N, 2025). As Melitz et al. (2019) found in empirical research, tariffs usually fail at their purpose and the costs are passed on to customers. According to the research, the effect was immediate in the U.S. CPI (Consumer Price Index) was falling steadily for years but right after the imposed tariffs began rising sharply.

The increase in CPI is driven by domestic producers raising their prices to align with the higher costs of imported goods due to tariffs. With reduced competition from foreign products, domestic firms had less pressure to keep prices low. Also, foreign exporters did not lower their prices to offset the impact of tariffs, meaning the full cost of the tariffs was passed on to U.S. importers. As a result, the U.S. consumers paid the price of the tariffs. This highlights the external negative effects of the tariffs that citizens face.

Tariffs can lead to exchange rate fluctuations, particularly by strengthening the currency of the country imposing the tariffs. This happens as higher inflation, driven by tariffs, leads to increased interest rates relative to other countries. Stronger currency makes imports cheaper than they would be without tariffs, therefore partially offsetting their intended effects. Conversely, tariffs can weaken the currency of exporting countries by reducing demand for their goods. This relationship is a recognized economic framework for understanding the impact of tariffs on exchange rates. However, it is important to acknowledge that exchange rates are influenced by multiple macroeconomic factors besides tariffs. (Riksbank, 2025)

As shown in Graph 3, last time Trump imposed tariffs on certain European products, the dollar appreciated remarkably against the euro. This trend is consistent with the economic framework discussed above. However, it is important to note that no direct causal relationship can be established between tariffs and exchange rate movements, as exchange rates are influenced by a wide range of factors.



Graph 3. Exchange rate fluctuations of USD/EUR
The graph illustrates the fluctuations in the USD/EUR exchange rate over the period from January 1, 2015, to February 26, 2025.
Source: European Central Bank (2025)

3.3 Tariffs and Exchange Rate Fluctuations in the Model

Returning to Equation 1 and including the possibility of tariffs and exchange rate fluctuations, unrestrained worldwide trade is altered. Inevitably, tariffs increase the fixed export cost f_{ni} as companies must pay additional costs to access the market of the country n, which are collected by the government of the country n. While this makes it more difficult for the exporting firms to remain profitable, it also increases prices in the importing country n as discussed in Chapter 3.2.

Tariffs are typically levied as a percentage of the product price rather than as a fixed amount, as in this case the U.S. is planning 25% tariffs on export products. However, in the model used in this thesis, the term f_{ni} is assumed to capture all tariff-related costs faced by the firm in addition to other export costs the firm is facing.

Increased prices affect the Consumer Price Index (CPI) of a country, as discussed in Chapter 3.2. However, the CPI is not the same as the Constant Elasticity of Substitution (CES) price index P_n in Equation 2. The CES price index aggregates the prices of multiple goods while considering elasticity of substitution (σ) and is derived from the CES utility function (Melitz & Redding, 2002).

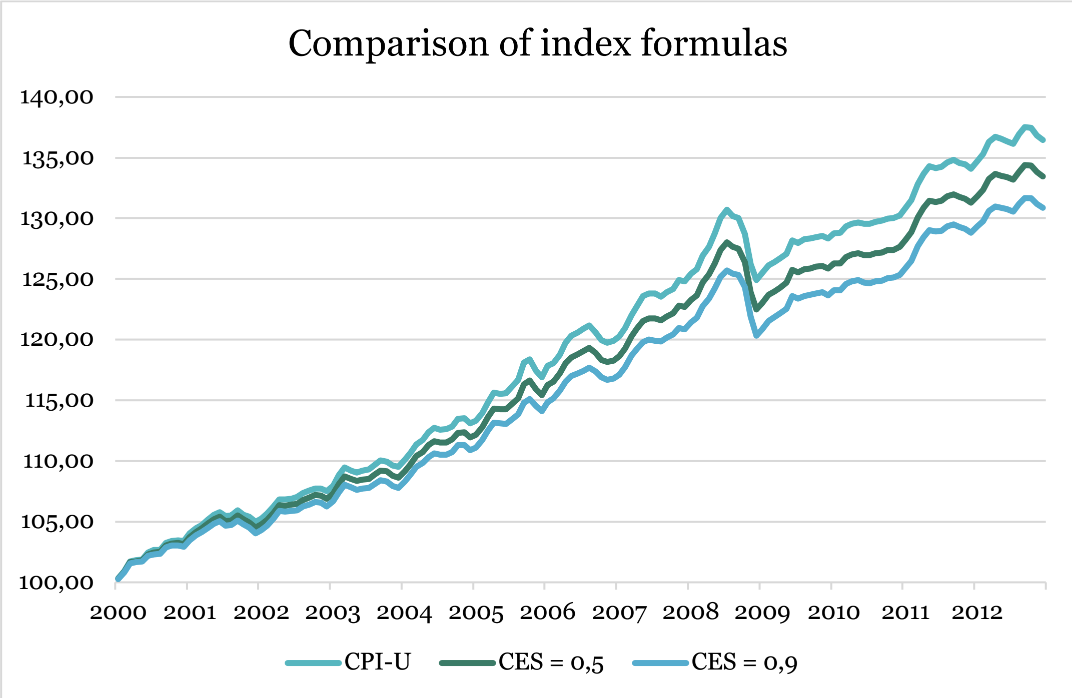
A key assumption in the Melitz and Redding's model is that there is only one elasticity of substitution that applies uniformly to all goods within the CES framework, meaning that it remains constant. Unlike CPI, which does not account for substitution effects, the CES price index helps improve inflation measurement accuracy. The CPI tends to overestimate inflation because it assumes a fixed basket of goods, meaning that consumers do not switch to cheaper alternatives assuming an elasticity of substitution of zero (U.S. Bureau of Labor Statistics, 2024).

Even though CPI and CES price indexes measure price changes differently, they are still connected. Graph 4 illustrates that the indexes move in tandem, as an increase in one is accompanied by an increase in the other. The CES price index adjusts more slowly than the CPI because it incorporates substitution effects. Based on the assumptions in CES and CPI, as well as the historical data in Graph 4, it can be inferred that the CES price index increases less in response to rising prices compared to the CPI.

As discussed in Chapter 3.2, tariffs increase the CPI index and, therefore, as described above, it can be assumed that they also increase the CES price index, but to a lesser extent. A change in CES price index P_n affects the market demand index B_n in equation 2. In the case of imposed tariffs, it increases the CES index decreasing market demand index B_n making it harder for the export companies to make it profitable when not adjusting other factors.

As discussed in the Chapter 3.2 exchange rate fluctuations usually offset implications of the tariffs. When considering the impact on profits from the export sales (Equation 1), appreciated currency in country n decreases fixed export costs f_{ni} for exporting firm. Also, the impact on trade costs $\tau_{ni}^{1-\sigma}$ is positive making it relatively easier for foreign firms to compete. Effects in Equation 1 are offsetting those discussed above.

Imposed tariffs affect both decreased market demand index B_n as described above and increased fixed costs of export f_{ni}. Both factors reduce the profits of export (Equation 1), making it more difficult for firms to export. On the contrary, exchange rate fluctuations offset these repercussions of the tariffs to the exporting country.



Graph 4. Comparison of the Consumer Price Index (CPI-U) and CES-based price indexes

The graph compares the Consumer Price Index for All Urban Consumers (CPI-U) with price indexes calculated using the constant elasticity of substitution (CES) formula, applying elasticity parameters (σ) of 0.5 and 0.9. The comparison covers the period from 2000 to 2012.

Source: Bureau of Labor Statistics (2018).

4 Implications for Pharmaceutical Companies

4.1 Pricing

The imposition of tariffs on European pharmaceutical exports could introduce significant complexity into pharmaceutical pricing structures. Chapter 2 outlines how pharmaceutical pricing is shaped by patent systems, the classification of medicines, and negotiations between Pharmacy Benefit Managers and pharmaceutical firms. Therefore, the standard economic demand and supply framework cannot depict fully direct impacts.

Patented medicines are usually also prescription medicines, which have monopolistic status eliminating direct substitutes. In addition, many patented medicines are essential treatments and therefore consumer demand is relatively inelastic. Due to these factors patented prescription medicines have very low elasticity of substitution (σ). In the situation of great bargaining power of the patent's owner company and very low substitution of elasticity, most likely outcome of imposed tariffs is that customers bear the costs of tariffs as increased prices for exported medicines. This aligns with economic theory, where inelastic demand and very low elasticity of substitution facilitate price increases without significantly affecting the quantity demanded. In this scenario, pharmaceutical companies maintain their pricing power, due to patents, increasing profitability $\varphi^{\sigma-1}$, offsetting higher export costs f_{ni} and reduced demand index B_n as described in Equation 1 (Melitz & Redding, 2014).

Graph 5 demonstrates in U.S. markets the Consumer Price Index (CPI) for prescription drugs. It has risen substantially faster compared to the overall CPI. This highlights the pharmaceutical industry's ability to raise prices under patent protection without experiencing a meaningful reduction in consumer demand, aligning with the theoretical framework presented earlier for patented products. According to the U.S. Bureau of Labor Statistics (2024), prices used in the CPI indexes for nonprescription and prescription drugs are calculated from prices paid directly by consumers and do not include compensations from insurance.

CPI for nonprescription drugs is calculated from all nonprescription drugs, whereas for prescription drugs all drugs dispensed by prescription are included and prices reported represent transaction prices between the pharmacy, patient, and third-party payer, if applicable. The CPI ultimately captures only the portion of the price paid directly by the consumer, even in cases where a third party contributes to the total cost. New prescription and non-prescription drugs are not automatically reflected in the CPIs for drugs. They are included if selected through periodic sampling based on recent sales volume and price levels at pharmacies. This implies a delay in capturing the price effect of newly produced medicines.

Graph 5 does not indicate a significant increase in price indexes following the imposition of tariffs by the Trump administration in 2018. The absence of notable shifts in the CPI curves for both prescription and non-prescription drugs aligns with the exclusion of pharmaceuticals from the 2018 tariff measures. The overall CPI remained stable in 2018, without any significant fluctuations. The lack of fluctuations in overall CPI can be explained by the limited scope of products imposed under the tariffs, the U.S. dollar appreciating, as explained in Chapter 3, as well as the limited scope of products in total consumer basket used to calculate CPI, and many other factors, so the effect was diluted. Notably, Amiti et al. (2019) excluded the impact of tariffs on CPI from the scope of their research, further indicating the complexity of isolating such effects in empirical analyses.

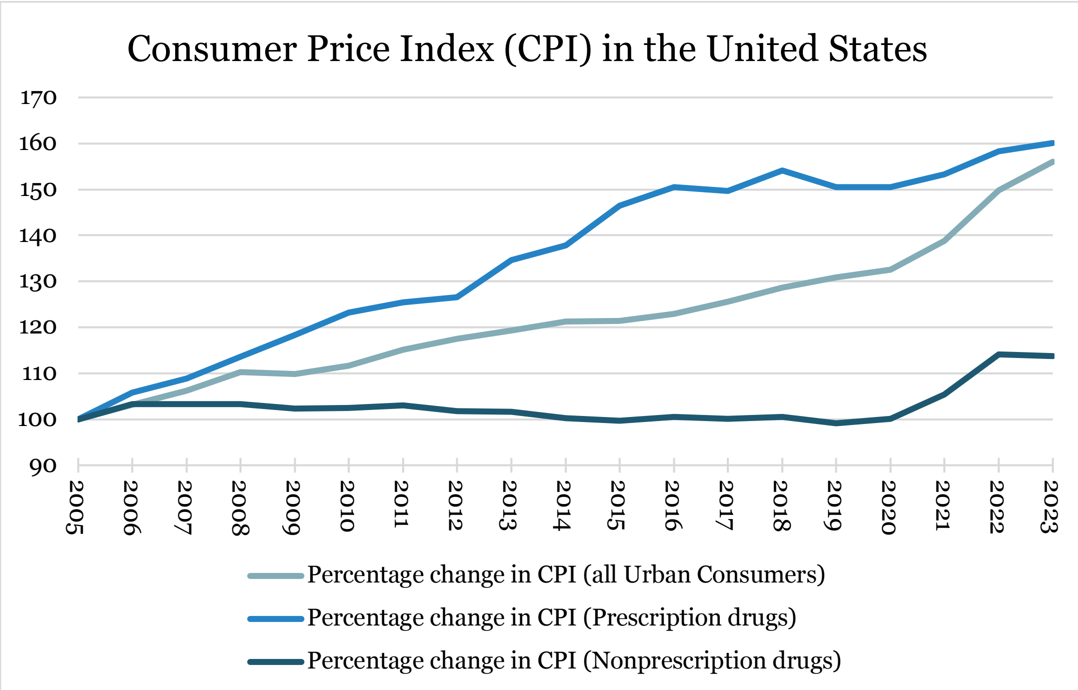
For nonprescription off-patented generic and branded medicines, elasticity of substitution is higher as the consumers can choose among the possible substitutes. Even in branded products substitutes have the same active ingredient regardless of the company specific name. Markets for the off-patented medicines are highly competitive, and prices are generally low (U.S. Department of Health and Human Services, 2019). Consequently, imposing tariffs on these products raises export costs f_{ni} for European pharmaceutical companies, and simultaneously reduces the market demand index B_n in the U.S.

According to the economic demand and supply framework with greater elasticity, European export companies may find it more challenging to pass the cost of tariffs onto consumers because significant price hikes would lead to a notable drop in quantity demanded in highly competitive markets. As a result, the most likely outcome for European pharmaceutical companies is to offset tariffs themselves increasing profitability in other ways than increasing prices of the products. Less productive firms may become unprofitable in the U.S market and cease exporting.

In Graph 5 Consumer Price Index (CPI) for nonprescription drugs is significantly lower than the overall CPI. As explained in Chapter 3, tariffs tend to raise the overall price index, this effect is not reflected in the prices of nonprescription drugs, as in Graph 5. The highly competitive market structure has helped keep prices low, supporting the assumption that the prices of nonprescription drugs are unlikely to increase in response to tariffs.

For European pharmaceutical companies exporting products to the U.S., the outcome of the tariffs differs depending on product type and market characteristics. For patented drugs, exporters can effectively transfer tariff costs onto consumers by raising prices, maintaining their competitive position due to the low elasticity of substitution. Generic medicines account for 90% of the drug volume in the U.S. but represent only 18% of total drug spending in the U.S. (Politico, 2024). This highlights the importance of the patented medicines in terms of money. For patented medicines, price increases are almost inevitable due to strong demand and limited (none) alternative products. In contrast, exporters of nonprescription generic medicines face greater challenges. High elasticity of substitution, lower market prices, and intense competition limit these companies' ability to pass on tariff-related costs to consumers, thus posing significant threats to their competitiveness and profitability in the U.S. market.

The U.S. pharmaceutical exports consist predominantly of patented medicines (Reuters, 2025), which also account for most national drug expenditures (Politico, 2024). Consequently, fluctuations in export volumes are largely attributable to patented (prescription) drugs.



Graph 5. Consumer Price Index (CPI) in the United States
The graph depicts the development of the Consumer Price Index (CPI) in the United States, using the year 2005 as the base year (index = 100). It includes separate CPI trends for all urban consumers, prescription drugs, and nonprescription drugs. The index values reflect relative price changes in each category over time.
Sources: U.S. Bureau of Labor Statistics (2024); Statista (2024d, 2024e).

4.2 Revenue

The imposition of tariffs by the United States would have direct consequences for the revenue of European pharmaceutical firms, primarily through their effects on pricing strategies, market access, and demand in the

U.S. market. In economics, the revenue for the firm is calculated by multiplying the price of the good by the quantity produced and sold (Bondarenko, 2025).

As examined in Section 4.1, the pricing responses to tariffs vary significantly between patented and generic medicines. These pricing dynamics are directly linked to the revenue implications. Building on the framework discussed earlier, firms exporting products with low elasticity of substitution, patented medicines, can raise prices without experiencing a significant decline in demand. As a result, the effect of tariffs on revenue in these cases is likely to be neutral or even positive. On the other hand, firms exporting off-patented medicines will face complex problems because of tariffs usually resulting in decreased revenue with high elasticity of substitution products. There are also other factors affecting revenue, such as the productivity of the firm, the role of Pharmacy Benefit Managers, and exchange rate fluctuations

Using Equation 1, firm productivity ($\varphi^{\sigma-1}$) significantly influences export profitability affecting the firm's revenue. Tariffs increase fixed export costs and affect other factors in the equation making it harder for the firm to be profitable. With higher productivity, a firm can more easily absorb these additional costs due to their competitive advantage. Highly productive firms can thus sustain their revenue streams by maintaining exports despite tariff-induced cost pressures. In contrast, less productive firms experience larger declines in profitability, as they have limited ability to offset higher export costs. When these firms' profits fall below sustainable levels, they might be compelled to exit the U.S. market altogether, resulting in substantial revenue losses.

One solution for European pharmaceutical firms to avoid tariff-related costs is relocating production to the U.S. While this may eliminate the direct costs associated with exporting (f_{ni}), it does not address other challenges such as decreased market demand (B_n) or exchange rate effects that would otherwise benefit foreign exporters. Moreover, establishing new production capacity abroad can be time-consuming, capital-intensive, and logistically complex. These factors especially affect in the highly regulated pharmaceutical sector. In many cases, this strategy may not be feasible for small or medium-sized firms, thereby reinforcing the uneven revenue effects of tariffs across different types of exporters.

In the U.S. pharmaceutical market, Pharmacy Benefit Managers (PBMs) significantly influence pricing through direct negotiations with pharmaceutical companies and pharmacies. Due to their central role, PBMs may partially alleviate the negative impacts of tariffs for European pharmaceutical exporters. Graphs 2 illustrates that pharmaceutical sales and revenue growth in the U.S. have consistently outpaced those in Europe, highlighting the strategic importance of preserving access to the U.S. market despite the additional costs imposed by tariffs. The unique pricing dynamics and profitability potential within the U.S. market can allow European pharmaceutical companies to sustain profitable revenue streams despite these trade challenges.

As discussed in Chapter 2.2, research by Simanjuntak (2011) highlights that profits serve as a key source of funding for R&D investments. A potential exit from the U.S. market would reduce revenue and therefore negatively affect profits. This, in turn, leads to lower R&D investments, ultimately slowing pharmaceutical innovation and reducing the long-term profitability of firms. Simanjuntak (2011) further emphasizes that a decline in R&D intensity can have a compounding negative impact on future profits, and consequently, on revenue as well. If tariffs have a negative influence on the revenue of the company, it is likely to reduce R&D intensity.

Revenue implications for European pharmaceutical firms exporting to the U.S. depend on multiple factors, such as firm's productivity, PMBs' influence in the U.S. markets for pharmaceuticals and exchange rate fluctuations. For generic medicines with higher elasticity of substitution revenue losses are possible. On the other hand, patented medicines with low elasticity of substitution revenue will most likely increase. Generally, firms have an incentive to export to the U.S. markets due to strong market profitability for pharmaceuticals.

4.3 Welfare

The welfare implications of tariffs are usually evaluated through analysis which considers changes in consumer surplus, producer surplus, and government tariff revenue (Krugman, P. R., & Obstfeld, M. (2009)). As stated in previous chapters, tariffs raise domestic prices, which benefits domestic producers but harms consumers, leading to a net welfare loss due to deadweight loss. Welfare losses in international trade for exporting companies are connected to reallocation across firms and within-firm productivity growth (Melitz et al., 2019).

According to Melitz et al. (2014), free trade without tariffs can enhance welfare, especially when reductions in labour market frictions within the differentiated sector contribute to improved domestic welfare. This happens by expanding the size of this differentiated sector and reducing its differentiated-sector price index. Welfare is maximized when countries produce and export the differentiated products increasing the utility of economies of scale and therefore the productivity of firms. However, for countries that import these same products, the displacement of domestic producers in the same sector may reduce their welfare due to a contraction in domestic production and potential losses in employment and firm diversity.

Melitz & Redding (2014) also discuss how the welfare effects of trade liberalization can be offset by two opposing mechanisms: increased innovation and reduced expected profits. While lower trade barriers tend to stimulate innovation by expanding market opportunities, they can simultaneously reduce the profitability of entry, thereby discouraging new firm participation. This dynamic is further explored in the model by Atkeson and Burstein (2010), who demonstrate that the positive impact of trade-induced innovation may be neutralized by the decline in expected profits, resulting in a limited net effect of trade liberalization on long-term welfare growth. Moreover, Melitz & Redding. acknowledge that consumers in larger markets experience higher welfare levels due to increased product variety and lower equilibrium prices, reinforcing the benefits of expanded market access.

Utilizing the model, the effect of decreased number of pharmaceutical firms in the U.S. markets decreases the welfare for the U.S consumers. On the contrary, the U.S imposing tariffs, may enjoy higher government earnings. For European pharmaceutical firms, welfare may decline due to reduced incentives to innovate and differentiate products. If firms respond by relocating production to avoid tariffs, results could be negative for the exporting country in externalities, particularly in terms of employment and innovation capacity.

The traditional economic welfare framework becomes inadequate, when reductions in consumer surplus are critical to public health. Social welfare effects of the importance of R&D investments are discussed in Chapter 2.2. In addition to the barriers to the access of pharmaceuticals, tariffs can decrease revenue and result in decreased R&D investments slowing down medical innovations for life saving products. As Stevens and Banik (2022) argue, imposing tariffs on medicines may not only be economically inefficient but also ethically problematic, as they reduce access to essential treatments, disproportionately affecting vulnerable populations.

When evaluating consumer welfare, it is reasonable to assume that reduced access to life-saving medicines significantly decreases individual well-being. Standard models for analyzing trade barriers often fail to account for substantial welfare losses that arise when the traded good, such as patented, scarce medicine, is less substitutable than typically assumed. As Cutler and

McClellan (2001) emphasize, innovations in medical treatment have contributed significantly to increased life expectancy and improved quality of life, indicating that access to effective pharmaceuticals plays a central role in societal welfare. Therefore, trade barriers on medicine negatively affect not only pharmaceutical firms but also, and more critically, individual patients.

Globally reduced competition in the pharmaceutical sector could lead to diminished welfare outcomes, both overall and specifically for the U.S. consumers and European pharmaceutical companies. It is important to consider that the Trump administration's tariffs are justified as increasing consumer surplus and overall welfare in the U.S. However, the resulting price increases inevitably have adverse effects on individual welfare, particularly in sectors as vital as healthcare.

5 Conclusion

The purpose of this literature review is to predict the implications of potential trade barriers on the current trade dynamics between the U.S. and European pharmaceutical firms. The study combined an analysis of the structural characteristics of pharmaceutical markets with an economic framework for heterogeneous firms in international trade. The key contribution of this thesis lies in merging these two perspectives: by accounting for the special features of pharmaceutical companies and applying theoretical models of trade. Research analyses possible outcomes for pricing, revenue, and welfare in the context of future tariff scenarios. The existing literature on the consequences of tariffs mainly focuses on their general impact on the countries that impose them, or on specific cases such as tariffs on vaccines exported to emerging economies.

The findings presented in Chapter 4 highlight important differences based on product type. For patented medicines, which face low elasticity of substitution, European exporters are likely to maintain pricing power and pass tariff costs onto U.S. consumers as increased prices. Conversely, firms exporting off-patented (generic and branded) medicines with high elasticity of substitution, competitive pressure limits price hikes to ensure market access to the U.S. The most likely scenario is the exit of the European exporters and domestic producers still increasing the pricing of the generic medicines.

Revenue outcomes were analyzed using the Melitz et al. (2014) model, emphasizing that firm-level productivity plays a critical role in determining whether exporters can remain viable under new trade costs. Additional offsetting factors for the tariffs such as a stronger U.S. dollar and the influence of Pharmacy Benefit Managers (PBMs) keeping prices higher than in Europe may partially offset negative impacts and sustain market access for European exporters.

Welfare effects were evaluated in this thesis from both economic and ethical perspectives. In line with theoretical expectations, tariffs reduce welfare in both the exporting (EU) and importing (the U.S.) countries through higher prices, reduced competition, and lower incentives for innovation. Conversely, the U.S. government enjoys increased earnings from tariff payments even though those are paid from the U.S. consumers' pockets due to higher prices. An ethical perspective is important, because when tariffs affect essential medicines, the consequences extend beyond economic inefficiency to issues of public health and equity.

This study is also subject to limitations. Since pharmaceutical products have not previously been subjected to tariffs in the U.S., the analysis remains speculative and is based solely on existing literature, without original data analysis. The scope of the thesis is also relatively narrow, focusing primarily on the basic effects of tariffs in the context of pharmaceutical market characteristics. The specific dynamics of European export firms remain unclear, such as whether they primarily export patented or off-patented medicines, even though exported medicines from Europe to the U.S. in 2023-2024 included mostly patented medicines with some exceptions. (Reuters, 2025). This thesis analyzes both cases despite patented medicines being the most imported to the U.S.

In the future, if tariffs are imposed on pharmaceuticals, more accurate data is likely to become available, allowing for a more precise analysis of the implications for European pharmaceutical firms. This data can cover e.g., the Consumer Price Index (CPI) of the prescription and nonprescription medicines in the U.S. as well as data about the real effects of relocating production factories to the U.S. as a response to the tariffs. For pharmaceutical companies studying how R&D pipelines and innovation strategies adapt during periods of uncertainty or trade restrictions could yield valuable insights into the resilience of the sector.

As the threat of tariffs for European pharmaceutical firms remains relevant, and general tariffs on exports appear likely, the U.S. is expected to face the issues analyzed above. In particular, the economic implications for the U.S. will likely play a key role in determining whether such tariffs will continue under future administrations. Ultimately, what happens in the U.S. will have consequences far beyond its own borders.

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AI Disclosure

In this thesis, I used Open AI's ChatGPT 4.0 for checking grammatical errors in the text. All content was created by the author, Anne Karvonen.