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Bachelorthesis

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Titel:

„The Future of Transatlanticism – Effects of a Rise of US Import Tariffs on Exports in the German Automotive Sector “

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Abstract

The promotion of low tariffs and free trade has been the underlying driver of global economic growth for the past decades. The recent political development in the United States and Great Britain calls into question, whether free trade will be supported by the governments of the industrialized world in the future. Shortly after being inaugurated in 2017, the President of the United States – Donald Trump - has repeatedly announced his plans to impose punitive tariffs on the import of foreign products in order to protect the country's domestic economy. Besides a controversial border adjustment tax, he has frequently brought up the possibility of imposing a 35% tariff on automobile imports.

This bachelor thesis aims to describe the theoretical background of import tariffs and analyze the effects of such a tariff on trade in the automotive sector between the United States and Germany as well as on German automobile manufacturers. Based on a theoretical literature research and international trade data from the United Nations, it will give theoretical insights into the effects of tariffs in general as well as specific implications for the automotive sector. The thesis will further analyze the importance of automotive trade between Germany and the United States. Finally, the paper will take a quantitative approach and draw a conclusion about the relationship between import tariffs on automobiles and passenger vehicle imports from Germany to the US utilizing a fixed-effects regression model based on panel data.

The model will find a significant negative correlation between the examined variables, but even in a worst case scenario, German manufacturers are resilient to the predicted revenue losses caused by a tariff increase.

Key words: International Trade, Transatlantic Trade, Tariffs, Automotive Trade, Protectionism, Fixed Effects, Least Squares Dummy Variable, Panel Data

JEL classification: C23, C53, F02, F13, F17

I. Outline

II. List of abbreviations

BAT	Border Adjustment Tax
EBIT	Earnings Before Interest and Taxes
FDI	Foreign Direct Investment
FE	Fixed Effects
FTA	Free Trade Agreement
GDP	Gross Domestic Product
LSDV	Least Squares Dummy Variable
NAFTA	North American Free Trade Agreement
OICA	Organisation Internationale des Constructeurs d'Automobiles
OLS	Ordinary Least Squares
R&D	Research & Development
SUV	Sport Utility Vehicle
TPP	Trans Pacific Partnership
TTIP	Transatlantic Trade and Investment Partnership
UN	United Nations
US	United States
VER	Voluntary Export Restraint
WTO	World Trade Organization
WWII	World War 2

III. List of figures and tables

1. Introduction

1.1. Relevance

"If you go down Fifth Avenue everyone has a Mercedes Benz in front of his house, isn't that the case? How many Chevrolets do you see in Germany? Not very many, maybe none at all ... it's a one-way street."
- Donald J. Trump, 2017

During his election campaign, Donald Trump's rhetoric and positions on international trade seemed far-fetched and differed fundamentally from previous mainstream liberal policies: He claimed that China was "raping" (Trump in Diamond, 2016) the United States (US) with its high trade surplus and that international free trade agreements (FTA) such as the North American Free Trade Agreement (NAFTA), the Trans-Pacific Partnership (TPP) and even the World Trade Organization (WTO) were a "disaster" and "job killers" (Trump in Freund, 2017, p. 64). His views have not fundamentally changed since he took office. While it is not yet clear, what exact policies his administration will produce, it is more than likely that he will continue with his hostile position towards international trade. At best, his presidential actions will cause a period of stagnation in global trade and at worst lead to mutual retaliation, the termination of multilateral trade agreements and a return to tariff levels unseen since the Kennedy Round in 1964 (Erixon & Lee-Makiyama, 2016, p. 1).
In Mr. Trump's view, the trade balance is the main metric to evaluate a country's success on the world market (Freund, Trump's Confrontational Trade Policy, 2017, p. 64). From this perspective the US is losing since it is running a large deficit and countries that run trade surpluses, such as Germany or China, are the winners of global trade. To fight this injustice, and to balance the large trade and public deficits of the US, the Republican Party has brought up the possibility to impose a general 20% border adjustment tax (BAT) in order to limit imports to the US and boost exports to global goods markets (Freund, 2017, p. 63). However, economists argue, that this BAT-model will be offset by an adjustment of the exchange rate since it works as an export subsidy for domestic producers as well as a blanket import tariff for all imports (Becker & Englisch, 2017, pp. 105-107). Also, President Trump himself has called this

tariff model “too complicated” (Trump in Freund, 2017b), suggesting that he prefers a different approach to mitigate the impact of the trade deficit. This statement makes the ratification of a BAT rather unlikely (Dullien, 2017, p. 164).

As reflected in the initial quote and according to several authors, it is more probable that Mr. Trump will impose a more selective protectionist tariff on the automotive sector since he repeatedly mentioned the option of taxing the import of automobiles. With this proposed tariff, Mr. Trump aims not only to balance trade and public deficits but also to protect the supposedly declining domestic industry (Kolev & Puls, 2017, p. 1; Dullien, 2017, p. 163; Klodt, 2017, p. 167).

It is likely that a selective protectionist tariff will harm the US’ general economy, specifically its globally interconnected automotive sector, and face strong opposition from US industry and Congress as well as provoke international and WTO retaliation. Despite these obstacles, the unpredictability of the new US government makes an attempt to implement one of these measures entirely possible. Additionally, the *International Emergency Economic Powers Act of 1977* enables the President of the US to implement tariffs and other import restrictions via a decree – that is, if the supreme court does not object, without consulting congress. This would enable Mr. Trump to follow through with actions that could significantly disrupt international business, affect global trade flows and cause economic losses for the US as well as its trading partners. (Dullien, 2017, p. 165).

The effects of the implementation of such a tariff in the US will be examined in this paper. Particularly, focus will be laid on the implications for German manufacturers and the German export-oriented automotive industry~~.~~

1.2. Research problem

The German economy heavily relies on exports for jobs and income generation, particularly so in the automotive sector (MacDougall, 2016, p. 5). Meanwhile, the US is the largest importer of automobiles in the world and Germany’s biggest export market (Kolev & Puls, 2017, p. 2). Both countries are connected by a strong trade relationship. Due to current political affairs, it is possible~~,~~ that this economic relationship will be impaired by the future imposition of US import tariffs.

The aim of this paper is to describe and evaluate the effects of a rise in US import tariffs on German automotive exports. This paper will quantify if and to what extent different scenarios of US import tariffs on automobiles will lead to a change in German passenger vehicle exports to the US.

In the fulfillment of the research objective, the paper will start out by describing tariffs' common effects on a country and its trading partners. Additionally, to provide a better understanding of the topic, a historical review of US policies in the sector will be undertaken. Next, international automotive trade in general, as well as the trade relationship between the US and Germany in particular, will be analyzed. To conclude the analysis, a quantitative regression model will be developed and applied in order to assess the effects of a change in US tariffs on German exports. Lastly, limitations and further effects of a potential tariff implementation will be discussed.

1.3. Course of investigation

As described in the previous paragraph, the aim of this paper is to describe and evaluate the effects of a rise in US import tariffs on finished passenger vehicles, with a particular focus on the effects on German exporters.

Therefore, the paper will first describe the theoretical background necessary to assess the general functioning of tariffs. Economically, the US is a large economy, the thesis will therefore focus on the effects of a tariff in a large country setting. Furthermore, it will describe the characteristics of the automotive industry and analyse international trade patterns in this particular sector. Moreover, historical insight will be given on the impact of US automobile import restrictions implemented in the 1980s under President Reagan.

Secondly, the trade relationship between Germany and the US will be examined. This chapter will focus on the characteristics of the automotive industry in both countries, the automotive trade between them as well as flows and stock of Foreign Direct Investment (FDI). It will also describe recent developments and trends in the automotive sector that are shaping industry-composition and future development.

Thirdly, a quantitative approach will be taken to determine the effects of a rise in US import tariffs on German manufacturers and exporters. Based on panel data obtained from various United Nations (UN) databases, a least squares dummy variable (LSDV) regression model with fixed-effects (FE) will be created with the help of the software

R Studio. The weighted average applied import tariff on automobiles will be correlated with the share that automobile imports hold of the importer's Gross Domestic Product (GDP). The model will then be applied to draw a conclusion on if and to what extent the tariff could reduce German exports to the US. The chapter will also give insight on secondary and long-term effects that might be triggered by a rise in the automobile import tariff.

In the last chapter, the findings of this paper will be summarized and a conclusion will be drawn while considering the limitations of the analysis.

2. Theoretical and historical background

2.1. General effects of a tariff

Since the end of World War II, the developed nations of the world have strived to create a global environment to promote freer trade, facilitate international investments and create economic interdependence between countries in order to increase economic growth and prevent the occurrence of another world war. The rise of nationalistic politicians and thus the outbreak of WWII had partly been linked to the unexpected and detrimental economic consequences of a global trade war in the 1930s. At that time, governments around the world had erected trade barriers and implemented nationalist isolation policies in retaliation for the passing of the Smoot Hawley Tariff Act in the US, causing worldwide economic hardship and giving ground to populist politicians' views (van den Berg, 2017, pp. 234-238). The effects of tariffs in the long and short term are better understood nowadays and will be discussed in this chapter.

In general, tariffs are taxes imposed on imported goods and services (Sawyer, 2017, p. 117). By definition, they will raise the domestic price of an imported good by the tariff amount that could either be *specific* – meaning that for every unit of an imported good a fixed value is charged – or *ad valorem* – meaning that the tariffs value is calculated as a percentage of the monetary value of the imported good (Pugel, 2016, p. 137). The government will collect the tariff and thereby create public revenue to be used for public expenses. According to several authors, this is particularly relevant for smaller developing countries that struggle to raise public revenue by way of direct or indirect domestic taxes (Sawyer, 2017, p.123; Appleyard & Field, 2017, p. 322).

For domestic consumers, the tariff raises the price of the imported good, and - dependent on the price elasticity of demand - reduces the quantity demanded. Products with a high price elasticity of demand are easier to substitute, therefore the quantity demanded will shrink more than for products that have inelastic demand. Domestic producers not affected by the tariff can now increase their own prices, gain a larger market share compared to the competition from abroad or both (Pugel, 2016, p. 140). The nation as a whole is suffering reduced total welfare. The consumers are paying the price of the tariff by way of higher prices and a reduced quantity sold on the market and are losing part of their consumer surplus. What is lost on the consumer's side gets partly offset by the revenue raised by the government through the tariff income and the welfare gains on the domestic producer's side who are able to collect higher profits through the increased prices. The remainder of the reduction in consumer welfare that is not redistributed to producers or public revenue is the deadweight loss and represents the net cost of the tariff to society (Appleyard & Field, 2017, pp. 282-285).

The above-mentioned effects are the case for a small economy that acts as a price taker on global markets. Small countries always experience deadweight loss upon the imposition of a tariff (Appleyard & Field, 2017, p. 285). For a large economy such as the US slightly different mechanics apply, especially if the large economy holds a big share of a specific product market. In 2015, the US accounted for more than 25%[1] of all automobile imports that were traded internationally. Therefore, they count as a large economy that has a significant influence on global prices and demand, particularly in the automotive sector. This means, that a decrease of demand for automobile imports to the US due to a domestic price increase following the imposition of a tariff would negatively influence the world price for cars by forcing dependent exporters in other nations to lower their export prices in order to maintain sales. In this case, the tariff is said to have a terms-of-trade effect (Pugel, 2016, p. 152).

Notably, in this large country setting, not only the domestic consumers shoulder the burden of the tariff, but it is partly shifted to foreign producers that accept a decline in their export price to maintain a high export quantity. The implementation of a tariff by a large country can therefore be seen as a "beggar-thy-neighbour" policy (Appleyard & Field, 2017, p. 325).

Who bears how much of the overall cost of the tariff is again determined by the elasticities of demand and supply and called the tariff incidence. Whoever has the lower elasticity is going to bear the larger share of the tariff's burden. If the domestic elasticity of demand is high – maybe because there are many goods available for

[1] Own calculation based on data retrieved from the WTO TRAINS database:
Global HS8703 Automotive Trade in 2015 (in million US$): 673,864.9
US HS8703 Automotive Imports 2015 (in million US$): 169,138.9
169138.9 ÷ 673864.9 = 0.251 => ~25%

substitution – domestic consumers will bear a lower share of the tariff's cost. Reversely, if the exporters elasticity of supply is low – as it is in the complicated and capital intensive production of automobiles (American Automotive Policy Council, 2016, p. 4) – the foreign exporter is less flexible when it comes to scaling production and as a result he is going to pay a larger share of the tariff's cost. In a small country setting, the elasticity of supply is perfectly elastic as the quantity of imports of the small country is insignificant to the world market and does not influence the price. Here, the small countries' consumers bear the entire burden of the tariff (Appleyard & Field, 2017, p. 295).

The effect on the large country's welfare following the imposition of an import tariff does not need to be negative. Because the large country can influence the world price through its market power, there can be a nationally optimal tariff that creates a net gain for the imposing country at the cost of its trading partners (Pugel, 2016, pp. 152-154). The lower the foreign supply elasticity, and the higher the domestic elasticity of demand, the higher is the optimal tariff to maximize national welfare. If the elasticity of supply from the foreign producer is low, then he would have to accept lowering his prices since he is dependent on the demand coming from the large country. For the large country, there can then actually be a deadweight gain as the price decline plus the public revenue that stems from the tariff outweigh the welfare loss on the consumer's side (Appleyard & Field, 2017, p. 304). Although the large country gains through the tariff, for the world as a whole, the tariff is still causing an overall deadweight loss. The tariff is also always resulting in a decrease in the quantity of the imported good, lowering the exports of the trading partner (Pugel, 2016, p. 155).

As illustrated by the historic example in the beginning of the next chapter, the imposition of tariffs could backfire and damage the economy of the protectionist country, even if it is a large one. Potential adverse effects include consumer welfare loss and foreign retaliation through the imposition of countervailing tariffs that harm the exports of the country that initially implemented the tariff. This behavior is setting the stage for a trade war that damages all world economies (Pugel, 2016, p. 156).

With respect to the objective of this thesis, the findings of this chapter allow to expect a decline in automobile imports from Germany should the US raise their import tariffs above the current level.

2.2. Motivations to impose a tariff in the US

The passing of the protectionist Smoot-Hawley Act in the US in 1930 – motivated by the desire to stabilize a slowing domestic economy and to create jobs –caused international global trade to collapse by more than 70% within just 3 years (van den Berg, 2017, p. 235). Finally, it left every country in the world worse off and exacerbated the economic downturn in the US massively (Sawyer, 2017, pp. 174-178).

Although unintended in its effects, the example of the "Smoot-Hawley Disaster" (Sawyer, 2017, p. 174) illustrates the intentions and motives behind the imposition of tariffs and the potential side effects they can have on the national as well as global economy. In the US of today, the ideas that once fuelled the imposition of tariffs in the interwar period have come back to the political agenda.

One of the most frequently brought up arguments for trade restrictions is the creation or protection of jobs (Mankiw, 2012, p. 182). Also, for the Trump administration, this argument is the politically most important and a pillar of their argumentation to implement tariffs (VanGrasstek, 2016, p. 3). They claim, that "Free Trade and Globalization [are] Designed to Screw Workers" (Lighthizer in Baker, 2016). Rather than protect low paying jobs, workers should be aided to successfully transition into better paying and internationally more competitive sectors (Irwin, 2015, p. 139). Tariffs or export subsidies are not going to stop the macroeconomic forces that cause the loss of jobs in the coal or automotive sector due to automation. They can only slow down this development at the expense of the overall national welfare. If senile or aging industries don't adapt and modernize, they are inevitably dying out or moving abroad where they can still be operated profitably (Sawyer, 2017, p. 127).

Furthermore, low-income households would be the ones to shoulder the biggest share of the cost of an import tariff. A recent report by the National Foundation for American Policy has calculated that a general tariff against all trading partners of the US would cost households in the lowest income decile up to 53% of their annual income (Tuerck, Bachmann et al., 2016, p. 2). An import tariff will evidently not counteract the underlying problem of slow economic growth and discontent in the working class, but is merely a political move to keep Trump's low-income voter base happy (VanGrasstek, 2016, p. 5). Trump had though dismissed the arguments that his proposal would hurt consumers, arguing that it would be offset by the jobs created in the import competing sectors he wants to protect (Tankersley, 2016).

Another popular argument for trade protection is the unfair-advantage or currency-manipulation argument (Mankiw, 2012, p. 186). Trump argues, that an unfair currency evaluation is working like an export subsidy thus making foreign goods cheaper on the world market, undercutting the prices of American producers and making them worse off (Lawder, 2017). Particularly China is under suspicion to manipulate its currency, but also Germany was accused of using the “grossly undervalued euro to exploit the US and its EU partners” by Trump’s Top advisor Peter Navarro (Donnan, 2017, p. 2). As understood by economists however, devaluating a currency works like implementing an import tax as well as export subsidy and would therefore have no long-term effect on global trade flows of exports and imports (Staiger & Sykes , 2010, pp. 592-597).

The third major factor that motivate the new US administration to threaten the imposition of tariffs and trade restrictions is that he can use them as bargaining chips in negotiations with other countries (Mankiw, 2012, p. 186). VanGrasstek from the Harvard Kennedy School (2016, p. 5) compares his tactics to a tale about Stalin’s tax policy. Stalin was supposed to have ordered a tax increase on the peasantry as well as the requirement to keep a goat inside their living room. When he revoked the order to keep the goat, everybody was so relieved, that they forgot about the tax increase. Trump might be inclined to use the US market power in this scare tactic to make the US partners voluntarily accept restrictive measures in order to avoid the outcome of an imposition of even higher tariffs (VanGrasstek, 2016, p. 6). As will be discussed in the next chapter, the US have already used this tactic successfully in order to protect their automotive industry from Japanese competition in the 1980. Back then, the Japanese government accepted a voluntary export quota in order to prevent the imposition of import tariffs on the side of the US.

2.3. Voluntary Export Restrictions on automobile exports from Japan

After having experienced a turbulent period in the 1970s and facing massive losses in 1980, the big American automakers were struggling to compete with Japanese imports. Due to their importance for the US-economy and domestic employment, the government stepped in and negotiated measures to protect the industry and keep it in business (Tong & Bures, 2003, p. 51).

Under the General Agreement on Tariffs and Trade (GATT), individual nations are not allowed to unilaterally impose general tariffs. Doing so could result in a lawsuit before international courts or the imposition of countervailing tariffs by other countries. Therefore, the US resorted to the negotiation of a voluntary export restraint (VER), where Japan voluntarily agreed to limit its automobile exports by way of a maximum quota that limited them to a fixed number of units per year (Crandall, 1987, pp. 272-274). It is possible, that the Japanese government agreed to the proposition of the Reagan administration in order to avoid measures that could have hurt the Japanese economy even more (van den Berg, 2017, p. 203).

The VER agreement limited vehicle imports from Japan to 1.68 million units per year. This number was raised to 2.3 million per year after the recession in the US ended in 1984 and stayed in place until 1994 (Tong & Bures, 2003, p. 56).

From an economic perspective, quotas and tariff have the exact same effects on trade and welfare. Both reduce the amount of imports, increase the price of the good on the domestic market, lower domestic consumers' welfare while raising domestic producers' welfare, all at the expense of causing deadweight losses in the overall economy. If the government sells the import quantity-limiting import licenses issued under such a quota scheme, they generate the same amount of public revenue that they would have gained through a tariff (Mankiw, 2012, p. 179). In the case of the VER agreement with Japan, the US administration let the Japanese government allocate the permits to the Japanese firms. The surplus from the licenses therefore accrued to the Japanese manufacturers and raised their profit. This made the agreement worse from the standpoint of the US since the government was not able to raise public revenue in order to partly offset the welfare loss experienced by consumers (Berry, Levinson, & Pakes, 1995, p. 35). This might have been one aspect of the deal that persuaded Japanese officials to voluntarily accept the agreement.

On the short term, the VER-agreement had a significant positive impact on the US auto industry. Not only was the amount of imports from Japan down but the domestic prices of Japanese automobiles rose, making them less competitive on the consumer market. The price of US-made cars rose as well, enabling manufacturers to realize higher profits (Crandall, 1987, p. 276). In the same time, US manufacturers were able to significantly reduce their break-even point through increased labor and resource productivity. These effects streamlined the businesses' operations and manifested the automotive industry as a backbone of the US economy (Tong & Bures, 2003, p. 57). Another scholar explains though, that the beneficial development might be partly attributed to business cycle rebound and capacity retirement effects rather than the import restriction itself (Crandall, 1987, p. 283).

On the long run, these short-term benefits for US manufacturers were far outweighed by significant long-term impairments in competitiveness for American carmakers. Through the decrease in competition and higher prices on the domestic market, the competitive position and incentives to innovate for US manufacturers were persistently impaired (Hüther, 2017, p. 159)

Japanese firms responded to the agreement by changing their export strategy to more luxurious cars in the upper price segment. By doing this, they could optimize their revenue that was limited only by the number of units they could send to the US and not by their value. This change from small and relatively cheap cars to larger and more opulent models greatly improved the Japanese manufacturers' brand images in the US consumers' mind (Tong & Bures, 2003, p. 56). Since the VER-agreement did not apply to cars manufactured on American soil, the Japanese also accelerated existing FDI projects in the US and started planning new production lines (Benjamin, 1999, p. 17). This integrated them with the domestic business cycle of the US and created a large amount of jobs that generate sustainable income for American workers (Crandall, 1987, p. 288). The current US-administration is expecting similar effects upon the imposition of another import tariff in the automotive sector.

US consumers – and here mostly low-income households that were purchasing cheap Japanese cars - were the ones to pay the cost of the quota. As calculated by Berry et al. (1995, p. 25) from the National Bureau of Economic Research, the average prices for Japanese cars rose by 1775 US$. These price increases amounted to an overall welfare loss that peaked at 5 billion US$ in the year of 1984 and amounted to over 15 billion US$ over the timespan of the agreement[2] (Crandall, 1987, p. 287).

As described in this chapter, tariffs and other trade restrictions such as voluntary export quotas can be used to redistribute income between different economic actors, for example between producers and consumer or even with a foreign trading partner. While a redistribution of income can be politically desired, a trade restriction reduces the overall economic welfare of the participants and therefore leaves the world as a whole worse off. There might also be more persistent effects that have detrimental long-term effects on the imposing country's economy.

[2] In today's prices, this would amount to 36.6 billion US$.
Consumer Price Index of 244.52 as of April 2017 with base year 1982. Retrieved from US Bureau of Labor Statistics (https://www.bls.gov/cpi/ on the 05/06/2017).
15 billion US$ × 2,4452 = 36.6 billion US$

3. The US-German trade relationship in the automotive sector

3.1. Developments, characteristics and trends in global automotive trade

Since the invention of the Automobile in the late 20th century, automobile production around the world has risen steadily. For the first time in history, it surpassed the mark of 70 million produced passenger vehicles in 2016. Calculated from data published by the International Organisation of Motor Vehicle Manufacturers (OICA, from French: Organisation Internationale des Constructeurs d'Automobiles", 2017) on their website, the average annual growth rate of automobile production has been 3.56% between 2000 and 2016[3].

The economic crisis of 2008-09 has been more severe for the automotive industry than for any other industry except construction and finance (Van Biesebroeck & Sturgeon, 2010). While manufacturers experienced declining sales during the crisis worldwide, the US automobile industry suffered losses during this period in particular. High gasoline prices shifted demand away from their large and inefficient models towards more fuel-efficient imports from Germany or Japan (La Botz, 2008).

In the years after the crisis, global automobile production quickly recuperated the losses of the previous years. While automotive sales had declined a total of 19.5% in 2008 and 2009 (Pavlínek, 2015, p. 21), production quickly gained pace in 2010. According to OICA, production was more than 10 million units higher in 2010 than in 2009 which corresponds to a growth rate of more than 22% compared to the previous year and lies far above the average for the period between 2000 and 2016 (OICA, 2017).

This example illustrates the strong business cycle sensitivity of the automotive industry. In the saturated markets of the industrialized world, automobile purchases are characterized by replacement demand (Pavlínek, 2015, p. 22). Contrary to the expanding markets in emerging countries, where many first time buyers are purchasing cars, consumers in the developed world tend to postpone the expenditure to buy a new vehicle in times of economic uncertainty (Dicken, 2011, p. 114). This

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[3] Global automobile production 2000: 41,215,653
Global automobile production 2016: 72,105,435
Average growth rate = 3.56 % annually

characteristic in conjunction with fewer consumer credits to fund the purchase of new cars caused sales to decline stronger in developed countries during the crisis. Emerging markets and the BRIC-Countries also saw demand growth slowing down during the crisis years of 2008 and 2009 but experienced no absolute decline in sales (Van Biesebroeck & Sturgeon, 2010, pp. 231-232).

The stronger resilience of emerging market growth against business cycles fluctuations together with their expanding market size and many new buyers are features that shifted the growth focus of the automotive sector to countries like China, India and Brazil. Already in 2009 China overtook Japan as the largest manufacturer of automobiles (OICA, 2017), but also sales and imports from foreign brands are rising fast. The following graphic illustrates the rising importance of China and other emerging markets for global passenger car sales.

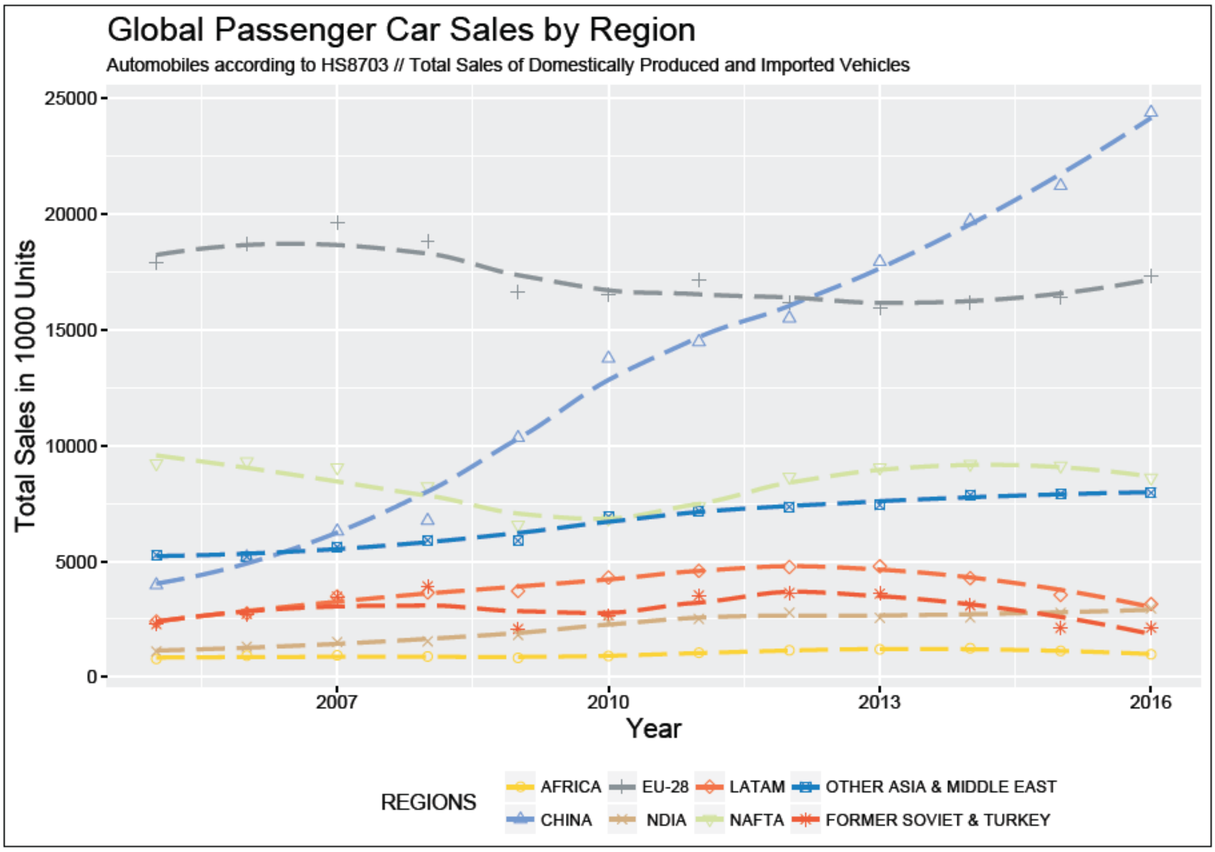

Figure 1: Global Passenger Car Sales (excluding light trucks and light commercial vehicles); Source: Own calculation and presentation based on data from OICA (Organisation Internationale des Contructeurs d'Automobile, 2017)

The graphic shows the development of total passenger car sales by regions in the years from 2005 to 2016. While the European and North American markets experienced declines in the years after the financial crisis, emerging market economies were able to sustain sales growth, if so at a slower rate. China overtook Europe as the largest market for passenger vehicles in 2013 and remains on course to increase its lead in the coming decade. Last year, almost 25 million new passenger cars have been sold in China. While domestic Chinese manufacturers are covering the largest share of the market, German manufacturers were able to increase their sales in China by 17% in 2013 making it their biggest growth market worldwide (Fuß, 2013, p. 17). Also, India and the other Asian economies are steadily growing if so at a lower level than China. While sales figures in Europe and the North American market stagnate, Asia has the potential to sustain global sales growth in the coming years.

Although market growth for conventional gasoline powered vehicles has mainly shifted to emerging markets, industrialized countries like Germany and the US remain centers for innovation in the area of future mobility trends such as alternative propulsion technologies or autonomous driving (Wissmann, 2016). These trends contribute to reducing the carbon footprint of traffic and can help to slow down climate change. According to Rachael et al. (2015, p. 21) the lifetime global emissions for an electric vehicle - including manufacturing of components including the battery, end of life recycling as well as operation – is less than half that of a conventional vehicle – and that even if the electric car's power is supplied by a conventional coal fired power plant. Using renewable energy to charge the electric vehicle reduces lifetime emissions compared to a same-sized car with a gas engine by up to 90 percent (ibid., 2015, p. 27).

Other trends in the individual mobility sector such as car-sharing or interconnected and autonomous driving will decrease the environmental impact of transportation further, increase safety and efficiency of transport while at the same time creating jobs and growth opportunities for manufacturers (Wissmann, 2016). According to the Association of the Automobile Industry, Germany is the global technological leader in the sector of autonomous and interconnected driving. (Verband der Automobilindustrie, 2016, p. 122).

Concluding this chapter, Asia has become the most important market for new passenger cars with sales growth far exceeding those of industrialized nations. The US and Europe have stagnated in terms of sales volume but remain leaders in technological innovation and alternative propulsion technologies.

3.2. Global Value Chain composition in the automotive industry

Automotive sales in a country consist of domestically produced as well as imported passenger vehicles. While the high value and technological input of the product demand a consolidation of production in order to exploit economies of scale, the large size and weight call for regionalized production of the final product to reduce transport costs (Argueta, 2014, p. 5). The trade-off between these two influencing factors defines the global industry structure and value chain composition in the automobile industry.

In various publications, Sturgeon and Van Biesebroeck argue that the automotive industry is neither fully global nor fully local (2008, p. 302; 2009, p. 2; 2010, p. 210). Instead, the degree of internationalization varies at the different stages that constitute the automotive value chain. The industry has shifted from separate national industries to a more integrated global industry while maintaining strong regional patterns at the production and assembly level (Lung et al., 2004, pp.23-42).

This regional integration of the production process is motivated by various factors. Market saturation and a high level of motorization have driven automakers to disperse their final assembly. Another factor that motivated automakers to produce more local is the political pressure put on them since the 1980s to "build where they sell" (Sturgeon & Van Biesebroeck, 2009, p. 2). In countries that have an automobile industry of their own, the political will to protect or subsidize the automotive sector is high and can be compared to sectors like energy, agriculture or military equipment (Sturgeon, Van Biesebroeck, & Gereffi, 2008, p. 312).

International lead firms in the automotive sector have responded by setting up final assembly plants in many of their major foreign markets. Many suppliers of automobile parts followed the lead firms move and established their factories close to the final assembly lines. Humphrey and Memodovic named this process "follow-sourcing" where the largest suppliers follow their customers abroad with own investment (Humphrey & Memodovic, 2003, p. 13). Model specific or heavy and large parts are produced in close proximity to the assembly plants in order to assure timely delivery. Other, more generic parts are also produced at distance in order to exploit economies of scale and location factors such as low labor costs (ibid., 2009, p.3). As a result, automotive parts are traded more heavily between world regions than finished vehicles (ibid. 2010, p 208). Passenger cars exported from Germany comprise mostly of expensive vehicles in the executive and luxury categories. For these manufacturers, it is still feasible to exploit economies of scale by producing domestically and then export the finished vehicles globally. This is the case because in high-value automobiles, transport costs make up a smaller share of the total vehicle value (Kolev & Puls, 2017, p. 4).

Recently, a shift of investment towards locations with lower production cost within the vehicle producing regions started to occur. In the US, production is moving to the southern states and Mexico, in Europe towards Spain and Eastern Europe (ibid., 2010, p. 209). This development caused the political voice for a more national production to get louder under President Donald Trump. He sees automobile imports as undermining the American manufacturing industry and threatens a tariff on imports from Mexico (Dullien, 2017, p. 163). Interestingly, Sturgeon and van Biesebroeck argue that it is the regional lead firms, using their regional expertise, that are pushing the shift towards lower cost locations within the main automobile regions (i.e. Chrysler and General Motors are outsourcing to Mexico and Volkswagen is investing in Eastern Europe). Foreign firms' direct investment remains concentrated in the main production centers of the host markets (i.e. Volkswagen investing in the Southern US) (Van Biesebroeck & Sturgeon, 2010, p. 209).

Contrary to the development in the production stage, the development and design stages have experienced the least internationalization and remain concentrated in specialized clusters such as Detroit, Tokyo or Southern Germany (ibid., 2010, p. 208-210). Manufacturers are trying to leverage economies of scope by centralizing design and development near their headquarters and serve all of their regional markets from there. To cope with the requirements of differing consumer preference and characteristics in other markets, affiliated design centers have been created in large foreign markets, that support the headquarters in the design of country specific product features but otherwise take a subordinate role in research and development activities (ibid. 2008, p. 303).

As a result, the regional value chains of the worldwide automotive industry that assemble final vehicles can be seen as embedded sub-chains nested the globally centralized activities of automotive research, engineering and design of the vehicles. The regional production, assembly and trade of passenger cars is generally more important than the intercontinental trade of finished automobiles, although both play a major role in many countries' economies (Argueta, 2014, pp. 5-8). As will be discussed in chapter 3.5, FDI in the automotive sector also plays a major role in the German-American trade relationship. Please also refer to Annex 1.3 for a modeling of the interdependency between automobile imports and exports.

3.3. The automotive industry in Germany and the US

Both Germany and the US are countries where the automotive industry is of particular importance to the national economy. In 2015, the German automotive sector had a total turnover of 404 billion US$ (MacDougall, 2016, p. 3) which accounts for approximately 12% of German GDP[4]. Japan is the only other large economy that has a comparably high exposure of GDP to the automotive sector. In the US, automotive is the biggest and most important manufacturing industry.
In percentage terms, the US automotive industry accounts for roughly 3% of GDP (American Automotive Policy Council, 2016, p. 5). This is a lower percentage than in Germany, but due to their large GDP figure of more than 18 trillion US$[5] and big domestic market the industry turnover is estimated at more than 500 billion US$ yearly (ibid., 2016, p. 6).

When looking at the absolute market size, the US had sales of 7 million passenger cars in 2015. On top of that, there were almost 10 million sales of so called light trucks (Pickups, Sport Utility Vehicles (SUV), Vans). These larger but less fuel-efficient vehicles are very popular in the US (Verband der Automobilindustrie, 2016, p. 17). In international trade, light trucks play a subordinate role because of their large size and therefore reduced transportability as well as a 25% import tariff in the US that had been signed into law by President Johnson in the 1960s. (Talbot, 1978, p. 37). The import tariff for regular passenger cars in the US is only 2.5%[6], therefore passenger cars are more frequently imported and light trucks almost exclusively manufactured

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[4] Automotive sector turnover 2015: 404 billion US$
Germany GDP 2015: 3,356 billion US$
404 ÷ 3,356 = 0.1203 => 12%
[5] Figure taken from the UNCTAD dataset used in the quantitative analysis of chapter 4.
US GDP in 2015: 18,139,554 million US$
[6] WTO TRAINS database, HS8703, retrieved 15.05.2017

domestically.
In both countries, the automotive sector is one of the biggest employers. In Germany and the US, automakers directly employ 792,500 (ACEA, 2013, p. 32) and 943,200 (Bureau of Labor Statistics, 2016) respectively. When counting jobs created indirectly, at supplier companies and other dependent spin-off employment, the employment number rises to more than 7 million jobs in the US (American Automotive Policy Council, 2016, p. 16).
The automobile and automobile parts industry ranks third when comparing global Research & Development (R&D) expenditure of major industries. Only the pharmaceuticals and technology hardware sectors are spending more (Hernández et al., 2014, p. 49). From the global automotive R&D expenditure of 85 Billion US$ in 2013, 14 billion (16.5%) occurred in the US. In the EU, 42 billion US$ were spent with the largest share attributable to Germany. Here 21 billion were spent on automobile R&D in the country, with Volkswagen spending more than half of the amount (11.7 billion US$). This makes Germany the biggest spender on automotive R&D and Volkswagen the largest R&D spender of all private corporations worldwide (ibid, 2014, pp. 3, 49). German Automakers also spend another 16 billion US$ on research and development in their dependencies abroad (MacDougall, 2016, p. 12).
These numbers underline Germany's innovation leadership in the area of automobiles and its significance as the world's premium car production hub (MacDougall, 2016, p. 4). A recent study by Ernst & Young comes to a similar conclusion and also ranks Germany as the world leader in technological innovation and product quality for automobiles (Fuß, 2013, p. 15) This leadership in technology and innovation could be one of the aspects that make German car brands so popular as a status symbol around the world (MacDougall, 2016, pp. 5, 13).
According to the report published by the German Trade and Invest Association (2016, p. 3) around 79 percent of passenger cars produced in Germany in 2015 were ultimately destined to be exported. For the US the export share only amounted to 23% of production (American Automotive Policy Council, 2016, p. 7).
Summarizing this chapter, The US, as well as Germany, have large and automotive sectors that constitute significant shares of their economies. While the US industry is more focused on production for the domestic market, the German manufacturers

heavily rely on exports in the high-value premium segment.

The next chapters will examine how the industry characteristics – Germany's heavy export reliance and the large US consumer market - influence the trade relationship and foreign direct investment flows between the two countries.

3.4. Automobile trade between Germany and the US

Due to their quality, reliability and image, German products are very popular around the world and in the US (Kolev & Puls, 2017, p. 4). This is also true for automobiles. Around 10% of the total automobile production in Germany was exported to the US in 2015. These exports predominantly consist of models in the high-value premium and luxury segments (ibid, 2017, p. 2).

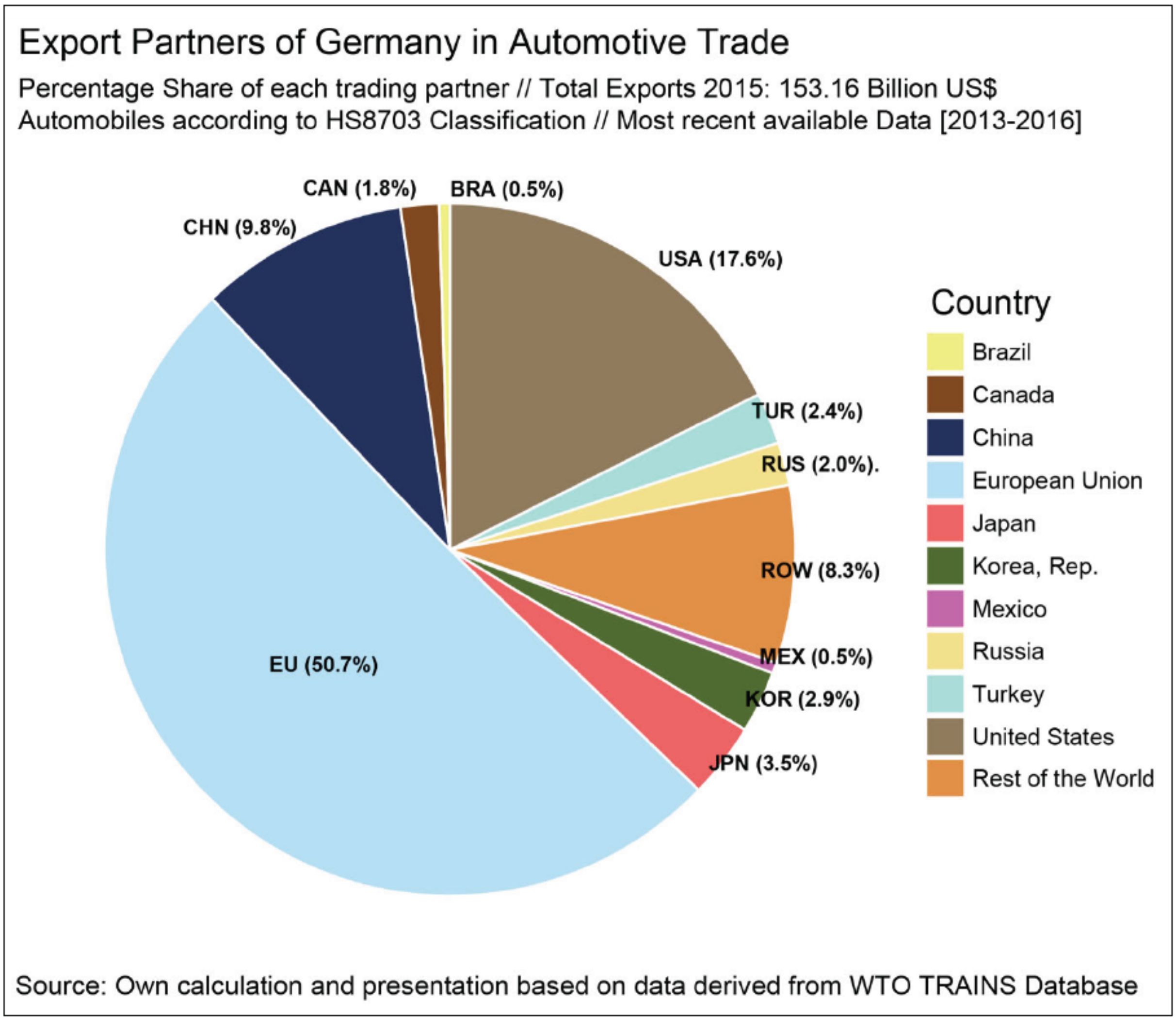

Figure 2: Export Partners for German passenger car exports in 2014;
Source: Own calculation and presentation based on data retrieved from UN UNCTAD TRAINS Database

According to trade data obtained from the UN UNCTAD TRAINS database and visualized in the before pie chart, the US accounted for 17.6 % (27 billion US$) of German automobile exports in 2014. This makes the US the largest extra-EU export market for German manufacturers. On the contrary, the US only exported vehicles to Germany with a total value of 5.4 billion US$[7] in 2014. Although the US is – as mentioned above - Germany's most important export market, Germany, on the other hand, is not the US biggest import partner (17% of total US car imports). NAFTA trade (42%) and imports from Japan (22%) and are taking bigger shares of the US market than imports from Germany. Please also refer to annex 1.1 and 1.2 for further information on the position of Germany and the US in the international automobile market.

As described in chapter 3.2, lower cost models are assembled in regional assembly plants supplied by close-by parts manufacturers. Since the 1980s automakers have invested heavily in production facilities abroad. Also, German and American corporation have built large factories outside their home regions to supply foreign markets. This flow of investment capital will be discussed in the next chapter.

3.5. Foreign Direct Investment of German carmakers in the US

When the VER discussed in chapter 2.3 were put in place in the 1980s, Japanese direct automobile exports to the US fell shortly after. On the long-run, the agreement spurred Japanese direct investment in production facilities in the US (Adams, 1991, p. 467). Japanese automotive companies were trying to "get behind the tariff wall" (Appleyard & Field, 2017, p. 238) by transplanting their production to the market where the final product was sold (ibid., 2017, p.239).

Generally, it is a common motivation to enforce local production and all associated benefits for the host country through the implementation or threat of trade restrictions (Verband der Automobilindustrie, 2016, p. 48). After his election, Donald Trump is trying to exert this pressure on German manufacturers. For example, he is concerned about ongoing construction projects by BMW and Volkswagen in Mexico (Kolev & Puls, 2017, p. 4). Both companies are currently constructing assembly plants to serve

[7] Harvard University's "The Atlas of Economic Complexity" (http://atlas.cid.harvard.edu/)

the NAFTA as well as international markets in Mexico worth more than 1 billion US$ each. Additionally, follow-up investment of supplier companies in the range of around 3 billion US$ is expected for each facility (Swiecki & Menk, 2016, p. 40).

Despite this investment trend, German manufacturers' commitment to the US as a manufacturing location remains larger than their investment in Mexico. According to the Chairman of the German Association of the Automotive Industry Matthias Wissmann (2017), German manufacturers have quadrupled their production in the US since 2009. Although this figure is inflated due to catch-up effects after a drop in production numbers following the 2008 economic crisis, the development trend is still upwards.

In comparison to Mexico, German manufacturers are producing significantly larger numbers of vehicles in the US. Kolev & Puls (2017, p. 4) state, that with 850.000 units, production of German manufacturers in the United State has been twice as high as their production volume in Mexico (420.000 units). Additionally, the vehicles produced in the US consist mostly of larger cars and more expensive vehicles like SUVs and Pickups (Kolev & Puls, 2017, p. 4). Vehicle production of German manufacturers in the US is actually larger than direct imports of passenger cars from Germany (ibid., p. 3).

For example, through a recent investment of 1 billion US$, BMW has increased the capacity of its Spartanburg (North Carolina) assembly plant by 50%, making it the manufacturers largest factory (Isidore, 2014). The factory is not only exporting 70% of its production but also makes BMW the largest exporter of automobiles from the US. From the 176.000 vehicles exported from the US to Germany, most were made by German manufacturers in the US (Kolev & Puls, 2017, p. 4).

Also, Volkswagen is increasing their commitment to the US by constructing another assembly line in their Chattanooga (Tennessee) factory to produce their new SUV model "Volkswagen Atlas" for the US market. The investment of 0.9 billion US$ created 2000 new jobs (Wilson, 2015). In general, the total investment of German automakers has been higher in the US than for Mexico every year except 2012 and continues to grow (Swiecki & Menk, 2016, p. 34).

American Manufacturers have directly invested in their own production facilities Germany as well. In order to serve European demand, Ford owns a factory near Köln and GM's subsidiary Open has its production located in Rüsselsheim. American manufacturers have produced and sold around 500.000 vehicles in Germany in 2016. This is still a considerable amount for the German economy, but substantially fewer units than German brands made and sold in North America (Kolev & Puls, 2017, p. 4). In conclusion, the FDI stock and commitment of German manufacturers to the US-market is very big. Outside of Germany, the US is the second biggest manufacturing location for German companies only surpassed by China (Wissmann, 2017).

4. Quantitative approach: Fixed-effects regression model

4.1. Methodology

4.1.1. Aim of the model and theoretical background

This part of the thesis project aims to quantify the effect of a rise in import tariffs in the US on the automobile exports from Germany to the US. It will show the correlation between the import tariff and the share of automobile imports of the GDP and assess whether and how much an increase of import tariffs for automobiles in the US would cause a decline in imports of automobiles from Germany. As described in chapter 2.1, it is expected that a higher tariff for imports of a specific good will cause the imports of that good to decline.

To estimate its parameters, the model uses panel data that covers cross-sectional as well as time-series observations of the examined variables. This means, that the data consists of observations from various relevant countries (cross-section) over a range of pertinent years (time-series) (Greene, 2010, pp. 343-344). In comparison to the basic pooled regression model described in chapter 4.2.3 which does not distinguish between the timeliness of observations or the different observed individuals, panel data allows to draw more precise conclusions about the underlying nature of the relationship between the examined variables.

Professor Baltagi (2005, pp. 3-6) mentions various advantages of panel data over traditional pooled ordinary least squares (OLS) estimation. Panel data is controlling for heterogeneity between individuals. This means that if there were some cultural, religious, governmental or other factors that influenced the behavior of the response variable for each examined country, the estimation with panel data could account for these effects. Furthermore, panel data contains more information, more variability, produces less collinearity among the variables as well as consumes fewer degrees of freedom and allows for a more efficient estimation.

At the same time, panel data has the disadvantage of potential cross-sectional dependence. This means that over long time-series, there might be a dependence or mutual influence between the different examined individuals (Baltagi, 2005, p. 8).

Two models will be adjusted in this paper. A regular OLS model will be applied in chapter 4.2.3, pooling all observations of all countries and years. Then, a model that accounts for the individual, country-specific effects mirrored in the panel data – a so called fixed-effects (FE) least squares dummy variable (LSDV) model - will be applied in chapter 4.2.4.

4.1.2. Data sources

The longitudinal data used in the present model has been compiled from various databases which are all accessible via the internet and will be explained in the following:

(1) Data on import tariffs has been extracted from the UN UNCTAD TRAINS database via an advanced query though the Worldbank "World Integrated Trade Solutions" (WITS) Interface. In this database, some countries had missing values for a few years mostly in the early 1990s. These missing values resulted in the final panel data being unbalanced.

(2) Data on the total value of imports for Automobiles has been extracted from the UN COMTRADE database. As will be explained in detail in chapter 4.1.4.2 automobiles in the context of this paper are understood as passenger cars according to the Harmonised System Trade Classification Number HS8703.

(3) Data on the GDP of the examined countries over the examined years has been obtained from the UN UNCTAD STAT Data Center in the chapter of economic trends, subsection national accounts.

The obtained data has then been carefully aggregated in Microsoft Excel. Special attention was dedicated to the exact matching of the corresponding years in every observed country. Subsequently, the data has been exported in the comma separated values file format (*.csv) and imported into the statistical processing software R Studio.

Here, the "base variables" have been processed and transformed to create the final variables that are used to estimate the fixed effects regression model. In chapter 4.1.4 a detailed description about the transformation of the variables is given.

The final dataset consists of a total of 220 observations distributed among 11 countries from 1989 to 2015. Observations per country range from 16 (Russia) to 26 (USA, Brazil). All monetary values used in the dataset are given in current US$ corresponding to the year to which they refer.

4.1.3. Introduction of examined country group

Not all countries in the world are alike when it comes to the design and manufacturing of automobiles. According to OICA, around 50 countries assemble automobiles inside their borders (OICA, 2017) and a lot fewer are able to design them from the ground up. In many of the countries that assemble automobiles, foreign direct investors have constructed and are operating the factories that assemble the vehicles. The vehicles produced in the FDI host country are then often times exported to neighboring countries or the world market. Also, intra-industry trade in passenger cars and auto parts is common and reaches large volumes between developed countries like Germany and the US (Havas, 1997, p. 231).

The US of America is one of the countries that have a large and independent automobile industry (OICA, 2017). Unlike many other countries that do not host a significant automobile industry and have no other choice but to import automobiles, the US is potentially capable of producing a sufficient amount of passenger cars inside their borders to meet domestic demand. Nevertheless, the United State is the largest importer of automobiles in the world[8].

To ensure comparability between the examined countries, the group that comprises the panel data in this model consists of the biggest automobile manufacturing countries of the world. Based on automobile production statistics published by the International Organization of Motor Vehicle Manufacturers (OICA, 2017), the 20 largest producers of cars with the highest number of produced units have been selected for further review[9]. Commercial vehicles – as they are not included in the HS8703 trade classification - have not been taken into account for this analysis.

To the 20 countries, some limitations apply. In order to assure meaningfulness of the

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[8] With 26.9 billion US$, the US have the highest value of automobiles imports of all countries according to data retrieved from UN COMTRADE Database.

[9] Please refer to annex 2 for a complete list of the 20 countries published by OICA.

analysis and applicability of the results, the following points were taken into account:

(1) In accordance with Article 28 of the Treaty on the Functioning of the European Union, the member states of the EU have established a customs union in 1968 (European Union, 2012, p. 59). This customs union eliminated tariffs between the EU member states and established a common tariff in their relations with third countries. The member states themselves are treated preferentially when it comes to the exchange of goods and form a single market without internal tariffs. Because of this preferential treatment that causes trade diversion to occur between Germany and its European Partners, the member states of the European Union have been left out in this analysis. With 13.8 million produced vehicles, the EU is the second largest producer of automobiles only surpassed by China with half of the European production taking place in Germany[10].

(2) Also, Japan has been removed from the data set due to the fact that Japan neither applied any import tariffs to automobile imports from Germany or any other trading partner during the time span of the data panel.

(3) Starting in 1995, Turkey has been integrated into the EU customs union and gradually started to reduce import tariffs on automobiles (EC-Turkey Association Council, 1995). From the year 2000, they did not apply any tariff for the import of automobiles from the European Union anymore. Still, Turkey has not been removed from the data set, as the example demonstrates clearly how a reduction in import tariffs over the time span of the sample leads to an increase of the share of automobile imports of the GDP.

(4) Iran has been removed from the data set due to trade sanctions imposed by many western countries and the UN that include restrictions in the automotive sector (Laub, 2015). These sanctions have caused significantly lower imports of automobiles and auto parts into Iran and also sustainably impaired the domestic Iranian economy, lowering production levels by more than 50%. Automobile imports from Germany have been eliminated almost completely due to the sanctions (Hosseinifar et al., 2012, p.3).

(5) Korea has entered into an FTA with the European Union. Starting with the

[10] Please refer to Annex 3.4 for a regression analysis of global automotive imports and tariffs that includes Europe as a whole as well as Germany.

agreement's ratification in 2011, mutual tariffs are gradually reduced until 2020 (De Gucht, 2011, pp. 3-4). Korea remains in the dataset as its example illustrates the examined correlation between lower tariffs and higher imports.

The remaining countries that comprise the panel data set are Brazil, Canada, China, India, Indonesia, Korea, Mexico, Russia, Thailand, Turkey and the US. Their relationship of import tariffs and automobile imports from Germany will be examined in the regression models adjusted in the following chapters.

4.1.4. Introduction of variables

4.1.4.1. Dependent variable

The dependent or response variable in the present model is the import value of passenger cars from Germany according to the HS8703 trade classification. The Harmonized System Code 8703 includes passenger cars principally designed for the transport of up to 9 people including the driver[11].

In order to account for differences in the overall size of the economy of the examined countries, the value has been divided by the total GDP of the corresponding country in the corresponding year. The final variable is therefore a percentage value that states the percentage of GDP of the importing country that was spent on automobile imports from Germany. This transformation also accounts for differences in openness to trade of the different economies. Larger or more closed economies have a lower exposure of the GDP to trade and thus would be biased if absolute automobile imports or the share of automobiles of total imports instead of GDP were used.

4.1.4.2. Independent variable

The independent or explanatory variable is the applied weighted average import tariff for automobiles according to HS8703 imported from Germany. It is a weighted average that there might be differing tariff rates applicable in the subsections of HS8703 of which the weighted average was calculated.

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[11] **HS8703**: Motor cars and other motor vehicles; principally designed for the transport of persons (other than those of heading no. 8702), including station wagons and racing cars.
HS8702: Vehicles; public transport passenger type (10 or more persons including the driver)

The variable was transformed logarithmically using the base 10 logarithm. The transformation has been applied because a change of one percentage point of the tariff is much more significant when the tariff is already low, i.e. that a reduction from 5% to 4% would likely have a bigger impact on the import share than a reduction from 75% to 74%. Applying the logarithmic transformation account for this diminishing marginal effectivity of tariffs. The explanatory variable now interprets as a logarithmic change, i.e. a 1 percentage point reduction in the tariff would correlate to a $\log(1)\,\beta_1$ - change in the corresponding response variable.

4.1.4.3. Dummy variable for the reporting country

In order to realize the Least Squares Dummy Variable Model, a dummy variable is needed to take into account the time-invariant characteristics of each individual's intercept that constitute the cross-sectional heterogeneity.

The introduced dummy variables are dichotomous variables. For each country except the base country (in this case Brazil as it is the first in alphabetical order) a dichotomous variable is added to the model. This dichotomous variable is a binary number and can only take the value of 1 or 0. In order to calculate the parameters of the model, for each observation of the corresponding country, the dummy variable is taking the value 1 while all other dummy variables are taking the value 0. In the case of the base country, all dummy variables are taking the value 0.

Although a number of degrees of freedom equal to the number of examined countries are consumed by adding the dummy variable to the regression model, this is not problematic for the present model since there is a sufficient number of observations in the data set to absorb this loss.

4.1.5. Description of methods

Two models are adjusted to estimate the relationship of automobile import tariffs and actual imports. First, a linear OLS model is applied. To overcome some of its shortcomings, a dummy variable is added in the second model to account for time-invariant country specific effects. This LSDV model uses FE for the analysis of panel data. An FE-model is fixed in so far, that the differences between the entities can be captured in a variation of the individual intercept α_i for each entity that is time-invariant (i.e. fixed) for the time span of the sample. The β-coefficient for the relationship between the variables is equal for all entities (Greene, 2010, p. 359).

It is to note that through the nature of the FE-model, any time-invariant entity specific effects are absorbed into the individual intercept α_i (Greene, 2010, p. 360). For the present example, country specific differences such as income level, grade of industrialization, infrastructure quality, use of public transport, population density or cultural aspects are imaginable as influencing time-invariant factors. Although generally seen as a shortcoming of FE-models (ibid., 2010, p. 360), this characteristic is not problematic in the context of the limited scope of this paper. It makes it possible to estimate the effect of the tariff on the import share while aggregating other influencing factors into one parameter.

According to Gujarati and Porter (2010, p. 595), the FE-model should be applied if the country specific intercept α_i is correlated with one or more of the independent regressors X_{it}. In the present dataset, a correlation between the import tariff and the country specific effects is likely and represents another reason for the application of an LSDV model. This means that constant country specific effects (the *α)* will not only influence the import share (dependent variable) as explained in the above paragraph but also the general tariff level (independent variable) that is imposed on foreign imports. In this model, constant country specific effects that correlate with the tariff level could be bilateral trade agreements, strong economic interdependence due to cultural ties or increased trade due to local proximity.

As evident in the name, the estimation of both model's parameters functions by way of the standard ordinary least squares method (OLS). For a detailed explanation of the theory behind the ordinary least squares method in the context of a fixed effects model see "Econometric Analysis" by William H. Greene (2010, pp. 360 – 362) or "Econometric Analysis of Panel Data" by Badi H. Baltagi (2005, pp. 12 – 14).

4.2. Analysis

4.2.1. Independent variable

The independent variable is the applied import tariff for passenger cars according to HS 8703 that the reporting country applied on automobile imports from Germany in a given year. The variable is numerical and continuous. The tariffs are calculated ad valorem, meaning that they are calculated as a percentage value of the imported good. As described in a previous chapter, the tariffs have been logarithmically transformed for the regression analysis of chapter 4.2.5.

In the below figure, the development of the tariff is displayed for each individual country. For better legibility of the tariff values in the lower range, the y-axis has been square root scaled.

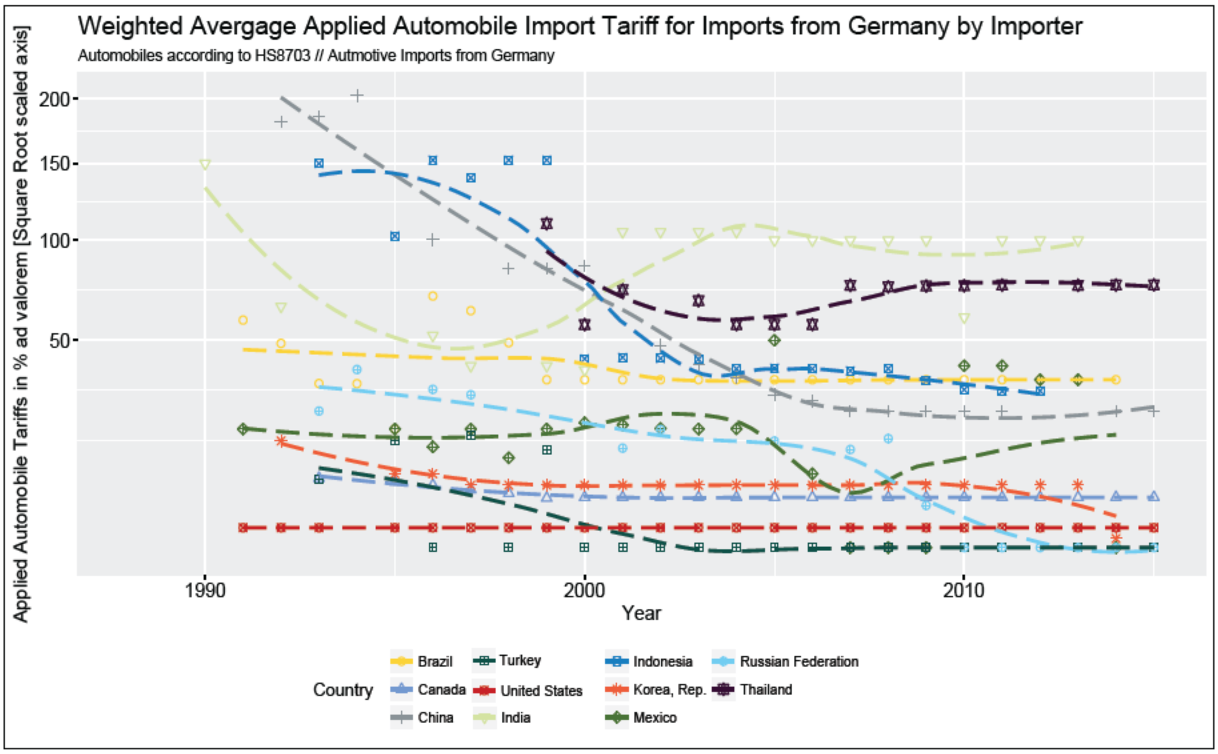

Figure 3: Weighted average applied automobile import tariff for passenger car imports from Germany. Source: Own calculation and presentation based on data retrieved from UN UNCTAD TRAINS Database (United Nations Conference on Trade and Development, 2017).

The applied import tariffs range from 0 (Turkey beginning in 2000 and Russia beginning in 2010) to 202.74% (China in 1994). Most of the examined countries apply relatively low tariffs under 50%. Some less developed nations have placed higher tariffs in order to protect their infant industries in the automotive sector from international competition (Mankiw, 2012, p. 183). Considering the uneven distribution with relatively few values in the area above 100%, it is reasonable that the median (21.08) is much lower than the mean value (35.41). For most countries, the trend line is downward sloping, meaning that they have lowered their tariffs during the examined period. While China and Indonesia have lowered their tariffs considerably, India has maintained the tariffs at a high level of around 100% and is now the country with the highest import tariffs for automobiles. The US is the only country that did not change their tariff and have applied a below average import tariff of 2.5% ad valorem for automobile imports from Germany in all examined years.

4.2.2. Dependent variable

The dependent variable is the share of automobile imports from Germany as a percentage of the reporting countries' GDP. It represents how much of its annual economic output a country spends in order to import finished passenger vehicles from Germany. The below graph depicts the development of the dependent variable over the time span of the analysis.

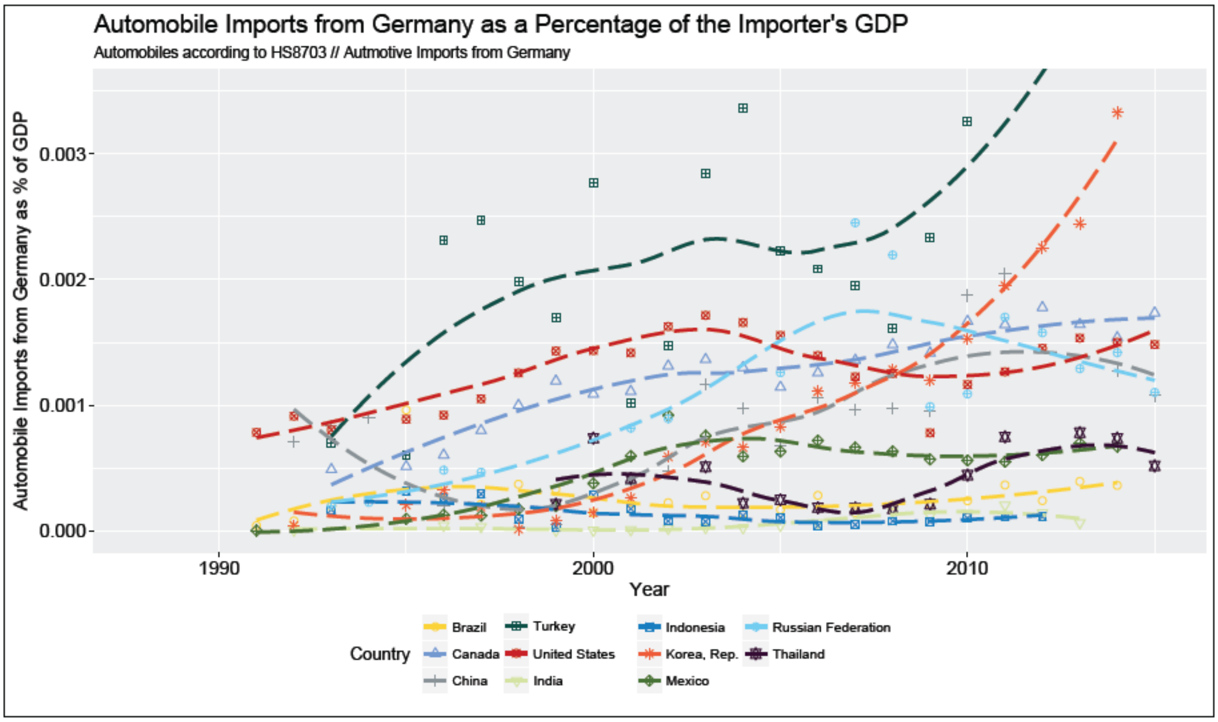

Figure 4: Share of passenger car imports from Germany of reporting countries' GDP. Source: Own calculation and presentation based on data retrieved from UN UNCTAD TRAINS and UNCTAD STAT Data Center - National Accounts Database (United Nations Conference on Trade and Development, 2017).

The values range from near 0% (Mexico in 1991, India in some years) to more than 0.3% (Korea in 2014 and Turkey in 2010 and 2012). The median is 0.07% while the mean is 0.11%, suggesting that the variable has a right skewed distribution as well as some outliers with extraordinarily high values.

The US has been spending a comparably large share of their GDP on passenger vehicles from Germany. After the economic crisis of 2008, imports fell slightly, but have since recovered to their pre-crisis levels.

Turkey is expending the largest share of their GDP on German automobiles. This may be attributed to an FTA between Turkey and the EU. Since the late 1990s, Turkey has phased out most tariffs for imports from the EU and is subsequentially experiencing increased imports due to trade diversion effects. Turkey is also the country with the largest variance of the import share.

Russia has unilaterally reduced tariff to almost zero in 2010. Still, the Russian import share has started to decline since around that year. This effect might be attributed to a slowing Russian economy since the global crisis in 2008 and trade restrictions imposed upon the country due to its military interventions in Ukraine (World Bank Group, 2017, p. 12).

The import share of German automobiles on the Korean GDP has risen sharply over the last years of the analysis. This can be attributed to the gradual reduction of tariffs following an FTA with the EU that entered into effect in 2011 (De Gucht, 2011, p. 3).

China's import share has declined for a short period of time from a relatively high level in the early 1990s. The development corresponds to a temporary increase in import tariffs during the same episode and illustrates the dampening effect of a tariff on imports.

Generally, many countries have experienced an increase in automobile imports from Germany during the analyzed years. This goes in accordance with Germany's strengthening competitive position in international automotive trade - predominantly in the luxury segment that sees growing demand in emerging economies (MacDougall, 2016, p. 5).

4.2.3. Correlation between the variables: Pooled OLS-model

The examined variables show a significant correlation in an ordinary least squares regression model when pooling all observations into one basket not accounting for timeliness or individual entities' specific effects. In a general form, the model can be written as:

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \varepsilon_{it}$$

where:

$$i = country; \qquad t = time$$

$$Y_{it} = Share\ of\ automobile\ imports\ from\ Germany\ (dependent\ variable)$$

$$X_{it} = Logarithm\ of\ applied\ import\ tariff\ (independent\ variable)$$

$$\beta_1 = The\ coefficient\ of\ the\ independent\ variable$$

$$\beta_0 = The\ intercept$$

$$\varepsilon_{it} = The\ error\ term$$

The estimation of the OLS-model function is as follows:

$$Y_{it} = 0.001862 - 0.0003798\, X_{it} + \varepsilon_{it}$$

The observations and estimation of the regression are displayed in figure 5 on the next page. Please also refer to Annex 4.2. for a detailed overview of the model's coefficients.

Because the variables are not normally distributed, the calculation of regular correlation coefficients would be biased (Gujarati & Porter, 2010, p. 62). In order to assess the correlation, the rank correlation coefficient has been calculated. With -0.52 (Kendall's Tau) and -0.72 (Spearman's Rho) the correlation between the two variables is moderately strong and negative, meaning that an observation with a higher import tariff is generally associated with a lower import share of automobiles of the GDP. The adjusted R^2 of the model is 0.47 and implies that almost half the variation of the GDP share of automobile imports from Germany can be explained by the applied import tariff. The global F-statistic is 194 with a corresponding p-value close to 0. Both the β_0 and β_1 coefficients are significant at over 99.9%. For further reference, the residuals are plotted against the model fit in Annex 4.1.

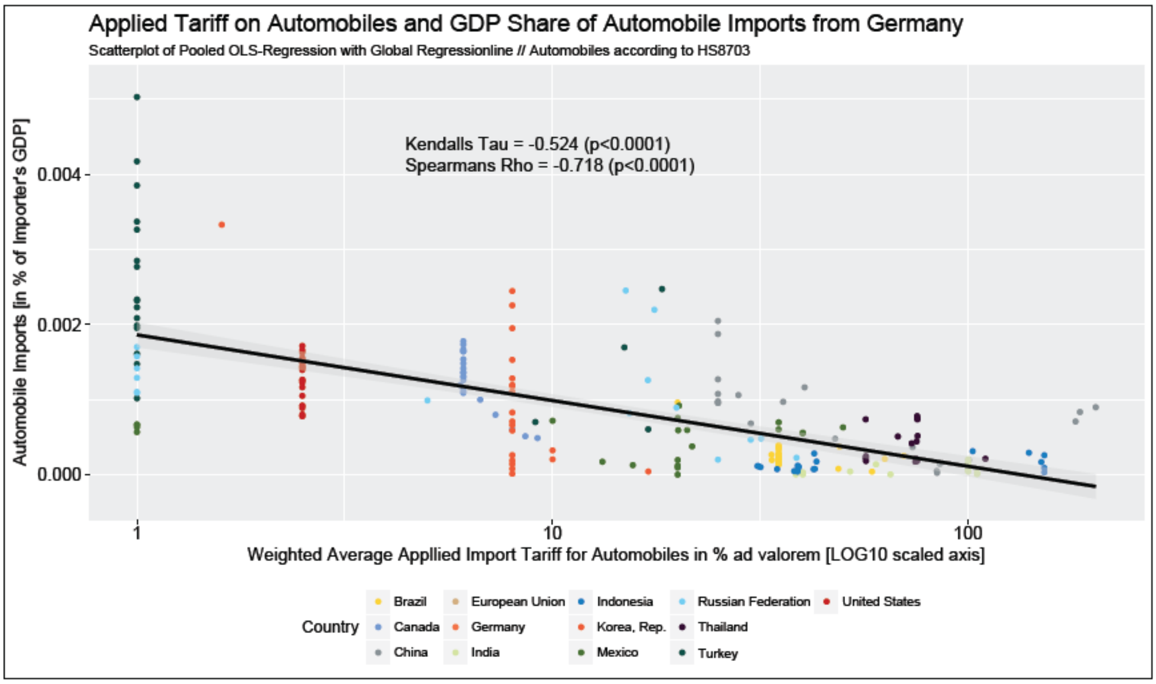

Figure 5: Pooled OLS-Regression: Automobile import share of the GDP and the average applied import tariff for passenger vehicle imports from Germany.
Source: Own calculation and presentation based on data from UN UNCTAD Databases (United Nations Conference on Trade and Development, 2017).

In fact, the pooled OLS model does not take into account, that the observations were made in a specific country at a specific time. The figure above shows, that the data points from individual nations cluster in close proximity on the value range of the diagram. To account for these country specific effects, the model has been adapted. These so called time-invariant country specific effects are added to the final model described in the proximate chapter.

4.2.4. Individual-effects regression: Fixed-effects LSDV-model

To overcome the shortcomings of the pooled OLS model and to utilize the complete information provided by the panel data used in this analysis, a fixed effects regression model for panel data is applied. This model now accounts for the country (indexed as i) of the observations. To account for the time-invariant country specific effects, the model uses a dummy variable D_i in order to quantify the constant country specific effects in the individual intercept α_i. Because the model is using ordinary least squares estimation it is therefore called a least squares dummy variable (LSDV) model.

In a general form, the model can be written as:

$$Y_{it} = \beta_1 X_{it} + D_i \alpha_i + \varepsilon_{it}$$

where:

$$i = country; \qquad t = time$$

$$Y_{it} = Share\ of\ automobile\ imports\ from\ Germany\ (dependent\ variable)$$

$$X_{it} = Logarithm\ of\ applied\ import\ tariff\ (independent\ variable)$$

$$\beta_1 = The\ coefficient\ of\ the\ independent\ variable\ (the\ common\ slope)$$

$$D_i = The\ dummy\ variable\ (for\ each\ country\ i)$$

$$\alpha_i = The\ country - specific\ intercept\ (for\ each\ country\ i)$$

$$\varepsilon_{it} = The\ error\ term$$

The estimation of the model's function is as follows:

$$Y_{it} = -0.00023\ X_{it} + \alpha_i D_i + \varepsilon_{it}$$

The country specific α_i is listed in the following table:

Country	α_i	p-value (significance level, bold print <5%)
Brazil	0.00110	**<0.0001**
Canada	0.00168	**0.0009**
China	0.00174	**<0.0001**
Indonesia	0.00107	0.8455
India	0.00108	0.8896
Korea	0.00145	**0.0438**
Mexico	0.00107	0.8726
Russia	0.00156	**0.0136**
Thailand	0.00141	0.0769
Turkey	0.00252	**<0.0001**
USA	0.00149	**0.0496**

Table 1: Country Specific Intercepts α_i and corresponding significance level.
Source: Own Calculation and Presentation based on R Studio results (Also see Annex 4.4)

In the following figure, the data is plotted with individual regression lines:

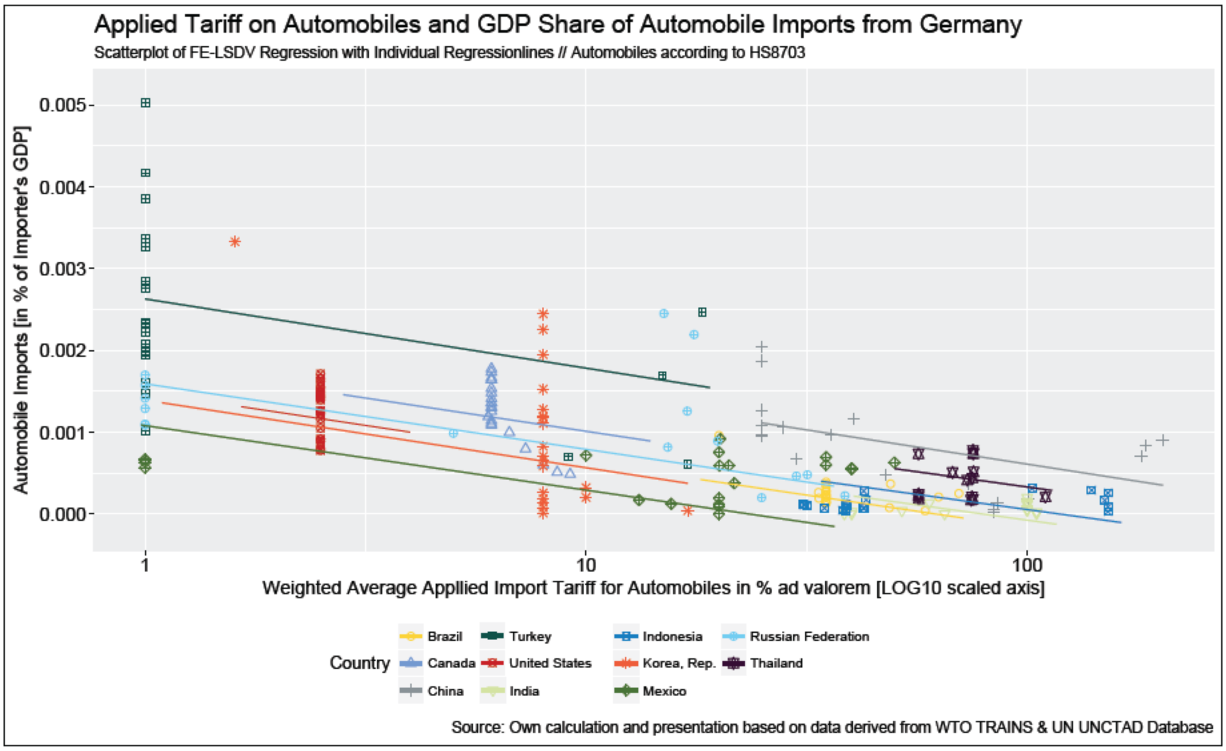

Figure 6: Fixed Effects LSDV-Regression: Automobile import share of the GDP and the average applied import tariff for passenger vehicle imports from Germany. Source: Own calculation and presentation based on data from UN UNCTAD TRAINS, UN COMTRADE and UN UNCSTAT STAT (United Nations Conference on Trade and Development, 2017).

As the figure shows, the individual lines are all downward sloping, adjusted with the same gradient. This reflects the model's cross-country homogeneous β_1 coefficient. Although having the same slope, the individual lines are at different levels, i.e. they intersect the y-axis at different heights and therefore have a different individual specific intercept α_i. This fits the FE-model that predicts a common β_1 coefficient with entity specific α_i intercepts (Greene, 2010, p. 359). Please also refer to annex 4.4 for a detailed overview of the model's coefficients.

4.2.5. Evaluation of the model and predictors

Compared to the pooled OLS model, the LSDV-model has an improved adjusted R^2 of 0.62. This means that 62% of the variation in the import share can be attributed to the applied import tariff X_{it} and the country specific effects modeled through α_i. The β-coefficient and global F statistic are significant with p values smaller than 0.0001. Except for Indonesia, India, Thailand and Mexico, all α-coefficients are significant at

5%. Thus, the model combines a relatively high predictive power of 62% with statistical significance for most predictors. The α-predictor for the USA which is relevant for the model application in the context of this paper is furthermore significant at 5%.

Despite coefficients with a good fit, the model violates some assumptions of ordinary least squares estimation such as the assumption of homoscedasticity and the assumption of no serial correlation (Greene, 2010, p. 16).

First of all, the error term of the present model is heteroscedastic, although the least squares estimation method supposes a normally distributed error term ε_{it} (Gujarati & Porter, 2010, pp. 596-599). Both the Breusch-Pagan and the Goldfeldt-Quandt test for heteroscedasticity result in a rejection of the null-hypothesis of no heteroscedasticity at significance above 99%. For further evidence of heteroscedasticity, please also refer to the plot of residuals and model fit in annex 4.3.

In addition, a country would not arbitrarily set its tariff every year independent of the tariffs they had applied in previous years but instead follow a trend of increasing, decreasing or maintaining tariffs. This theory implies, that the present data is subject to serial correlation. Accordingly, the Breusch-Godfrey test for serial correlation and the Durban-Watson test for autocorrelation of the disturbance term both underpin this theory with significance over 99%. This means, that the tariff of the previous year has a significant influence on the next year's tariff. These effects have not been taken into account in the present model and should be incorporated in further research.

Please also refer to chapter 3 of the annex for a modeling of the relationship of the import tariff for automobile imports and the import share not only for imports from Germany but from all trading partners worldwide. The model has been adjusted with data from the same sources and shows similar results.

4.3. Discussion

4.3.1. Findings

This section will discuss the findings from the FE-LSDV model with a focus on the predictors' effects on automobile imports from Germany. The LSDV model demonstrates, that higher import tariffs will generally be correlated with lower automobile imports. The β-coefficient of the independent variable predicts that for an x increase in the import tariff for automobiles from Germany, the share of automobile imports on the GDP will decrease by the logarithm of that x multiplied by its estimated coefficient of 0.00023. In addition to this common relationship in all examined countries, each country has a specific intercept that determines the base-level of its automobile imports. For Brazil as the base country, this value is 0.0011, meaning that if Brazil did not impose any import tariffs they would be spending 0.11% of their annual GDP on automobile imports from Germany. For the USA, the entity specific intercept is 0.0015, meaning that if they did not impose any tariffs they would spend roughly 0.15% of their GDP on automobile imports from Germany. The model's prediction of the actual import share for the US is 0.139%. It has an error of -6.67% against the actual reported value for 2015 of 0.148%. From all analyzed countries, Turkey and China have the highest base intercept while India and Mexico have the lowest.

These findings correspond to the expected outcome based on the findings of chapter 2.1, where a rise in import tariffs led to a decrease in the imported quantity. The next chapter will use the model's estimators to assess this decline from a quantitative perspective.

4.3.2. Application of the model

To illustrate the model's prediction and quantify the postulated research question, the model has been applied to various scenarios of import tariffs in the US. Besides the status-quo and the automobile import tariffs of 35% or 45% that Donald Trump has brought up in various communications, a scenario has been included where the US apply the same 10% tariff for passenger vehicle imports like the EU. Also, a scenario with free trade and one with a general 20% BAT has been included.

The table on the following page shows the results of the application:

Scenario	Applied US tariff in % ad valorem	Predicted share of automobile imports from Germany	Change against baseline scenario	Change against actual import share (=0.148%)
TTIP best case	**0**	0.1711 %	+23.09 %	**+15.4 %**
Baseline scenario	**2.5**	0.1390 %	0 %	**-6.67 %**
EU-like tariffs	**10**	0.1252 %	-9.94 %	**-15.57 %**
BTA scenario	**20**	0.1182 %	-14.92 %	**-20.23 %**
Trump tariff 35	**35**	0.1127 %	-18.93 %	**-24.00 %**
Trump tariff 45	**45**	0.1102 %	-20.73 %	**-25.69 %**

Table 2: Results of LSDV-model application;
Source: Own calculation and presentation

The table shows that compared to the status quo of a 2.5% import tariff, automobile imports from Germany could fall around 25% upon the implementation of a 35%-45% import tariff as repeatedly threatened by the Trump administration. On the contrary, an FTA best case scenario between the EU and the US such as the failed Transatlantic Trade and Investment Partnership (TTIP) treaty could have led to an increase of automobile exports from Germany to the US of around 15%. The prediction shows, that the effect of a percentage point change is more pronounced in the area of low tariffs. For high tariffs, the import share is more robust to further tariff increases. Using these predictions, German automakers could test their companies' stress resistance to a corresponding decrease in revenue from US-exports.

In 2016, Germany exported 26.9 billion US$ worth of automobiles to the US. A decrease in exports of 25% would amount to a revenue loss of 6.73 billion US$ for all manufacturers combined. When comparing this to the total revenue of the German automotive industry in the same year (404 billion US$), this corresponds to a total loss of 1.67% when not accounting for possible price effects due to the size of the US automobile market.

According to Fuß (2013, p. 15), the EBIT margins of the major German corporations have been between 5.9% (Volkswagen) and 10.8% (BMW) in 2013. In absolute numbers, the operating income has been 7.6 billion for Daimler, 8 billion for BMW and

11.7 billion for Volkswagen. Although the US is an export market with major importance, these numbers show the resilience of these corporations' balance sheet to the potential effects of a tariff increase. All corporations have higher profit margins than the predicted average revenue loss and would theoretically be able to absorb the predicted losses without compromising profitability.

As described in chapter 3.5, German automakers are not only fabricating vehicles in Germany but have also invested in manufacturing locations abroad outside the US. Vehicles manufactured in Mexico or Brazil and then exported to the US are not considered in this analysis and could have further adverse effects on German carmakers' profits. Automotive parts that are traded further down the value chain and might be subject to trade restrictions are not taken into account for this analysis either.

4.3.3. Limitations of the model

Besides the technical limitations of the model described in chapter 4.2.5, some further theoretical limitations apply that should be considered when evaluating the findings.

First of all, automobiles are a highly complex good and not a simple and replaceable commodity like orange juice or iron ore. Although consumer behavior in the sector is highly researched, many unpredictable and complex factors play a role in decision making (Drew et al., 2014, p. 5). Marketing efforts of manufacturers, social and cultural trends, government incentives, socioeconomic background and automobile manufacturers' brand images amongst many other factors all play a role when it comes to purchasing decisions (Drew et al., 2014, pp. 6-12; MacDougall, 2016, pp. 7-9). This makes it much harder to predict outcomes in a complex and diversified market like automobiles where differences between various manufacturers and models make purchasing an emotional decision and substitution a more complex task.

Second, the US enjoys a special position in the international automotive market. As assessed in chapter 2.1, they are the largest importer of automobiles worldwide. For this reason, the cost to introduce higher tariffs in the US would not only be absorbed by US consumers but also be partly borne by foreign suppliers that depend on US sales. This effect could partly counteract the fall in domestic US demand for imported passenger vehicles at the cost of foreign producers and is not reflected in the LSDV-model.

The third limitation of the model is that the data for each country only extends over a relatively limited range of applied tariffs. Although some countries like Russia or Turkey have seen massive tariff reductions and subsequent increases in import levels over the timespan of the observation, many other countries have changed their import tariffs very little or not at all. The US is one of the countries that have maintained their tariffs at the same level for all years included in the analysis. The predicted effects of a change in tariffs on the US import share have therefore been deducted from variations in the import share of other countries that have changed their tariffs. That being the case, the specific effects that accrue to the US because of its particular position in the international automotive trade have not been reflected accurately in the parameters as the data does not show how a change in tariffs in the US specifically would affect their import share of automobiles.

Lastly, correlation does not imply causality (Aldrich, 1995, p. 365). Although the model presents a statistical correlation between the examined variables, this does not necessarily indicate that a lower tariff results in higher imports or vice versa. It might be possible, that higher demand for imports results in a lower tariff or that the general development of the two variables has been caused exogenously by other macro-economic or technological developments that have not been included in the model. Thinkable are recent global trends like the implementation of international treaties on trade through the WTO, facilitation and cost reductions of intercontinental logistics through improvements in global shipping or internationalization efforts of market-seeking private firms.

4.3.4. Further effects of a tariff increase

Besides reductions in imports and a possible pivot of US consumers to more domestically manufactured vehicles, the introduction of a higher tariff might have other effects on the American economy and their transatlantic relationships. Various scholars have theorized about possible outcomes of this development.

Not only could deadweight losses from a tariff lead to a sustained slowing of US economic growth, but retaliation from trading partners could lead to a trade war that would damage all participating countries (Noland & Hufbauer, 2016, p. 18). China, Mexico and the EU would be hit hard by the tariffs as their economies particularly rely on trade with the US. Their retaliation would initiate an adverse development that could not only cost millions of jobs but impair the confidence in the international trade and economic system.

One of the motivations behind the introduction of automobile import tariffs in the US is the saving of domestic jobs in manufacturing as described in chapter 2.2. As claimed by Klodt (2017, p. 168) the introduction of tariffs would likely not help with this intention. Due to high wages in the US, manufacturers have moved production to locations with lower wages. Accordingly, the introduction of tariffs would not incentivize manufacturers to give back jobs to expensive US auto workers but rather lead to increased investments in automation and industrial robots to make US production profitable. The US-Industry would lose competitive pressure and therefore suffer an erosion of quality standards, ultimately killing more jobs and making the industry internationally uncompetitive. Winners of this development would then be manufacturers of industrial robots – of which many are located in Germany (Klodt, 2017, p. 169).

5. Conclusion

5.1. Summary

This paper analyses how a tariff increase for automobile imports in the US could affect the exports of German car manufacturers to this particular market.

Through the imposition of a tariff in a large market like the US the world price of automobiles might be lowered, thus creating a welfare gain for the US at the expense of overall global welfare. The US administration is aiming to protect domestic manufacturing jobs, counter the supposed currency manipulation by its trading partners and therefore uses the threat of a tariff as a bargaining chip. In the 1980s this tactic was used successfully in order to ease the pressure on US manufacturers from Japanese imports. The VER gave short term relief to the US industry, but some scholars suspect, that it also caused a long term decline in competitiveness against Japanese brands. It also spurred foreign investment in the automotive sector on US soil – an objective that is also pursued by the current US administration.

After a harsh sales decline in the aftermath of the financial crisis in 2008, the automobile market has quickly rebounded to pre-crisis levels. This business cycle sensitivity is less pronounced in emerging economies which are growth markets for the automobile industry and are characterized by an expanding market size. In industrialized nations, the saturated automobile market is typified by replacement demand. Still, these countries – and here foremost Germany – remain leaders in innovation and technological development in the automotive sector such as alternative propulsion technologies or interconnected driving. On a global scale, the design and development activities remain centralized in the main automobile clusters while production and assembly have mostly been outsourced to the sales regions. Only vehicles in the upper price segments are viable to export as for them intercontinental transport is relatively cheap in comparison to the vehicle value.

For both Germany and the US, the automobile industry is highly important for the national economy and employment. The US is the largest importer of automobiles while Germany is the largest exporter in absolute terms. For their quality and brand image, German vehicles are highly popular in the US. The US therefore represents the most important export market for German automakers. This is underpinned by significant investment commitments. FDI flows in the automotive sector from Germany to the US have consistently ranked above capital flows to Mexico and amount to the second largest FDI stock of German automakers behind China.

The applied fixed effect regression model shows a significant negative correlation between the applied import tariff for passenger cars and the import share of the GDP for automobile imports from Germany. Higher import tariffs for automobiles are generally associated with a lower percentage of the GDP spent on passenger vehicle imports from Germany. When applied, the model suggests, that an increase of import tariffs to 35% in the US could lead to a fall in German exports to the US of up to 25%. On the contrary, a reduction of tariffs as part of the failed TTIP agreement could have increased exports by more than 20% compared to the baseline scenario. Through their strong competitive position in the international and domestic automobile markets, the German manufacturers are fairly resilient to a tariff increase on the side of the US. Although the US is a sales market with major importance, their focus on emerging market growth as well as their high profit margins put them in a position to overcome a potential sales decline in the US without compromising operational profitability.

Besides a reduction of imports from Germany, a tariff increase could have additional repercussions for the US economy. US consumers will be paying the tariffs' cost through higher prices for imported goods. International retaliation could damage the US' own exports and accelerated investment in industrial automation could cost further jobs.

5.2. Critical acclaim

Generally, it is very difficult to predict the economic consequences of trade policy as the global economic system is extremely complex and many factors influence its outcomes that have not yet been researched or sufficiently understood by researchers.

Various limitations apply to the model that call for improvement in connection with further investigation into the field. In its simplicity, the model excluded many factors that could potentially influence the level of automobile imports and should be considered and quantified as part of further research. Because the global automobile industry is so interdependent, special attention should be put on secondary and feedback effects of a tariff increase in the US when evaluating and modelling the effects of trade policies.

A further problem is, that the model uses observations from other countries to derive its parameters and project its prediction how the US imports would behave. This is therefore problematic that different economic mechanisms apply to the US as they are the largest economy in the world. These implications have been acknowledged but not been quantified for the present analysis. To draw more robust conclusions, it could also be advantageous to obtain data from further ago in the underlying dataset in order to include a wider range of observations from the US.

Lastly, the short time horizon between the recent political development and the formulation of this paper has resulted in relatively few sources being available about the specific topic of Donald Trump's trade policy and its effects. After all, the available scientific articles are reflecting very similar opinions on the topic making the evaluation of the examined policy options mostly uncontroversial.

5.3. Outlook

If Donald Trump has demonstrated one persistent characteristic during his young presidency, then it surely is inconsistency. He has changed his mind on a plethora of topics whenever the right opportunity arose. This makes it harder to believe that he would actually go through with the imposition of a high import tariff. Internal opposition inside the Republican Party or the US Congress are further obstacles to be overcome when progressing this bill. Also, domestic US manufacturers would possibly lobby against a tariff since they would most likely be negatively affected by its implementation.

From the side of German exporters, there exist tactical instruments to deal with the implications of a rise in tariffs. Depending on the exact specifications of the trade restriction, they could change their export strategy to circumvent the additional cost. Indirect transit trade through a country with an FTA like Canada or the export and assembly of large, pre-fabricated components in the US are potentially viable options.

Already, the focus of the global automobile industry has shifted to the growing emerging market economies. In the long term, developed nations like the US and Europe are going to become relatively less important on a global scale. Through this macro-economic development, their future strategy will be less focussed on sales growth but more on technological innovation and alternative, clean propulsion technologies.

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VI. Declaration of originality

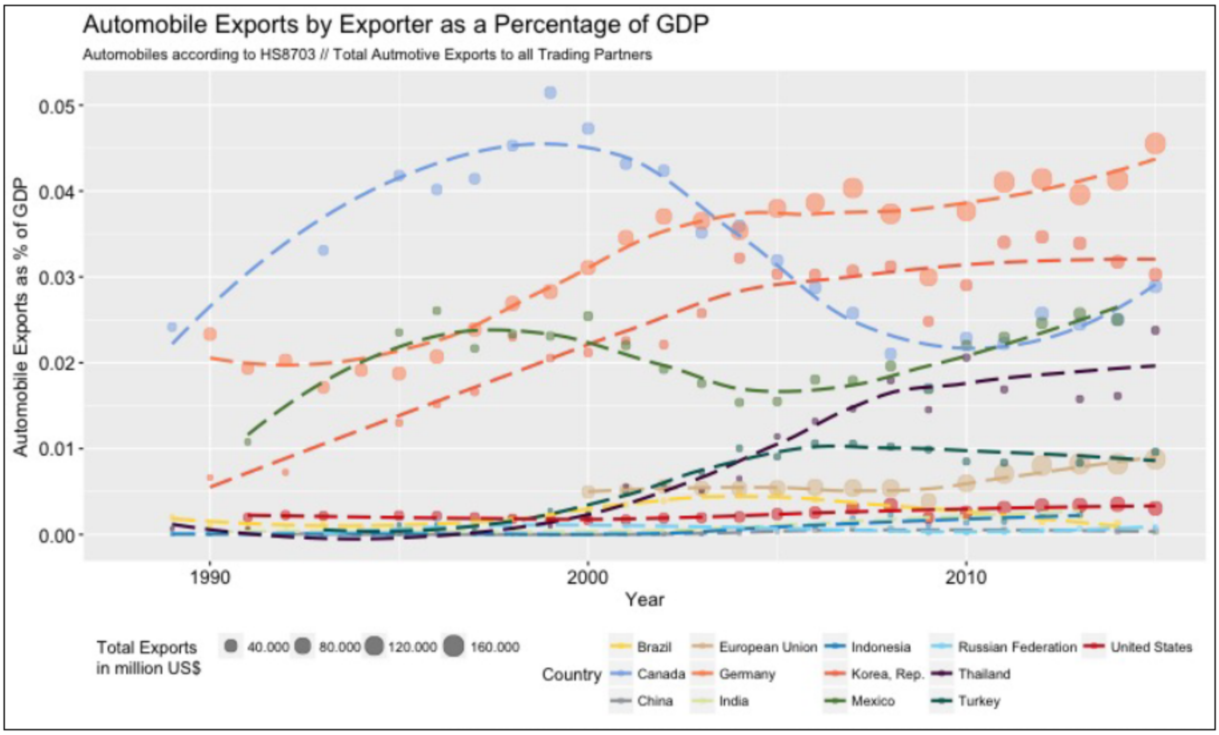
I hereby declare that this bachelor thesis has been completed by myself independently without outside help and only the defined sources and study aids were used. Sections that reflect the thoughts of others are made known through the definition of sources.

City, Date and Signature

VII. Annexes

1. Interdependency of Exports and Imports in the Automotive Industry

1.1. Global Automobile Exports



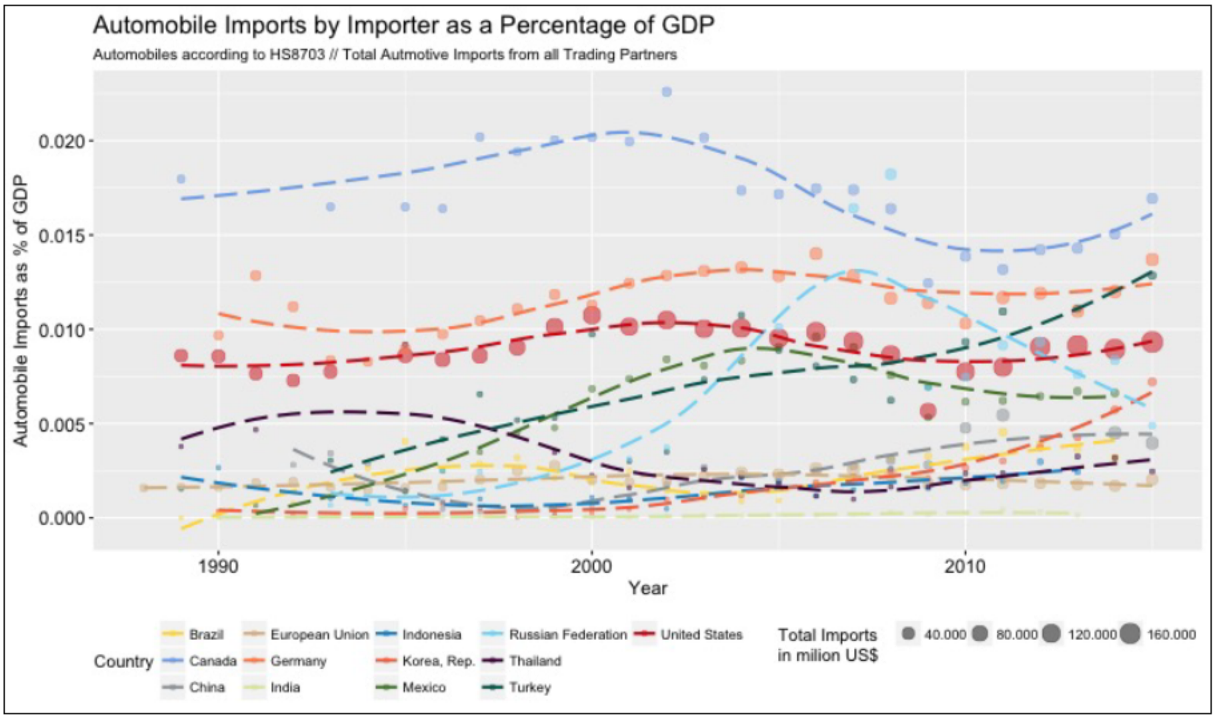
Share of Automobile exports of the GDP to all trading partners worldwide between 1990 and 2015. The bubble size stands for absolute export value of automobiles according to HS8703.

Sources: Own presentation based on data from UN UNCTAD COMTRADE and UNCTAD STAT

The figure clearly shows the importance of automobile exports for Germany. Not only is Germany the country with the largest GDP share of automobile exports, it also exports the nominally highest value of all countries.

On the contrary, in the US, automobile exports play a subordinate role.

1.2. Global Automobile Imports

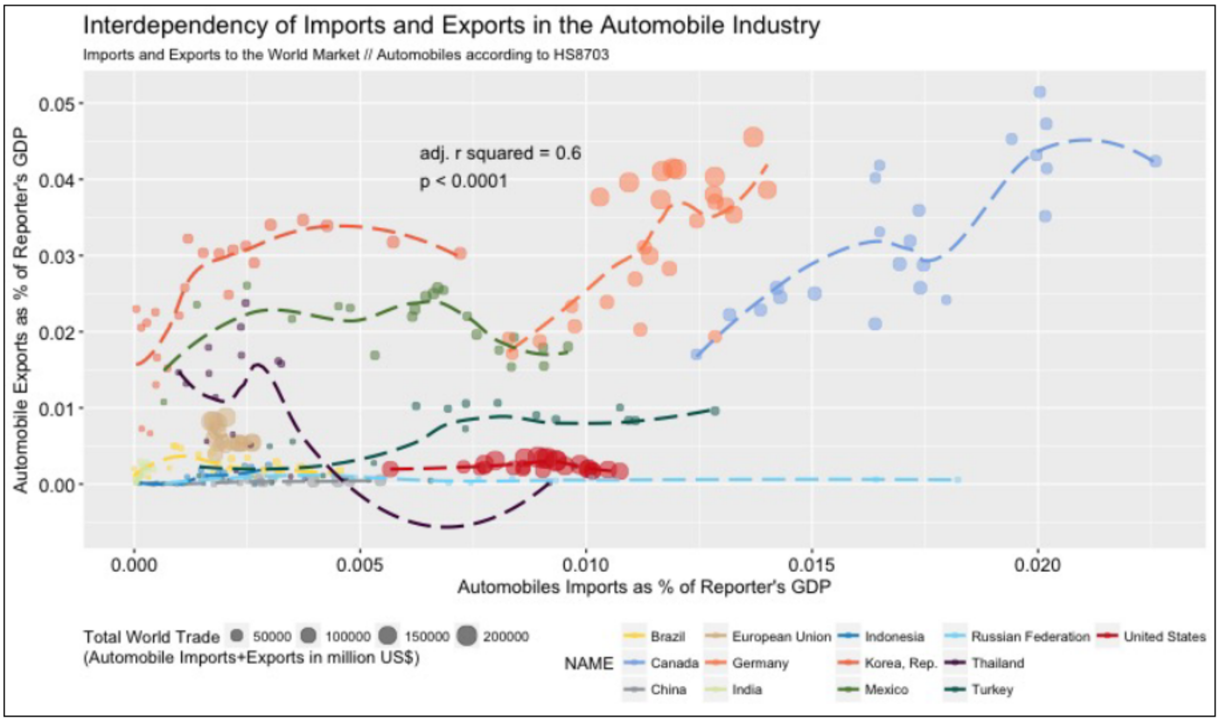


Share of Automobile imports of the GDP to all trading partners worldwide between 1990 and 2015. The bubble size stands for absolute import value of automobiles according to HS8703.

Sources: Own presentation based on data from UN UNCTAD COMTRADE and UNCTAD STAT

The figure shows clearly, that the US are the largest importer of automobiles in absolute values, although other counties are expending a larger share of their GDP for automobile imports. Interestingly, also Germany is spending more on automobile imports than the US relative to its GDP.

1.3. Interdependency between Exports and Imports



Interdependency of exports and imports of finished passenger cars. The bubble size stands for absolute import value plus export value of automobiles according to HS8703.

Sources: Own presentation based on data from UN UNCTAD COMTRADE and UNCTAD STAT

The figure illustrates the importance of intra industry trade in automobiles and the interconnectedness of the worldwide automotive industry.

Some countries like Germany and Canada import and export large amounts of automobiles. Mexico and Korea Export a lot of cars without importing the same quantity, while the US, Russia and China import a significantly larger share than they export.

2. List of Automobile Producing Countries as Published by OICA

The following list is an excerpt from the complete production statistics list published by OICA.

Country Group

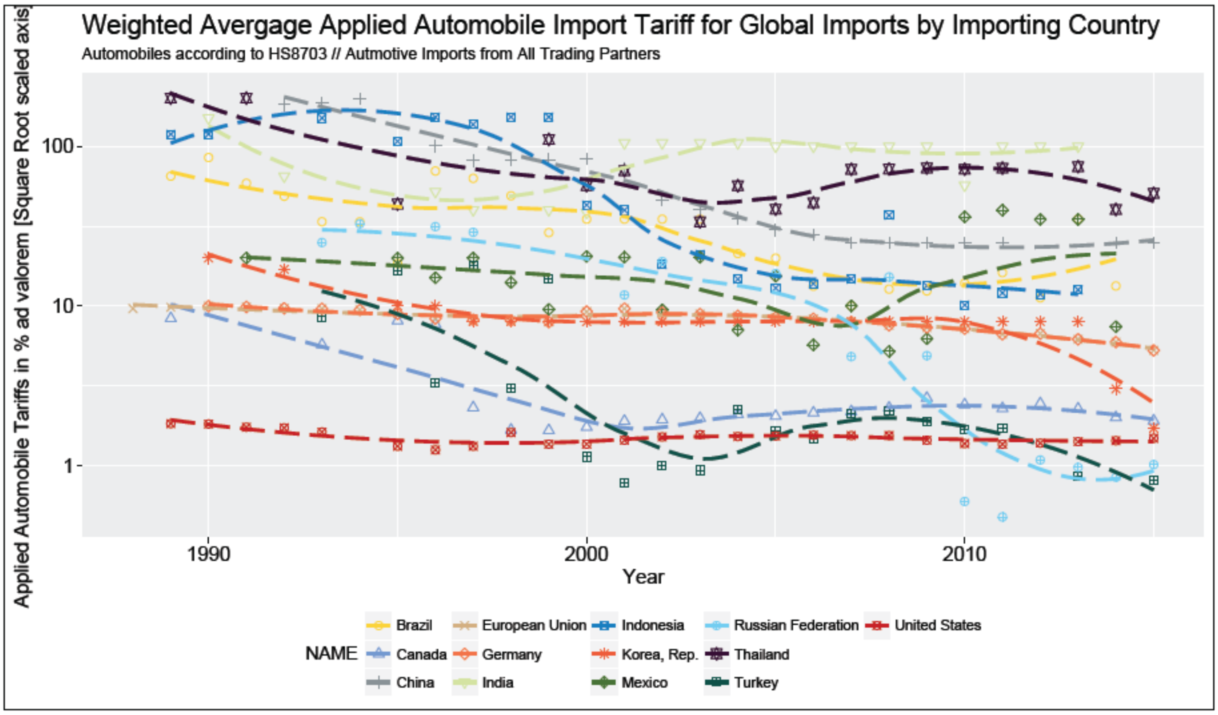
Largest manufacturing countries of automobiles in 2016 according to the Organisation Internationale des Constructeurs d'Automobiles (OICA)

http://www.oica.net/category/production-statistics/; retrieved 24/05/2017

Country	**Produced quantity of passenger vehicles**	
China	24,420,744	
Japan	7,873,886	(excluded due to 0% tariffs (log not possible))
Germany	5,746,808	(aggregated into EU)
USA	3,934,357	
South Korea	3,859,991	
India	3,677,605	
Spain	2,354,117	(aggregated into EU)
Mexico	1,993,168	
Brazil	1,778,464	
UK	1,722,698	(aggregated into EU)
France	1,626,000	(aggregated into EU)
Czech Rep.	1,344,182	(aggregated into EU)
Russia	1,124,774	
Iran	1,074,000	(excluded due to distorting sanctions)
Slovakia	1,040,000	(aggregated into EU)
Indonesia	968,101	
Turkey	950,888	(part of EU customs union from 1995)
Thailand	805,033	
Canada	802,057	

3. Regression model of global automotive Imports and applied import tariff

3.1. World Independent Variable



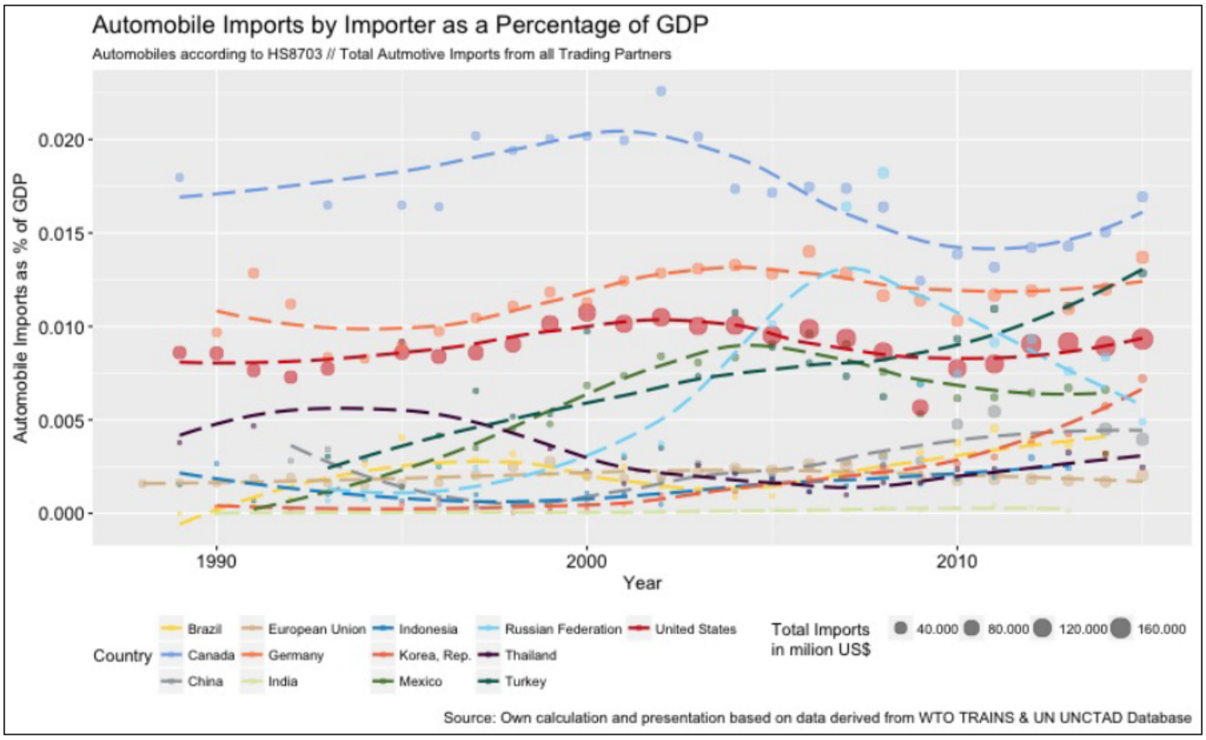
Weighted Average Applied Automobile Import Tariff for Automobile Imports from worldwide trading partners.

Source: Own presentation based on data retrieved from UN UNCTAD TRAINS Database

The figure shows the development of general tariffs for automobile imports from worldwide trading partners. The data is used as the independent variable in the following global regression model.

Except from minor differences, the tariffs are similar to the import tariffs for imports from Germany. Contrary to the main analysis that focussed on Germany as the exporting country, this additional regression utilizes global imports and tariffs. Therefore, Germany and the EU are included but have the same tariffs because Germany is part of the European Union's Customs Area.

3.2. World Dependent Variable



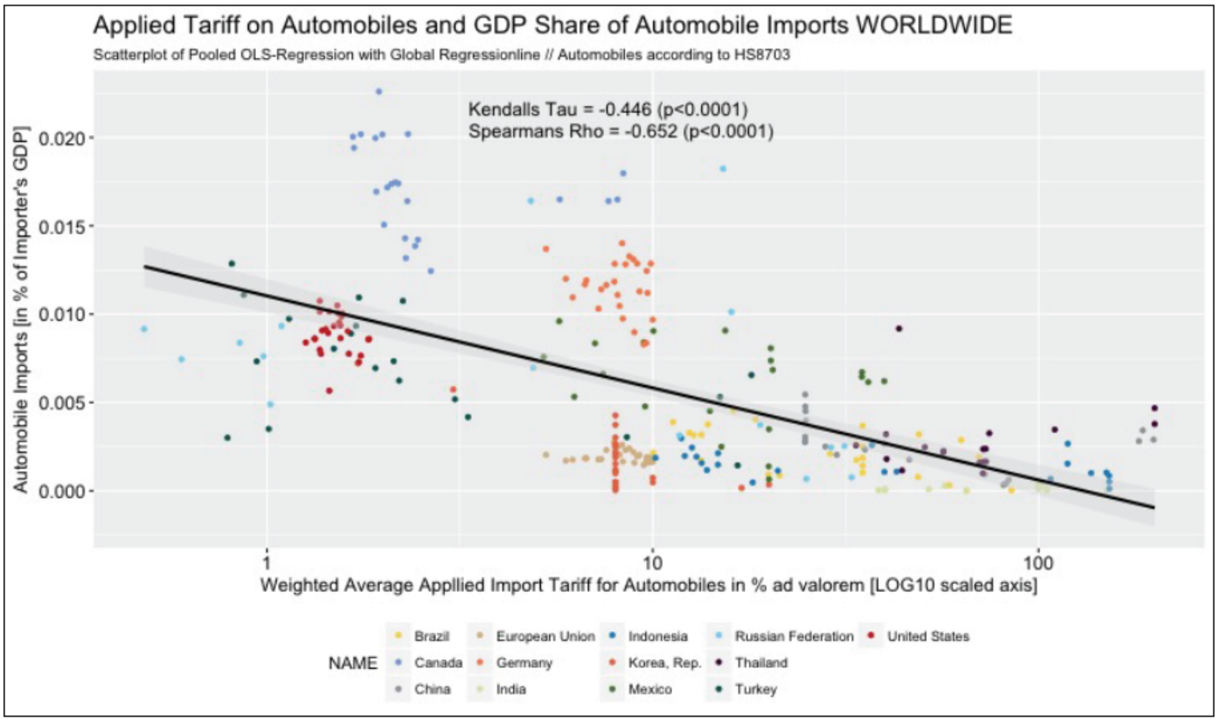
Share of Automobile imports of the GDP to all trading partners worldwide between 1990 and 2015. The bubble size stands for absolute import value of automobiles according to HS8703.

Sources: Own presentation based on data from UN UNCTAD COMTRADE and UNCTAD STAT

The figure shows the development of the share of automobile imports of the GDP of the examined countries. The data is used as the independent variable in the following global regression model.

The figure shows clearly, that the US are the largest importer of automobiles in absolute values, although other counties are expending a larger share of their GDP for automobile imports. Contrary to the main analysis that focussed on Germany as the exporting country, this additional regression utilizes global imports and tariffs. Therefore, Germany and the EU are included as well.

3.3. World Pooled OLS-Regression

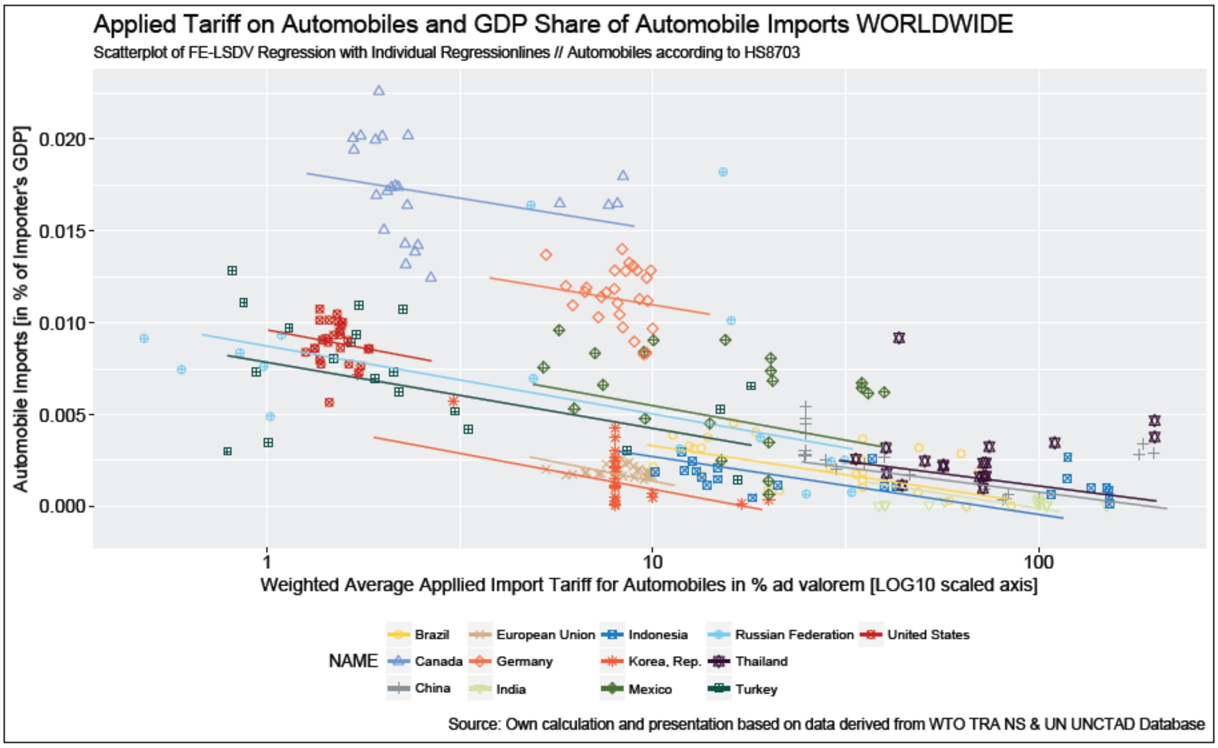


Pooled OLS regression of automobile import share of the GDP and the average applied import tariff for passenger vehicle import for all imports.
Source: Own calculation and presentation based on data from UN UNCTAD TRAINS, UN COMTRADE and UN UNCSTAT STAT.

The global regression model and its coefficients are very similar to the main model focussed on Germany.

```
Call:
lm(formula = IM_VALUE_P_GDP_W ~ LOG_APL_WAVG_W, data = tradex)

Residuals:
       Min         1Q     Median         3Q        Max
-0.0085640 -0.0030296 -0.0006432  0.0019784  0.0133536

Coefficients:
                 Estimate Std. Error t value Pr(>|t|)
(Intercept)     0.0110306  0.0004767   23.14   <2e-16 ***
LOG_APL_WAVG_W -0.0022629  0.0001695  -13.35   <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.004101 on 287 degrees of freedom
Multiple R-squared:  0.3832,    Adjusted R-squared:  0.381
F-statistic: 178.3 on 1 and 287 DF,  p-value: < 2.2e-16
```

3.4. World FE LSDV Regression



FE LSDV regression of automobile import share of the GDP and the average applied import tariff for passenger vehicle import for all imports by importing country.
Source: Own calculation and presentation based on data from UN UNCTAD TRAINS, UN COMTRADE and UN UNCSTAT STAT.

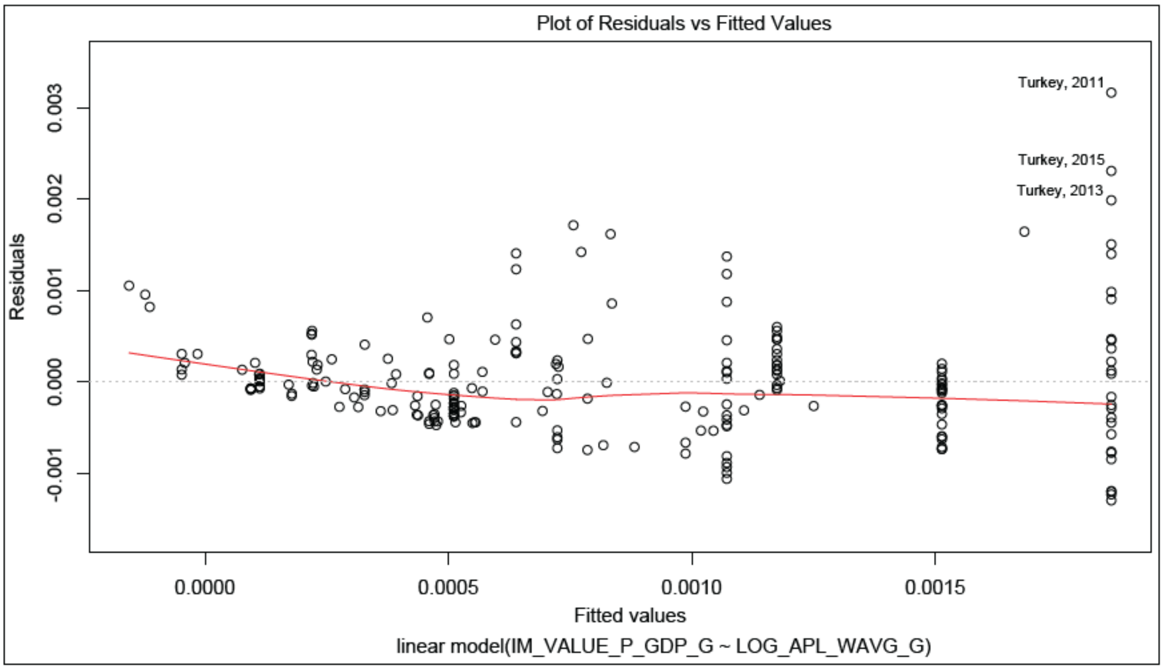
The global regression model with fixed effects indeed shows slightly improved results over the main model focussed on Germany. The coefficients shown on the next page have a slightly better fit and marginally higher significance.

Germany and the EU could be included in this analysis since imports from all trading partners worldwide are analysed.

```
Call:
lm(formula = IM_VALUE_P_GDP_W ~ LOG_APL_WAVG_W + factor(REPORTER),
    data = tradex)

Residuals:
       Min         1Q     Median         3Q        Max
-0.0051930 -0.0009280 -0.0000755  0.0008502  0.0123201

Coefficients:
                       Estimate Std. Error t value Pr(>|t|)
(Intercept)           0.0055540  0.0006860   8.096 1.85e-14 ***
LOG_APL_WAVG_W       -0.0010047  0.0001711  -5.872 1.24e-08 ***
factor(REPORTER)CAN   0.0126121  0.0006911  18.250  < 2e-16 ***
factor(REPORTER)CHN   0.0008213  0.0005837   1.407 0.160520
factor(REPORTER)DEU   0.0080384  0.0005822  13.806  < 2e-16 ***
factor(REPORTER)EU   -0.0014650  0.0005723  -2.560 0.011009 *
factor(REPORTER)IDN  -0.0004685  0.0005690  -0.823 0.411016
factor(REPORTER)IND  -0.0009802  0.0006190  -1.583 0.114484
factor(REPORTER)KOR  -0.0016015  0.0006004  -2.668 0.008094 **
factor(REPORTER)MEX   0.0032971  0.0005844   5.642 4.18e-08 ***
factor(REPORTER)RUS   0.0030846  0.0006853   4.501 9.98e-06 ***
factor(REPORTER)THA   0.0014840  0.0006190   2.397 0.017178 *
factor(REPORTER)TUR   0.0024022  0.0007179   3.346 0.000934 ***
factor(REPORTER)USA   0.0037540  0.0007373   5.092 6.59e-07 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.001957 on 275 degrees of freedom
Multiple R-squared:  0.8653,	Adjusted R-squared:  0.859
F-statistic: 135.9 on 13 and 275 DF,  p-value: < 2.2e-16
```

4. Coefficient Overview and Residual Plots of Applied models

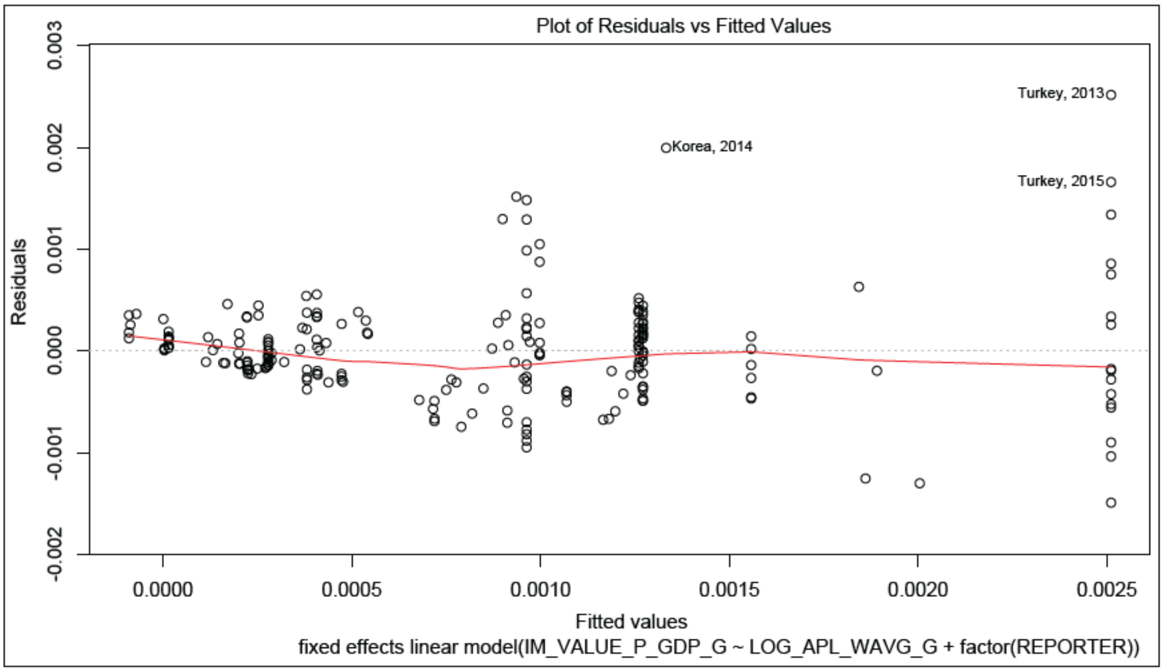
4.1. OLS Residuals



4.2. OLS Coefficients

```
Call:
lm(formula = IM_VALUE_P_GDP_G ~ LOG_APL_WAVG_G, data = tradex)

Residuals:
       Min         1Q     Median         3Q        Max
-0.0012938 -0.0003495 -0.0000727  0.0002101  0.0031658

Coefficients:
                Estimate Std. Error t value Pr(>|t|)
(Intercept)    1.862e-03  8.326e-05   22.36   <2e-16 ***
LOG_APL_WAVG_G -3.798e-04  2.727e-05  -13.93   <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.0006082 on 218 degrees of freedom
  (69 observations deleted due to missingness)
Multiple R-squared:  0.4709,    Adjusted R-squared:  0.4684
F-statistic:   194 on 1 and 218 DF,  p-value: < 2.2e-16
```

4.3. LSDV Residuals



4.4. LSDV Coefficients

```
Call:
lm(formula = IM_VALUE_P_GDP_G ~ LOG_APL_WAVG_G + factor(REPORTER),
    data = tradex)

Residuals:
       Min         1Q     Median         3Q        Max
-1.493e-03 -2.428e-04 -1.968e-05  2.128e-04  2.517e-03

Coefficients:
                      Estimate Std. Error t value Pr(>|t|)
(Intercept)          1.095e-03  2.004e-04   5.463 1.33e-07 ***
LOG_APL_WAVG_G      -2.296e-04  4.703e-05  -4.882 2.09e-06 ***
factor(REPORTER)CAN  5.803e-04  1.729e-04   3.357 0.000937 ***
factor(REPORTER)CHN  6.417e-04  1.561e-04   4.110 5.68e-05 ***
factor(REPORTER)IDN -3.101e-05  1.589e-04  -0.195 0.845512
factor(REPORTER)IND -2.277e-05  1.639e-04  -0.139 0.889641
factor(REPORTER)KOR  3.455e-04  1.704e-04   2.028 0.043827 *
factor(REPORTER)MEX -2.600e-05  1.620e-04  -0.160 0.872668
factor(REPORTER)RUS  4.627e-04  1.859e-04   2.488 0.013619 *
factor(REPORTER)THA  3.052e-04  1.717e-04   1.778 0.076928 .
factor(REPORTER)TUR  1.416e-03  2.132e-04   6.643 2.64e-10 ***
factor(REPORTER)USA  3.864e-04  1.957e-04   1.975 0.049642 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.0005137 on 208 degrees of freedom
  (69 observations deleted due to missingness)
Multiple R-squared:  0.6398,    Adjusted R-squared:  0.6207
F-statistic: 33.59 on 11 and 208 DF,  p-value: < 2.2e-16
```