The limiting factors of exchange rate pass through for the German manufacturing sectors

Master Thesis Financial Economics
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Abstract

Exports of goods and services became the primary driver of GDP growth since 2008 in the Eurozone. The accommodative ECB policies during the same period (2008-Present day) are seen as an important determinant to explain the increase in the share of GDP and GDP growth. An intuitive argument for the growth in exports is the competitiveness of export prices, partially enabled through the depreciation of the Euro vis-à-vis other currencies by ECB. This paper checks the sensitivity of export prices to exchange rate fluctuations in German manufacturing exports at 2-digit HS channels. The results show that the exchange rate pass-through into destination currency prices is around 70% within a quarter. This figure is quite higher than the existing literature. It is also found that the bilateral trade within the same sector significantly diminishes the pass-through estimates both due to the global supply chains and intermediate inputs. Overall results support the notion that ECB policies transmit notably into export prices within the same quarter in the selected German manufacturing industries.

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Table of Contents

1. Introduction

Transmission of ECB monetary policy into real economic activity became a pressing issue as the economic growth and inflation didn't reach the projected levels after 2013. Former ECB President Mario Draghi emphasized that the transmission of monetary shocks to financing factors was successful. However, he adds that the second step of the transfer, from financing conditions to the real economic activity was slower than expected (Acharya et al. ,2020). This paper analyses the conduction of ECB monetary shocks to real economic activity through its effect on German manufacturing exports. Three strands of knowledge are necessary to justify the use of exports as a proxy for real economic activity.

First of all, ECB monetary policy actions can be divided into four periods. These are :
1) Beginning of the ECB Monetary Policy and Integration Phase, January 1999-June 2003
2) Revision of the Monetary Strategy to the Beginning of the Financial Crisis, July 2003-July 2007
3)Great Recession and Sovereign Debt Crises, August 2007-June 2013
4)Ultra-Low Inflation and Recovery after Crises June 2013-Present.

The general direction of the policies starting from phase 3 was mainly expansionary or accommodative. In the Double-Dip recessive stage, ECB conducted definitive interest rate cuts and introduced comprehensive asset purchase programs. This recessive episode also directed the focus of policy analysis to the imperfections in the transmission of monetary policy to real factors in the economy (An example is the Bank Lending Channel). In Stage 4, ECB used expansionary tools such as quantitative easing or explicit forward guidance to minimize deflation risks and reach the intended level of inflation (2%). It is also notable that the ECB became the first major central bank to use a negative Deposit Facility Rate during the 4th phase (Hartmann and Smets, 2018).

Likewise, the Current Account balance surplus as a share of the Eurozone economy has grown steadily during this period. In 2020, the Current Account surplus was 349.1 billion Euros, which was equal to 2.6% of Euro Area GDP. The share of the Current Account balance surplus within GDP has grown from 0.9% in 2009 to 3.2% in 2016. Another interesting point to add is that the Current Account surplus reached its peak as a share of GDP during the most intensive phase of the Quantitative Easing program (March 2015-March 2017). Additionally, the

majority portion of the Current Account Surplus comes from the Goods Account rather than the Services. Goods Account Surplus was 2.5% of the GDP since the total share of Current Account Surplus was 2.6%, around 95% of the Surplus is the result of goods exports (Eurostat, 2021).

Thirdly, aside from its impeccable growth since the Great Recession in 2008, Exports became the main driver of GDP growth in the Eurozone. Exports in total represent 45% of the Eurozone GDP in 2019, which jumped from 34% in 2009. Between 2009-2019, on average 35% of the GDP growth is due to the growth in exports of goods and services. Also, the share of exports within annual GDP growth peaked at 77% in 2017 and was 45% again in 2019(World Bank, 2021).

All in all, the Euro area data shows these three facts:

1)ECB's policies are mainly accommodative or expansionary since the Great Recession in 2008.

2) Parallel with the expansionary monetary policy, Current Account Surplus (specifically the Goods Account surplus) as a share of GDP increased consistently during the same period.

3)The share of Exports within GDP increased and reached 45%, and exports became the primary driver of GDP growth in the Eurozone.

Therefore, these numbers suggest that Eurozone's economic growth became more and more dependent on the export of goods and services. Since the export growth and the expansionary policy trend starting from 2009 coincide, one possible channel for the increased demand of Eurozone exports is lower prices. So, the depreciation of the Euro vis-a-vis trade partner's currencies can partially explain the surge of exports in the Euro area. The goal of this paper is to assess the exchange rate pass-through to customer/destination currency prices. More precisely, it checks how bilateral trade within similar products and export market share in a sector can change exchange rate pass-through. Amiti et al. (2014) used a similar approach to explain the low aggregate exchange rate pass-through and pass-through variation among exporters. With Belgian firm-product level data, researchers concluded that exchange rate pass-through significantly diminishes in firms that are more import-intensive or have higher market shares (from almost full pass-through for small non-importing firms to around 50% for the large exporters). Authors theorized that the import-intensive firms experience offsetting exchange rate effects in their marginal costs. Furthermore, firms that have high export market

shares can set higher mark-ups to adjust to marginal cost shifts. This paper uses German sector-level data and similar arguments with Amiti et al. (2011) to further understand how the devaluation of the Euro affects export prices in different sectors, trade partners. Correspondingly to Amiti et al. (2011), in sectors where export market shares are high; German firms are expected to set higher mark-ups to alleviate unfavourable exchange rate movements. Also, import intensive sectors (sectors where the value of German imports is high around a similar timeframe with its exports) would face a neutralizing exchange rate effect due to their expenditures in the trade partner's currency.

The second part of the article introduces the related literature about this analysis. Next, the third part explains the data and methodology of the estimations. Also, this part of the paper aims to justify the use of import intensity and export share as appropriate explanatory variables in pass-through evaluation. In the fourth section, the empirical analysis starts by showing how unconventional ECB policies depreciate the Euro against top non-Euro export partners of Germany. Visually it is clear that there is a positive correlation between a country's total trade volume with Germany and its currency's reactiveness to ECB policy announcements. Also, the currencies of developed countries seem to be more susceptible to policy changes as opposed to emerging country currencies. After that, the price elasticities of the exchange rate, import intensity of the sector and the export market shares are estimated. Results are statistically significant and positive for each of the three parameters. Thus, this estimation proves that Euro producer prices indeed react positively to the changes in the proposed controls (import intensity and export market share) and the depreciation of the Euro. Lastly, the primary specification is estimated first for the whole data set and then for the developed countries only. The results are significant for the proposed HS channels. For the whole data set, the aggregate exchange rate pass-through into consumer prices is approximately 70% for the median import-intensity level. Additionally, the estimation for developed countries demonstrate a similar exchange rate pass-through into non-Euro destination prices. Aggregate pass-through is to 73% for the median import intensity of 42%.

2. Related Literature

Literature on three subjects is relevant for this paper. First, it is related to the literature on exchange rate disconnect. Primarily, this paper uses Amiti et al. (2014)'s arguments and estimation method to find out two potentially limiting factors of pass-through to the prices of internationally traded goods. Researchers before Amiti et al. (2014) proposed three different

channels to explain incomplete pass-through. In the first channel, Gopinath and Rigobon (2008) demonstrated short-run price stickiness for the destination currency prices with US export and import price data. This channel is named local currency pricing (Engel, 2002). The second channel, Pricing-to-Market, correlates local market conditions and location-specific marginal costs with the segmentation in pricing at destinations (Atkeson and Burstein, 2008) (Goldberg and Hellerstein,2008). Lastly, the third channel of partial exchange rate pass-through is related to local distribution costs (Burstein et al., 2003) (Goldberg and Campa, 2010). The import intensity in similar goods in this paper explains a similar offsetting channel with the local distribution cost channel. However, in this paper, incomplete exchange rate pass-through to Euro-producer prices is also distinguishable due to non-Euro expenditures in similar goods.

The second strand of literature investigates the impact of Monetary Policy decisions on currency movements, particularly the ECB policies. In agreement with this paper's data, Dedola et al. (2018) found that quantitative easing programs conducted by ECB, FED have significant and persistent effects on the USD/EUR rate. They also concluded that the future expectations regarding Central bank policies contribute significantly to the exchange rate responses of expansionary policies. The accommodative stance by ECB generated a statistically significant expected depreciation of the Euro against the USD, 12 months after the QE announcement. Similarly, Cecioni (2018) provides empirical evidence for the effects of ECB's unconventional and conventional monetary policies on the exchange rate, with a specific focus after 2013 January. The author analysed that the responsiveness of exchange rate evolutions to the news about monetary policy became more sensitive starting from 2013. Cecioni (2018) also found that the efficacy of policy actions on exchange rate became more striking when DFR became negative and when the unexpected portion (monetary surprise) of the unconventional and conventional policies move in the same direction.

Finally, the last relevant branch of literature is about how international trade affects exchange rate pass-through. Devereux et al. (2017) inspected the relationship between the currency of invoicing in international trade and exchange rate pass-through. They found that the pass-through is lower for larger firms-firms with higher export market shares, and these firms tend to use local currency invoicing more compared to smaller or mid-sized companies. Another interesting article by Georgiadis and Grab (2019) explores the link between the rise of global value chains and low exchange rate pass-through to prices. Researchers explained that global

value chain participation reduces the exchange rate pass-through to import prices. Furthermore, their paper showed that the value-chains are becoming more regionally focused since 2011.

3. Methodology & Data

A) Theoretical Framework

i. Why German Manufacturing Sectors?

This paper uses three German manufacturing sectors to further understand the claim: "the Eurozone economic growth became much more dependent on exports over time, partially due to the depreciation of the Euro against other currencies". This papers' results are by no means generalizable to the whole Eurozone due to the unique economic characteristics and the level of differentiation in German manufacturing sectors in this paper. On the other hand, German manufacturing industry exports represent a significant share of Euro area exports and its Current account surplus. Germany was the largest exporter of goods and services in the Eurozone with a 28% share in 2019, and its share within Eurozone was never lower than 26% since 2000. Moreover, in the goods exports, the main driver of the Current Account Surplus growth, Germany had a share of 32% in 2019 and had seen its lowest share in 2000 with 29.5% within the Euro area. Therefore, German exports can be seen as the chief driver of export induced growth in the Eurozone. More specifically, the top three export sectors of Germany are used in this paper. These three sectors make up around 43% of all Germany's exports (Mechanical Machinery:17%, Vehicles other than railway:15%, Electrical Machinery:11%) (Eurostat, 2021) (Word Bank, 2021).

ii. Market Share and Mark-ups

This section theorizes that the firms with high-market shares charge higher mark-ups and aims to generalize this notion in a macro-level dataset. Amiti et al. (2014) use the same model to explain how mark-up elasticity of firm prices increase with firm's market share. To begin with, suppose a firm producing good i in sector s and selling it to the country k at time t. Consumers have a nested CES demand over a range of products and services. There exists the elasticity of substitution for the products within the sector, ρ, and the elasticity of substitution for different sectors, η. A crucial assumption to continue is $\rho > \eta \geq 1$. As an example, suppose there are two car brands and two different modes of transportation cars and planes. The assumption

above is that it is easier to substitute from one car brand to another than the entire mode of transportation. Additionally, condition $\eta \geq 1$ ensures finite mark-ups for the firms. So, a firm faces the flowing demand for its product

(1) $$Q_{k,i} = \xi_{k,i} * P_{k,i}^{-\rho} * P_{k,}^{\rho-\eta} * D_k$$

where $Q_{k,i}$ is the quantity demanded, $\xi_{k,i}$ indicates the relative quality(preference) parameter of the firm's product, $P_{k,i}$ is the firm's price, P_k is the sectoral price index and $D_{k,}$ is the sectoral demand shifter. The sectoral price index is defined as:

$P_k = [\sum_i \xi_{k,i} * P_{k,i}^{1-\rho}]^{\frac{1}{1-\rho}}$ where the sum of the quality parameters is equal to 1 ($\sum_i \xi_{k,i} = 1$).

To move on, the market share of a firm is given by and algebraically equal to

(2) $$S_{k,i} = \frac{P_{k,i} * Q_{k,i}}{\sum_{i'} P_{k,i'} * Q_{k,i'}} = \xi_{k,i} * \left(\frac{P_{k,i}}{P_k}\right)^{\frac{1}{1-\rho}}$$

Thus, a firm's market share depends on its products relative quality, the ratio of its price and sectoral price index (lower prices indicate larger market shares), elasticity of substitution for the products within the sector. The effective demand elasticity for the firm is then:

(3) $$\sigma_{k,i} = -\frac{dlogQ_{k,i}}{dlogP_{k,i}} = \rho * \left(1 - S_{k,i}\right) + \eta * (S_{k,i})$$

This equation shows that the weight of the within sector elasticity diminishes as the market share of the firm increases. Consequentially, as a firm's market share gets higher, its influence on the sectoral price index becomes more dominant ($\frac{\partial P_k}{\partial P_{k,i}} = S_{k,i}$). Therefore, any price change

by the high-market share firm changes the variables $Q_{k,i}, \eta$ less in turn the effective demand elasticity less. So, a high-market share firm's quantity demanded is less affected by its own price changes compared to other smaller firms.

Competing firms are able to price their goods depending on their consumers WTP and add, $\frac{\sigma_{k,i}}{\sigma_{k,i}-1} * Marginal\ unit\ cost$, a mark-up to their marginal costs to derive prices. Since the effective demand elasticity is less responsive to the price changes of the high-market share firms, high-market share firms charge higher mark-ups. Amiti et al. (2014) defined a mark-up elasticity of the firm's product price:

(4) $$\Gamma_{k,i} = -\frac{dlog\mathrm{M}_{k,i}}{dlogP_{k,i}} = \frac{S_{k,i}}{\left(\frac{\rho}{\rho-\eta}-S_{k,i}\right)*\left(1-S_{k,i}*\frac{\rho-\eta}{\rho-1}\right)} > 0$$

This relationship shows that the mark-up elasticity of price is increasing with the market share of the firm. Therefore, in a price shock, the high market share firm can increase its mark-ups more compared to smaller firms.

The theoretical framework above is designated for an individual firm but this papers data is sector level. Accordingly, can we assume the same mark-up power for German companies with the export market share data in a destination k? The framework is not applicable if, for example, a 40% market share in a destination is due to forty firms each having a 1% market share. To solidify the assumption of market power of German firms, the empirical analysis provides support in part 4.B. Also, firm-level data to US exports in these three sectors specify the large market shares of a few German firms rather than a fragmented share of exporters (ITC, 2021).

iii. Bilateral Trade in the Same Sector

This part is considerably harder to model compared to the relationship between market share and mark-ups. Since this papers data has import data at the two-digit HS code level. So, contrary to Amiti et al. (2014), imported goods are not necessarily used for potential exports but can be consumed by the government, firms or consumers. The main mechanism to prove

that bilateral trade within the same sector around the same quarter is uncomplicated. It just considers that as the expenditures in foreign currency (or the demand for the foreign currency) increases, any exchange rate shocks are muted and can limitedly pass-through prices. To be more precise, this aggregate expenditure channel includes both the marginal cost channel due to imported intermediate goods and expenditure in non-Euro priced goods. Firstly, Campa and Goldberg (2010) claimed that intermediate inputs are indeed used extensively during production may account for approximately 48% of the final price for tradeable goods. Likewise, as in this paper, Amiti et al (2014) used the non-Euro invoiced imported intermediaries to understand the partial elasticity of marginal cost to exchange rate. Another feature that can affect the partial elasticity of marginal cost to exchange rate is the globalization or more global production/supply chains (Georgiadis et al., 2018) (Bussière and Peltonen, 2013). Secondly, as an intuitive result, an increase in the non-Euro invoiced imports increases the demand for the trade partners' currency against Euro. Thus, the expenditure in trade partners' currencies as measured by the sector level imports hedge the effect of exchange rate changes on destination currency prices. A required assumption for both the German and the foreign firms from Germany's top trade partners is the predominant usage of the local currency invoicing in exports. Boz et al. (2020) gathered an amazingly comprehensive dataset for the invoicing currencies in the world trade for more than 100 countries, between 1990 to 2020. According to this data set, 79% of German exports are invoiced in Euro (around 15% in USD and 6% in other currencies. So the currency choice in exports for the selected trade partners are: USA: 96% USD, UK:42.3% GBP-27.7% USD, Poland 22.3% PLN-27.2% USD, Russia 10.04% RUB-76.5% USD, Japan38% JPY- 50.4% USD, Switzerland 44.1% CFH-20.35% USD, Turkey 3.5% TRY – 47% USD, South Korea 1.04%KRW, 86% USD. The invoicing data for the people's Republic of China does not exist. Considering these countries share in German manufacturing imports (in HS:84,85,87), the weighted average of local currency invoicing is around 47%(USD is 52%) (UNComtrade,2020). This result shows that even though the USD and EUR are the dominant choices in export invoices, approximately 50% of the exports are receipted by the local currency of the trade partner.

iv. Equilibrium Relationship

In the part 3.i. it is shown that the producers price their goods considering a multiplicative mark-up. So the price equation on firm level becomes:

(5) $$P_{k,i}^{*} = \frac{\sigma_{k,i}}{\sigma_{k,i}-1} * MC_{i}^{*}$$

Consequently, in order to derive the exchange rate pass-through into export prices with import intensity and export market share as explanatory variables. The full differential of the equation can be written for the German exporters in a sector can be written as:

(6) $$dlogP_{s,k}^{*} = dlogM_{s,k} + dlog\mathcal{E}_{s,k},$$

where $\mathcal{E}_{s,k}$ is the sector level non-Euro expenditures for intermediate inputs or consumption and the $M_{s,k}$ sector level aggregate mark-up. $P_{s,k}^{*}$ indicates the sum of the prices German firms change in sector s and destination k. Therefore, the total change in the German aggregate exporter price depends on the changes in aggregate mark-up of German firms in a sector and non-euro German expenditures in a sector. To procure the exchange rate pass-through elasticity to export prices, we need to divide equation by the log change in the bilateral exchange rate $dlog\epsilon_{k}$.

(7) $$\frac{dlogP_{s,k}^{*}}{dlog\epsilon_{k}} = \frac{dlogM_{s,k}}{dlog\epsilon_{k}} + \frac{dlog\mathcal{E}_{s,k}}{dlog\epsilon_{k}},$$

The first determinant then is the mark-up elasticity of exchange rate. According to the equation (4), mark-up elasticity of a firms' price is positively elastic and the change in consumer currency price as a sector aggregate can be defined as

(8) $$dlogP_{s,k}^{*} = dlogP_{s,k} + dlog\epsilon_{k}$$

Hence, in case of a Euro depreciation in this case (variable $dlog\epsilon_{k}$ increases) producers need to increase their prices in Euros in order to receive the same value for the goods they provide. As a result, in a price shock due to the Euro depreciation, aggregate mark-up increases of

German firms in high-market-share sectors would be greater as equation (4) shows a positive elasticity.

Secondly, non-Euro expenditure elasticity of exchange rate would be the second determinant. Intuitively an increase in the variable $dlog\epsilon_k$ results in an increase in non-Euro expenses both for the firms and consumers. In order to offset the growth in costs, German producers again would rise their Euro prices to sustain their profit margin to the best of their ability.

The expected exchange rate pass through elasticity into producer currency export prices can be written as:

(9) $$\psi_{s,k} = E\left(\frac{dlogP^*_{s,k}}{dlog\epsilon_k}\right) = \alpha_{s,k} + \beta\varphi_{s,k} + \gamma S_{s,k}$$

In conclusion, pass-through into destination currency prices in sector s,1- $\psi_{s,k}$, decreases when the German imports from destination k and the market share of German firms in sector s in destination k increases.

B) Data and Stylized Facts

i. Data Description and Construction of Variables

Eurostat is the main data source for the estimations in this paper. It provides detailed data on internationally traded goods and bilateral exchange rates. Internationally traded goods data include export and import values, quantities for the three of the six main sectors within the manufacturing exports, from January 1999 to March 2021. These three aggregated sectors are Mechanical Machinery (HS code:84), Electrical Machinery (HS code:85), Vehicles and its accessories, parts excluding railway (HS code: 87). I had to drop Railway (HS code:86), Aircraft (HS code:88), Nautical-Ships thereof (HS code:89) sectors due to the extreme variations between months, data availability and their share within the German manufacturing exports in certain periods. Top export partners of Germany which do not use the Euro as their

national currency are used during the estimation. These countries are the United States, United Kingdom, Japan, Switzerland, Poland, Russian Federation and Turkey.

The dependent variable in the exchange rate-pass through analysis is the log change in export price of sector s to the destination of country k at time t. The price is defined on a per quantity basis where quantities are measured as weights, more specifically in tonnes.

(10) $$\Delta p^{*}_{s,k,t} = \Delta log\left(\frac{Export\ Value_{s,k,t}}{Export\ Quantity_{s,k,t}}\right)$$

Notably, the monthly export prices may fluctuate wildly due to the seasonal shifts in orders, measurement errors in both quantities and values and different accounting formats these countries use (Amiti et al, 2014). This article uses quarterly moving averages in all the variables to mitigate this issue. So, for example, a price for April 2010 represents the average of the ratios of export values and quantities between January 2010 and April 2010. Sector level export prices and exchange rate fluctuations normalize significantly after using quarterly moving averages while conserving the general trend of these variables. This method is used in the construction of four key variables in the analysis. Likewise, another supporting argument for the usage of quarterly moving averages is the findings of Gopinath et al. (2010). Researchers found that half of the long run exchange rate pass through takes place in the first 5 months. Similarly, Berner (2010) presented that pass through mostly occurs within the first 3 months by using German micro data (8-digit level).

Firstly, import intensity ($\varphi_{s,k,t}$) shows the share of German imports within the total value of trade flows in sector s with country k at time t.

(11) $$\varphi_{s,k,t} = \frac{Import\ Value_{s,k,t}}{Import\ Value_{s,k,t} + Export\ Value_{s,k,t}}$$

The import intensity in Amiti et al. (2014) intends to measure the share of non-euro expenditures within the total variable costs of the firm. They proposed this variable to show a

firm's marginal cost sensitivity to the exchange rate movements, as the value of imported inputs represents the non-euro expenditures. As mentioned in the part 2.A, this paper uses German expenditures in a sector to show how similar demand levels for goods that are traded in different currencies have an offsetting effect on prices.

Second independent variable is the market share of German exports in sector s at country k at time t.

(12) $$S_{s,k,t}=\frac{German\ Export\ Value_{s,k,t}}{(\Sigma Export\ Value_{s,k,t})}$$

Monthly export value data from all countries in sector s to country k comes from UNComtrade or Eurostat. This paper applies the sum of export values from all available countries for the sector s to destination k at time t as much as possible, instead of the total value of imports from country k to derive the total export market. The main reason for this is the value mismatch between import and export values (IMF, 2021) (The World Bank, 2010). As a result of accounting or reporting mistakes, some export market shares could be more than one, or similar ostentatious market shares are possible. Although the quarterly moving average method assuages the illogical numbers, the share of them remains significant. Using the sum of export values from all over the world to the destination k solves this issue, and the new export market share amounts are aligned with the sum of the market shares of large companies in the USA(Tulumba,2021).

ii. Stylized facts

The median import intensity of the whole data set is 31%. Therefore, on average, the value of the imported goods in the designated three sectors is equal to 62% of the exported goods from Germany within the same month. On the other hand, the average share of imports within the total trade of Germany between 2010 to 2020 is equal to 46%. This number declines to 44% in the goods trade within the same period (World Bank, 2021). These numbers show that German firms export significantly more in these three sectors as their import intensities are lower. The total expenditure of German firms, customers, government reaches around 62% of the total sales to the countries in the data set in a given month.

Table-1: Median Import Intensity by Export Partner/Sector Combinations

Partner/Product	Mechanical Machinery(HS:84)	Electrical Machinery(HS:85)	Motor Vehicles and parts thereof(HS:87)
USA	**23.8%**	**29.5%**	**15.2%**
United Kingdom	**30.8%**	**41.7%**	**14.2%**
Russian Federation	**2.2%**	**2.7%**	**1%**
Poland	**42.2%**	**48.6%**	**49.8%**
Switzerland	**48.7%**	**45.4%**	**11.2%**
Turkey	**29.6%**	**26.6%**	**25.3%**
Japan	**56.3%**	**73.2%**	**38.8%**

Table-1 demonstrates detailed median import intensity measurements for countries and sectors in the dataset. The vehicle or motor vehicle sector is the least import intensive in Germany with approximately 16%. Only in three trading partners, the median import intensity exceeds 16% which are Japan, Turkey and Poland. Unsurprisingly, German Multinational Motor Vehicle Companies have crucial suppliers for vehicle parts or partially /fully owned vehicle factories in Poland and Turkey (ACEA, 2020). Additionally, Japan is the second-largest exporter of Motor vehicle and vehicle parts after Germany, and the median German import intensity with Japan in the motor vehicle sector is 39% (OEC, 2019). Electrical machinery has the highest median import intensity within the sectors in this paper with 41%. Import intensity in this sector is much higher for the EU/past EU members (excluding Japan) which don't use Euro as their currency. Interestingly the import intensity with Japan is much higher than any other country with 73%, which means that Germany on average has a deficit in this account.

Table-2: Median Export Market Share by Export Partner/Sector Combinations

Partner/Product	Mechanical Machinery(HS:84)	Electrical Machinery(HS:85)	Motor Vehicles and parts thereof(HS:87)
USA	**7.6%**	**4.7%**	**12.5%**
United Kingdom	**22.3%**	**15.1%**	**41.2%**
Russian Federation	**17.2%**	**9.7%**	**12%**
Poland	**36.8%**	**25.5%**	**37.7%**
Switzerland	**37.4%**	**30.4%**	**39.9%**
Turkey	**22.9%**	**14.3%**	**36.5%**
Japan	**4.3%**	**1.8%**	**8.4%**

Table-2 shows the median export market shares of the German firms in the seven countries and three sectors in this paper. Germany has the highest export market share in the aggregate motor vehicle sector with almost 34% market share in these seven countries markets. As Germany is the largest motor vehicle exporter in the world (19% of all car exports in the world in 2019), this figure is not unanticipated (OEC,2019). Median market shares are positively correlated with the distance from Germany except for Russia. USA, Russia and Japan are the only three countries in which the German motor vehicle sector's median market share is below 34%. The median export market share of Germany in the USA for motor vehicles is around 12.5%. This figure seems proportionate as the 8.6% of USA car imports are from Germany in 2020 (ITC,2021). The electrical machinery sector has the lowest median export market share with 13%, mirroring the import intensity numbers similar to the motor vehicles. Similarly, Germany has the lowest median market share in Japan in electrical machinery with approximately 2%.

C) Empirical Specification

The main empirical analysis aims to describe the relationship between exchange rate pass-through, export market shares and import intensity (bilateral trade within similar goods). In the primary specification, the quarterly moving average changes per month in log Euro export prices are regressed on the changes in the log exchange rate and its interaction variables with import intensity, export market share.

$$\Delta p^{*}_{s,k,t} = \left[\alpha_{s,k} + \beta\varphi_{s,k,t-1} + \gamma S_{s,k,t-1}\right] * \Delta\epsilon_{k,t} + \delta_{s,k} + \delta_{s,t} + u_{s,k,t} \tag{13}$$

The dependent variable is the log Euro producer price, but not the destination currency price, in the sector s to destination k at time t. The format of the exchange rate is the Euro/Foreign exchange rate. Thus, a depreciation in Euro against the foreign destination currency increases the variable $\epsilon_{k,t}$. The regression equation is derived from the theoretical link constructed in part 3.A. iv. A necessary assumption for this estimation is that there is no correlation between the changes in the exchange rate and other independent variables $\varphi_{s,k,t-1}, S_{s,k,t-1}$. Also, this paper's assessment uses the first-time lags(t-1) for the import intensity and export market share variables just as in the Amiti et al. (2014). Usage of the first lags relies on two arguments. First, Gopinath et al. (2010) found that the LRPT occurs mostly within the first five months where they used horizons up to 24 months. So, combining the first-time lag with the quarterly moving averages enables the specification to capture a larger share of the LRPT. Also, by assumption, producers set their prices according to their historical price sensitivities and market power not due to contemporaneous results. This paper assumes that the price setters try to forecast, finalize their sales prices at least a month before adjusting. As all four of the variables are quarterly moving averages, extreme outliers are normalized and lagged effect of exchange rate changes on prices are partially controlled. All estimations include either the sector-destination or sector-time fixed effects or a combination of both ($\delta_{s,k} + \delta_{s,t}$). Aim of the sector-destination binary indicators ($\delta_{s,k}$) is to absorb the omitted sector-destination variables which vary across sector-destination combinations but are constant over time ($\alpha_{s,k}$). Additionally, sector-time fixed effects control the omitted variables which fluctuate considerably over time and allows for a variation at destination level. (Stock and Watson, 2020).

4. Empirical Evidence

Furthermore, to understand how the ECB monetary shocks transmit to the real economy through export prices, two transmission mechanisms need to be proved. Initially, ECB policies should devaluate the Euro vis-à-vis trade partner's currencies. Secondly, the change in the exchange rate should pass on to the export prices. This section displays the main empirical result regarding the two transmissions. Firstly, from ECB policies to exchange rate and then from exchange rate to the destination currency prices. Moreover, the feasibility of the proposed independent variables will be shown, approving the specific mechanisms explained in part 3.

A) Transmission of ECB shocks to the Euro

The purpose of this segment is to present that the Expansionary Policies conducted by ECB indeed depreciate Euro against top trade partner's currencies. Thus, theoretically, the import prices should fall from the trade partners point of view.

Figure-1 USD/EUR

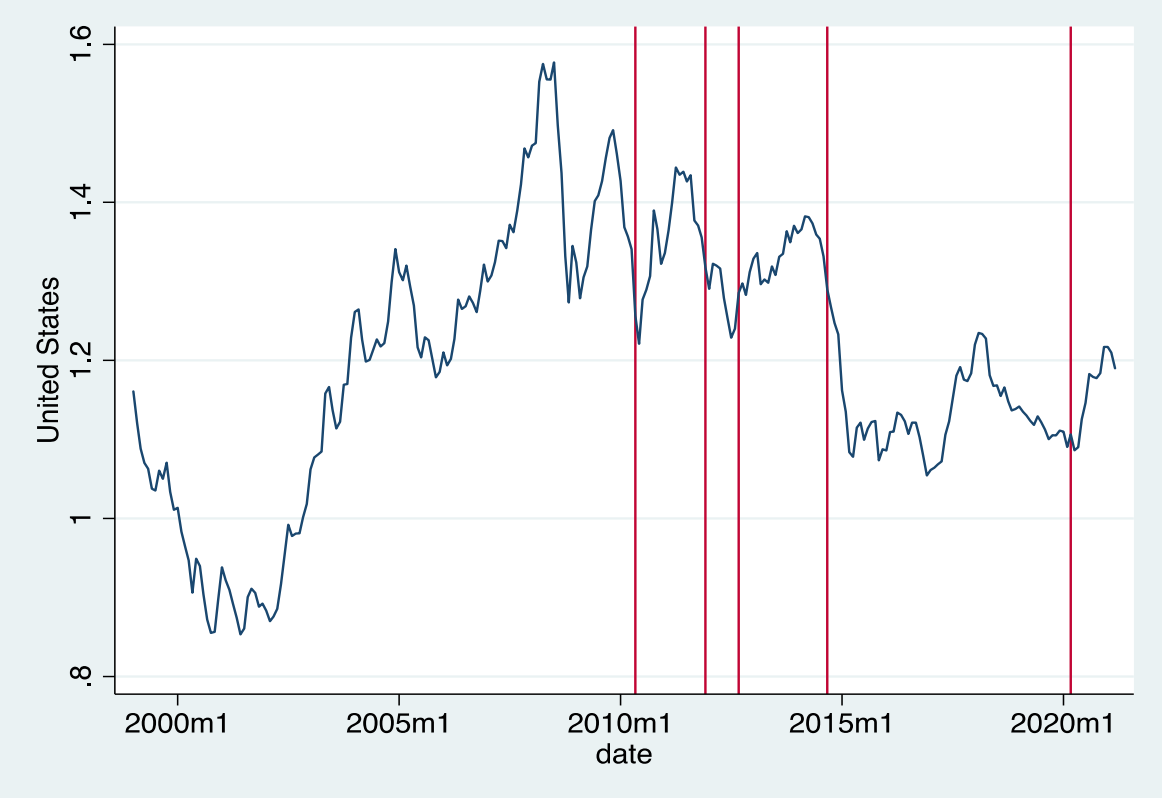

Figure-1 shows the evolution of the USD/EUR rate from January 1999 to March 2021.US was the biggest trading partner of the Eurozone before 2020(China overtake during 2020) (Eurostat,

2021). Therefore, it is important to visualize how the major trading partner's currency reacts to ECB policy introductions. The red reference lines indicate ECB's expansionary policy introduction dates. These are 1) Securities Market Program - May 2010 2) Long Term Refinancing Operations - December 2011 3) Outright Monetary Transactions - September 2012 4) Covered Bond Purchasing Program & Asset-Backed Securities Program - September 2014 5) Pandemic Emergency Purchase Program – March 2020. Introduction dates of expansionary policies indeed coincide with the local minimums at the USD/EUR graph. It visually demonstrates that unconventional expansionary policies indeed depreciated the Euro against the USD. More specifically, SMP became operational almost instantly, five days after its announcement (Smith, 2020). So, the local minimum at the graph directly concurs with the month of the policy announcement. In November 2010, FED announced to buy 600 billion dollars' worth of government bonds. This QE program may explain the steep rise after the SMP (Leubsdorf, 2016). The effect of OMT seems less pronounced compared to SMP and LTRO programs. A potential explanation is that not even a single Euro is spent on the program to this day (Altavilla et al, 2014). Consequently, the expectation regarding the depreciation of the Euro probably diminished along with time, after the announcement by the ECB President Mario Draghi. Asset purchasing programs announced in September 2014 devaluated the Euro significantly into pre-2008 levels. Also, the USD/EUR rate has seen its lowest rates since 2005 during the most intensive phase of the Quantitative Easing between March 2015 to March 2017(Pimco, 2017). Dedola et al. (2018) estimated that a typical expansionary QE announcement (aims to increase its balance sheet by 20% within nine months) depreciates Euro against USD by 7% and the depreciation stays relevant for up to 18 months. These results are consistent with Figure-1, especially for the period between September 2014 to September 2018. Finally, ECB launched a 750 billion Pandemic Emergency Program five days before the FED briefing regarding their QE program for the pandemic relief. As ECB's program was announced and became operational earlier, there exists a modest but obvious Euro depreciation around March 2020. However, since FED's balance sheet expanded 16 percentage points more compared to ECB's from March 2020 to October 2020, the USD depreciated against the Euro during this period. The USD depreciation is also reflected in the graph after March 2020(Dedola, 2020). Finally, this is not shown with reference lines, but the USD depreciation or local maximums in the graph match the introduction dates of expansionary FED policies, mirroring the effect of ECB announcements in Figure-1 (FED, 2021).

Figure-2 Bilateral exchange rate changes for top non-Euro trade partners of Germany (Format: Foreign Currency/Euro)

Figure-2 exhibits how the bilateral exchange rates have changed over time for the top nine export partners of Germany (excluding the Czech Republic, Sweden, Hungary) that don't use the Euro as their currency. Again, the red reference lines illustrate the announcement dates of expansionary policy programs. In general, policy introductions affected the Foreign currency/Euro rate negatively. The local troughs are in accord with the introduction dates of ECB. The least reactive currencies to ECB policies seem to be the Turkish Lira and Russian Ruble. These two currencies have seen considerably lower changes against Euro and have been depreciating almost consistently since 2013. Apart from a vast collection of other economic and political fundamentals, defaults on the foreign-denominated debt can be shown as the primary cause (Arbaa and Varon, 2019) (Viktorov and Abramov, 2019). Nevertheless, these two currencies still depreciate against Euro around the reference lines. The most reactive currencies to ECB policies are the US Dollar, British Pound, Chinese Yuan and Japanese Yen.

These countries except Japan are the top three trading partners of Germany. Also, the effect of the ECB's QE campaign is substantially pronounced in almost all currencies in Figure-2.

B) The relationship between export prices and proposed explanatory variables

This section targets to prove that the relationship between the export price changes and the changes in the independent variables are statistically significant and positively related.

Table-3 Price Elasticity of Import Intensity, Market Share and Exchange Rate

Dependent Variable	(1)	(2)	(3)	(4)	(5)
$\ln(p^*_{s,k,t})$					
$\ln(\Delta\epsilon_{k,t})$	0.129***				
	(0.009)				
$\ln(\varphi_{s,k,t})$		-0.0445***	0.0397***	0.0638***	
		(0.007)	(0.009)	(0.005)	
$\ln(S_{s,k,t})$					0.0515**
					(0.016)
_cons	4.383***	3.761***	3.935***	3.320***	3.970***
	(0.056)	(0.035)	(0.011)	(0.131)	(0.076)
Fixed Effects					
$\delta_{s,k} + \delta_{s,t}$	Yes	Yes	No	No	Yes
$\delta_{s,k}$	No	No	Yes	No	No
$\delta_{s,t}$	No	No	No	Yes	No
N	2769	2769	2769	2769	2590
R^2	0.975	0.973	0.937	0.619	0.974

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table-3 presents the estimates for five regressions which display the export price elasticity of 1) Euro/Foreign currency, 2) Export Market Share, 3) Import Intensity. Estimation is quite

similar to the main specification explained in part 3.C. This analysis utilizes the whole panel data with the seven countries and three sectors between January 2010-December 2020. Again, the combination of sector-destination and sector-time fixed effects are included to control sector-country or sector-time specific shocks. Congruent with the theoretical predictions, all three of the independent variables are positively related to the export prices and the results are statistically significant. Therefore, these results back up the theoretical predictions in part 3 about the relationship between export prices, export market share and import intensity.

According to regression-1, a 10% depreciation in Euro increases the producer/Euro export prices by 1.3% in aggregate in this dataset. This result is theoretically intuitive and well-documented empirically (Devereux and Engel, 2003) (Betts and Devereux, 2000).

In regression-2, the coefficient of import intensity is negative and statistically significant with a p-value smaller than 0.001. This result is unorthodox as regressions 3 &4 pinpoint the exact opposite result. One potential explanation is the suppression effect (Ludlow and Klein, 2014). In contrast, in columns-3 & 4 where only a single fixed effect is used, the price elasticity of import intensity is positive and statistically significant. For example, in regression-3, a 10% increase in the import intensity results in a price increase of 0.6%. This result is both due to the intermediate inputs and the non-Euro invoiced goods consumption. Amiti et al. (2014) emphasized that firms that have higher productivity/quality/demand have higher import intensity and export market shares. Thus, a more import intensive firm can charge higher prices because the mark-up elasticity of price is increasing with the export market share.

Regression-5 shows that a 10% increase in the export market share translates to a 0.515% price increase. This result does not directly show that mark-ups are increasing in export market shares. However, it supports the claim that high market share firms charge higher prices. This result proves the notion that in high-market-share firms' demand is less sensitive to their price as they can raise them, parallel with their emphasis on sectoral price index. Therefore, it supports equation (3). Consequently, it is intuitive to argue that the mark-up elasticity of price is increasing in a firm’s market share because the effective demand elasticity of price is decreasing with the market share. So, in case of a price increase (potentially due to a currency depreciation), high market share firms can increase their prices more compared to low-market-share firms.

C) Exchange rate pass through into destination currency prices

Table-4 Import Intensity, Market Share and Exchange Rate Pass-Through

Dependent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta p^*_{s,k,t}$								
$\Delta\epsilon_{k,t}$	0.152**	0.111*	0.091	0.111*	0.193**	0.188**	0.196**	0.155*
	(0.049)	(0.055)	(0.050)	(0.053)	(0.064)	(0.575)	(0.063)	(0.066)
$\Delta\epsilon_{k,t} \cdot \varphi_{s,k,t-1}$		0.394*	0.474**	0.361*				0.458*
		(0.166)	(0.151)	(0.163)				(0.185)
$\Delta\epsilon_{k,t} \cdot S_{s,k,t-1}$					-0.062	0.017	-0.090	-0.384
					(0.325)	(0.292)	(0.312)	(0.350)
Fixed Effects								
$\delta_{s,k} + \delta_{s,t}$	Yes	Yes	No	Yes	Yes	No	No	Yes
$\delta_{s,k}$	No	No	Yes	No	No	Yes	No	No
$\delta_{s,t}$	No	No	No	Yes	No	No	Yes	No
N	2748	2724	2724	2724	2555	2555	2555	2555
R^2	0.170	0.177	0.012	0.176	0.189	0.008	0.188	0.191

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table-4 shows the results of the exchange rate pass-through analysis.The two interaction variables are delta exchange rate times the first lag of import intensity and delta exchange rate multiplied by the first lag of export market share. All seven countries and three aggregated manufacturing sectors at the 2-digit HS code level are included. Destination-sector and sector-period fixed effects are used to eliminate the period-sector and country-sector specific factors which can abruptly influence the prices. The results for the full specification in column 8 are higher than the literature's estimates for the pass-through on German manufacturing exports and the pass-through on manufacturing imports in recipient countries. (Vigfusson et al., 2007) (Ortega and Osbat, 2020)

Regression-1 exhibits that the average exchange rate pass-through elasticity into destination currency prices is approximately 0.85(0.15 into producer currency prices) and the independent variable is statistically significant with a p-value less than 0.01. Therefore, 85% of the

exchange rate change is reflected in average quarterly prices without including the proposed limiting factors.

Column-2 includes the interaction between import intensity and delta exchange rate as an addition to the first estimation. Regression-2 reveals that the import intensity is a differentiating factor in exchange rate pass-through, and the delta exchange rate alone is not a sufficient explanatory variable. Destinations, sectors where German consumers, firms import more relative to the total trade volume have lower exchange rate pass-through on aggregate. If import intensity in a destination sector within the same quarter increases by 10%, the pass-through into the producer prices would elevate by 4%. A sector destination combination with 0% import intensity, has an 89% pass-through into the destination currency. On the other hand, with the median import intensity of 31% among the panel data, the exchange rate pass-through to destination currency prices drops to 0.76% (1-0.111-0.394*0.31).

Regressions in Column-3 & 4 allow for variations in time-varying and destination-specific factors respectively. R-squared drops to approximately 2% from 17% when the sector-period fixed effects are not used, which indicates that the variation in the sector-time specific events significantly decreases the robustness of estimates. Another sign of noteworthy measurement error is the significance of the delta exchange rate in Regression-3. Although the estimate is close to becoming statistically significant at the 5% level, it is not, which again supports the usage of sector-time fixed effects. Regression-4 solidifies the notion that sector-time variation in the data has a greater distortive effect than sector-destination variation. The R-Squared returns to 17.6% and the coefficient of log change in exchange rate become statistically different from zero.

After that, in column-5 & 6 & 7, the second interaction variable is added, which is an interaction between delta exchange rate and export market share in a destination, sector and time. Although the empirical findings in part 4.B confirmed that the export price increases with the export market share, the interaction is not statistically significant in these regressions. Accordingly, the firm-level hypothesis about the mark-up elasticity of prices and its relationship with a market share cannot be generalized for the aggregated sector level in this dataset.The main specification is estimated in the eighth column. Moreover, the coefficients for delta exchange rate and the first interaction term are significant both at 5% level. The second interaction term is again not statistically different from zero. In this estimation, a 10% higher import intensity is linked with a 5% lower pass-through in destination currency prices. For the

sector-destination combinations with the median import intensity of 31%, the exchange rate pass-through into non-Euro consumer prices is 70.3%.

These results suggest that the bilateral trade in the same aggregate sector within the same quarter importantly explain the variation in the exchange rate pass-through across different trade partner-sector combinations. Unfortunately, the export market share cannot explain the variation in the destination currency pass-through in different countries. There can be four potential reasons for this result. 1) import-export data is not compatible, figures don't match for different sector-destination combinations. I had used the total import data to calculate the total export markets in some sector-destination pairs. 2) Theoretical framework derivation started from an individual firm, the total sector behaviour may be different.The effective demand elasticity for the aggregate German firms at the 2-digit level may be different in individual firms or more microdata.3) Assumptions miss the entry-exit decisions of firms which may affect the market share. However, entry-exit decisions do not necessarily affect the firm price within a quarter if the firm is in a contractual agreement.4) Manufacturing firms may review their prices with their consumers in longer timescales than quarters such as semi-annual or annual.

Table-5 Exchange Rate Pass-Through for the Median Import Intensity in Sector-Destination Combinations

Partner/Product	Mechanical Machinery(HS:84)	Electrical Machinery(HS:85)	Motor Vehicles and parts thereof(HS:87)
USA	**73.6%**	**71.0%**	**77.5%**
United Kingdom	**70.4%**	**65.4%**	**78.0%**
Russian Federation	**83.5%**	**83.3%**	**84.0%**
Poland	**65.2%**	**62.2%**	**61.7%**
Switzerland	**62.2%**	**63.7%**	**79.4%**
Turkey	**70.9%**	**72.3%**	**72.9%**
Japan	**58.7%**	**51.0%**	**66.7%**

D) Exchange rate pass-through within developed countries only

This section presents the exchange rate pass-through elasticity into producer currency prices only with the Developed countries. Thus, the analysis for this dataset does not include the data about Russian Federation and Turkey. Poland is considered a developed nation by OECD since it is classified as a high-income member (World Bank, 2021). Results in Table-6 is close to part 4.C, but some coefficients have questionable interpretations.

Just like in the part 4.C, regression-1 in Table-6 conceals a noteworthy variation in pass-through estimates for different import intensity measures. According to column 1, the log change in the exchange rate is not a sufficient independent variable to explain the log export price movements to developed countries within four months. This result is not completely intuitive as Part 4.A illustrates how ECB policies devaluate Euro against these trade partners currencies and Gopinath et al.'s(2010) outcome remarks a prominent LRPT. However, both sector-destination and sector-period fixed effects are used, and the exchange rate data seems to be in line with the Eurostat database.

Again, parallel with Table-4, when the interaction variable between log change in the exchange rate and import intensity is added, it majorly increases the dependent variable. This notion stays true regardless of the fixed effects that are used in columns 2 & 3 & 4.For example, for the median import intensity for the developed countries in the dataset,41.6%, the exchange rate pass-through to customer currency prices is 75%(1-0.416*0.601) in regression-2. These results mean that in the case of an expansionary policy, the effect of depreciation passes through the destination currency prices on a remarkable margin within the first quarter. These findings are contrary to the existing literature. Many prior studies showed that the exchange rate pass-through of or among developed nations is notably lower(Ca' Zorzi et al., 2007) (Jasova et al., 2019).

Similar to Table-4, estimates in columns-5 & 6 & 7 do not reveal any heterogeneity in pass-through into destination currency prices due to export market shares. Therefore, further adjustments in the data collection, estimation specification or theoretical framework are necessary.

Lastly, estimates in column-8 reveal a similar result which is in line with the analysis in column-2. For the destination-sector combination that has an import intensity of 0%(it doesn't exist in the dataset for the Developed countries), the exchange rate pass-through to non-Euro prices is 100% on average in a quarter. However, the pass-through becomes 73%(1-0.638*0.416) once the first interaction is included. It should be noted that these results may be due to the aggregated nature of the dataset at the 2-digit level. At a more disaggregated level, such as with 8- or 10-digit HS codes, the ERPT estimates may deviate substantially from this paper's results.

Table-6 Import Intensity, Market Share and Exchange Rate Pass-Through (Developed Countries Only)

Dependent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta p^*_{s,k,t}$								
$\Delta\epsilon_{k,t}$	0.102	0.002	0.023	-0.0002	0.188	0.230**	0.186	0.0264
	(0.091)	(0.115)	(0.092)	(0.114)	(0.103)	(0.084)	(0.102)	(0.120)
$\Delta\epsilon_{k,t} \cdot \varphi_{s,k,t-1}$		0.601**	0.654***	0.599**				0.638**
		(0.233)	(0.194)	(0.231)				(0.242)
$\Delta\epsilon_{k,t} \cdot S_{s,k,t-1}$					0.040	-0.06	0.020	-0.288
					(0.456)	(0.391)	(0.449)	(0.472)
Fixed Effects								
$\delta_{s,k} + \delta_{s,t}$	Yes	Yes	No	Yes	Yes	No	No	Yes
$\delta_{s,k}$	No	No	Yes	No	No	Yes	No	No
$\delta_{s,t}$	No	No	No	Yes	No	No	Yes	No
N	1962	1944	1944	1944	1934	1934	1934	1934
R^2	0.214	0.218	0.012	0.217	0.215	0.006	0.214	0.219

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

5. Conclusion

The goal of this research is to understand whether the bilateral trade and market power limit the exchange rate pass-through within a quarter. Amiti et al.'s (2014) estimation methodology is used on a more macro dataset about German manufacturing exports at the 2-digit Harmonized Code level. This question is relevant due to two different points.

Firstly, the accommodative monetary actions of the ECB in the last decade was effective in depreciating the Euro vis-à-vis Eurozone's main export partners that don't use the Euro. This notion potentially makes Eurozone goods more competitive, cheaper. Secondly, exports became the chief contributor to Euro area GDP and GDP growth in the last decade. It represented almost half of both GDP and GDP growth. Therefore, understanding the limiting factors of exchange rate pass-through into destination currency prices is important to understand the transmission of ECB policies into export prices. Additionally, it allows us to evaluate the claim 'Eurozone economic growth became much more dependent on exports partially due to the depreciation against its trade partners' currencies'.

Results of this paper indicate that the bilateral trade within the same quarter in the same industry significantly diminishes the exchange rate pass-through estimates. Overall pass-through estimates are higher than the existing literature, which further bolsters the significance of unconventional policies on trade as findings suggest ERPT estimates that are greater than 0.5. Pass-through results do not change much when the dataset is limited to the developed nations only. Furthermore, the results of this paper cannot reject the null hypothesis that partially links the export induced growth to currency devaluation and confirm that export growth is mostly because of superior product quality or other demand drivers.

Further research may focus on the limitations of this research to understand the cost sensitivity channel from the import intensity and the market power channel from the market share. The easiest way to clarify the ambiguities in this paper is to use a more micro dataset potentially at an 8-digit or 10-digit level. Another interesting topic would be to include currency choice in invoicing to recognize the ERPT differences in different currency choices and how the proposed channels affect different currencies in trade. Thirdly, import intensity should consist of the share of intermediate goods in exported goods just like in Amiti et al. (2014). It would be beneficial if monthly data is used for the portion of intermediate inputs within exports.

Lastly, the research may change the definition of import intensity and may try to perceive how the share of global-local supply chains may affect the pass-through estimates.

Notes

1) Data: I initially wanted to conduct my analysis at the firm level, as in Amiti et al. (2014). However, I wasn't able to gather the necessary data from the Deutsche Bundesbank without an inquiry, so I switched to the International trade in goods data in Eurostat. Then I planned to work on 6- or 4-digit HS codes, but the data availability in total export markets for the selected countries forced me to shrink my dataset and use 2-digit HS channels. Again, due to the data availability in UN Comtrade, this paper uses the time frame between 2010-2020 instead of 1999-2021.

2) Empirical estimation: The main empirical specification wasn't using any lags and sector-period fixed effects in the first draft. Firstly, I tried using contemporaneous variables with sector-destination and time fixed effects. Unfortunately, none of the coefficients could explain the variation in export prices as they were statistically insignificant. After that, I started adding time lags or using various moving averages according to the ERPT time-frame estimates in the literature (2-months, 3-months, quarterly, semi-annual). In line with Gopinath et al. (2010) and Berner(2010), quarterly moving averages was sufficient to generate statistically meaningful estimates. The persisting problem in the estimation results which is also visible in the synchronous variables was the negative sign for the first interaction term(import intensity and log change in exchange rate). To mitigate this issue, I first recollected my full dataset again. The results were the same as the previous outcome. After that, I used stricter fixed effects to minimize the measurement errors in the regression outcome, by adding sector-destination and sector-period fixed effects. This approach was not fruitful as well. Then, I attempted to use time-invariant import intensities. Amiti et al.(2014) use time-invariant import intensities in Table-5 to reduce the measurement errors. Sector-destination specific time-invariant import intensities(I used different combinations there as well, 10-years, 5-years, 2-years) didn't turn the coefficient to positive but diminished its statistical significance. Lastly, I regressed my specification with different mixtures of time lags and quarterly moving averages of variables. The best result I have found in terms of statistical significance, the accuracy of the coefficient sign and the coefficient amount occurred while using quarterly moving averages and using the first-time

lags for the explanatory variables. Amiti et al.(2014) also proposed using the first-time lag in their main specification explanation, and my ERPT results are in line with the LRPT time-frame explored in the Gopinath et al.(2010)(5 months). Therefore, I assumed these results as theoretically logical.

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