Invoice Currency Choice, Exchange Rate and Tariff Pass-through: Evidence from Malawi Customs-Level Data

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Abstract

Import prices are crucial for the transmission of external shocks across countries in an open economy. Both exchange rates and tariffs affect exporters pricing decisions and the final prices importers face and pay, and these prices are all affected by the currency in which products are invoiced in. This thesis documents new evidence on exchange rate pass-through, tariff pass-through and determinants of invoice currency choice in international trade by using an unpublished transaction-level dataset of Malawian imports at the Harmonized System (HS) 8-digit level.

The first chapter addresses exchange rate pass-through (ERPT) to import prices before and after an importer has switched from a de facto peg to a floating exchange rate regime. We construct three measures of market share and analyze their effects and that of the main invoice currencies on pass-through across the two regimes. ERPT and invoice currency choice between a peg and a float is a new aspect in this literature. Overall, we find that the share of U.S. dollar invoicing and the rate of pass-through increased after the regime switch, with higher market share increasing pass-through only in the floating regime. We show that the fixed exchange rate regime limits pass-through of the bilateral exchange rate, but devaluations by the monetary authority are fully passed on by exporters when the dollar pass-through is considered, since these are perceived to be permanent.

The second chapter provides new evidence on the role of invoicing currencies in exporters price pass-through of both exchange rates and tariffs. We then consider the role of tariffs in invoice currency choice among goods from the European Union to Malawi. Two novelties in this line of literature are explored: the effect of invoice currencies on tariff pass-through and second, the effect of import duties on invoice currency choice among exporters. A simple mark-up framework is supported by these findings: an increase in tariffs causes a low (high) exchange rate pass-through exporter to have a high (low) tariff pass-through in a currency of invoicing; and, for exporters

that switch currencies in response to higher tariffs, there is an inverse relationship between import duty and the share of that currency.

The third chapter is the first to present detailed Chinese renminbi (RMB) invoiced trade and shows that the internationalization of the RMB lags behind that of the Japanese yen in Malawian imports, despite China having a much larger market share. A panel logit model reveals that that product differentiation and exporters market share increase the probability of yen invoicing in imports from Japan, but not RMB usage for China. The volatility of the exchange rate, however, has negative (positive) effect on exporters (vehicle) currency invoicing for all the 17 exporting Asian countries in the sample, whilst lower value transactions are invoiced more in the South African Rand compared to the US dollar.

These underlying conclusion from all the chapters is that invoice currency choice is a key parameter in determining who between the importer and exporter, bears both the exchange rate shock and the import tax. Trade liberalization policies and stable exchange rates are likely to may reduce the dominance of the US dollar in the global economy and give way for more internationalization of the euro and the Chinese RMB, at least when trading with developing countries such as Malawi.

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To my parents.

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Overview

The currencies in which transactions in international trade are invoiced in reveals one of the key mechanisms that explain heterogeneity in exchange rate and by extension tariff pass-through. Trade prices are a principal channel through which movements in the exchange rate and changes in import taxes affect domestic variables for an open economy and the balance of payments. Invoice currency choice has implications on who, between the exporter and the consumer, bears the exchange rate risk and the tariff change. Further, it signals on the internationalization of the currencies themselves. It is therefore important to understand how exchange rate and tariff changes affect exporters mark-ups for products invoiced in various currencies, and what factors affect the invoicing decision. This introduction is a brief overview of the three chapters included in this thesis which tackle these issues using import data from Malawi, a low-income open economy in South East Africa.

In the first chapter, we document comparative evidence on exchange rate pass-through to import prices before and after an importer has switched from a de facto peg to a floating exchange rate regime. Using Malawi's import transactions from 219 countries at the HS 8-digit level, we analyze the effects of overall, sectoral and product market share and invoice currency choice on pass-through across the two regimes, a novel feature of this study. This chapter takes on a broader perspective looking at this issue amongst all of Malawi's imports from high, middle and low-

income countries as well as major currencies used in Malawian imports: the US dollar, the euro and the South African Rand.

We demonstrate that products from countries such as the U.K, Italy, and Japan are among the few countries from which products invoiced in the US dollar are less than 50 percent of the value in the fixed regime, but these shares increase by 8.7 percent, 41.0 percent and 23.6 percent in the floating regime. Overall, the share of U.S. dollar invoicing increased by 9.4 percent, and exchange rate pass-through increased by 47 percent after the regime switch, with highest pass-through to products from high-income countries and exporters with larger overall market share. A non-linear interaction between market share and pass-through suggests a Kuznets curve and not a U-shaped relationship as in (Devereux, Dong, & Tomlin, 2017). We further show that a fixed exchange rate regime limits pass-through of the bilateral exchange rate, but devaluations result in pass-through of more than 100 percent of the US dollar exchange rate. There are variations across industries but in general, a higher pass-through in the floating regimes. The findings suggest the importance of micro data analysis, exporter and importer characteristics in the inferences of exchange rate fluctuations on domestic price levels for an open economy.

The second chapter and third chapters focus of specific exporters, namely European and Asian exporters to Malawi, respectively. Chapter 2 uses disaggregated transactions of Malawian imports from the European Union (EU) to construct prices for goods invoiced in 33 different currencies. EU countries are separated based on their eurozone membership status. Two new aspects in this line of literature are explored: the effect of invoice currencies on tariff pass-through and second, the effect of import duties on invoice currency choice among exporters. Simultaneous studies on exchange rate pass-through and tariff pass-through, have not considered the invoicing decision in this relationship. A simple mark-up framework is supported by the following empirical findings: an increase in tariffs causes a low (high) exchange rate pass-

through exporter to reduce their price by a smaller (larger) amount in a currency of invoicing. Both tariff and exchange rate pass-through are lower for goods priced in the euro across countries and sectors, although only eurozone exporters tend to switch currencies in response to a change in tariffs, resulting in an inverse relationship between import duty and the share of the euro. For non-EU exporters, the probability of euro invoicing increases as membership of both the euro area and the EU increase. The results highlight that even in the presence of trade restrictions, euro invoicing would be the importers preferred currency compared to the U.S. Dollar and the pound, although such restrictions and a weakening of the monetary union, would limit internationalization of the euro.

The third chapter is the first study that presents detailed information on Chinese renminbi (RMB) invoiced trade. By processing unpublished customs level data of Malawi's from 17 Asian countries including China and Japan, we show that the RMB is rarely used in imports from China, while 2030 percent of imports from Japan are invoiced in the yen, suggesting that the internationalization of the RMB lags behind that of the yen. This is the case despite China having a much larger market share in Malawian imports than Japan. A panel logit model reveals that that product differentiation and exporters market share increase the probability of yen invoicing in imports from Japan, but not RMB usage for China. The volatility of the exchange rate, however, has negative (positive) effect on exporters (vehicle) currency invoicing for all the exporting Asian countries in the sample, whilst lower value transactions are invoiced more in the South African Rand compared to the US dollar. The is room for increased RMB usage especially with increased product differentiation, stable exchange rates and by implication, as the RMB becomes more available to importers.

These results suggest exporters pricing behavior is different when there is a significant structural change in a partner economy and that both microeconomic and

macroeconomic aspects, especially the currency of invoicing, ought to be considered of both exchange rate and tariff pass-through analysis. Further, both the RMB and the euro have room for increased usage considering that the EU and China are among Malawi's main trading partners and the exporter has more bargaining power when it comes to settling the invoice currency.

Chapter 1

Exchange Rate Pass-through, Market Share and Invoicing Currency Choice Between Fixed and Floating Exchange Rate Regimes

1.1 Introduction

The knowledge of exchange rate pass-through (ERPT) dynamics has important and direct macroeconomic implications for any open economy. Nominal variables can react directly in terms of size, speed and adjustment under alternative exchange rate regimes. ERPT to prices may explain the reluctance to switch to more flexible exchange rate regimes due to the so-called "fear of floating" by many less developed economies (Calvo & Reinhart, 2002). The fear of floating is linked to uneasiness about complete (or high) import exchange rate pass-through. As articulated by Mirdala

(2013), a fixed exchange rate arrangement provides domestic and external market players with a nominal anchor in the form of the exchange rate, and thus expectations are managed. With predictability of the exchange rate, nominal shocks have a much lesser role in driving price fluctuations (Taylor, 2000; Lopez-Villavicencio & Mignon, 2016). In a fixed exchange rate regime, an exchange rate change is perceived to be more permanent due to the artificially fixed rate, hence higher ERPT, but this policy is likely to encourage pricing in the destination currency, hence lower ERPT. On the other hand, in a floating regime, fluctuations may be larger and occur at higher frequencies, but the exchange rate change is more temporary.

The literature is mixed when it comes to ERPT and the exchange rate regime. Beirne and Bijsterbosch (2009) find ERPTto be higher during a fixed exchange rate regime for Central and Eastern Europe. on the other hand, Lopez-Villavicencio and Mignon (2016) find that a fixed regime leads to a diminishing ERPT in emerging markets. As observed by Devereux and Engel (2003), the optimality of a float or a peg depends on the firms' currency choice, whilst the degree of pass-through depends on the market power of the trading partners. The possible switching of invoicing currency between two exchange rate regimes has not been empirically investigated in the literature.

We present novel evidence on two key issues: First, the impact of exporter's market share on exchange rate pass-through across a fixed and floating exchange rate regime by constructing three measures of market. Second, we show evidence as to whether there is a change in invoicing currency choice after an importer shifts from a de facto peg to a floating exchange rate regime and the consequent effect on import prices. Our study utilizes customs data of Malawian imports from across the globe, at Harmonized System (HS) 8-digit level. This enables us to (1) construct unit prices without the loss of information associated with aggregate variables, (2) use panel data analysis to investigate exchange rate pass-through into import prices of

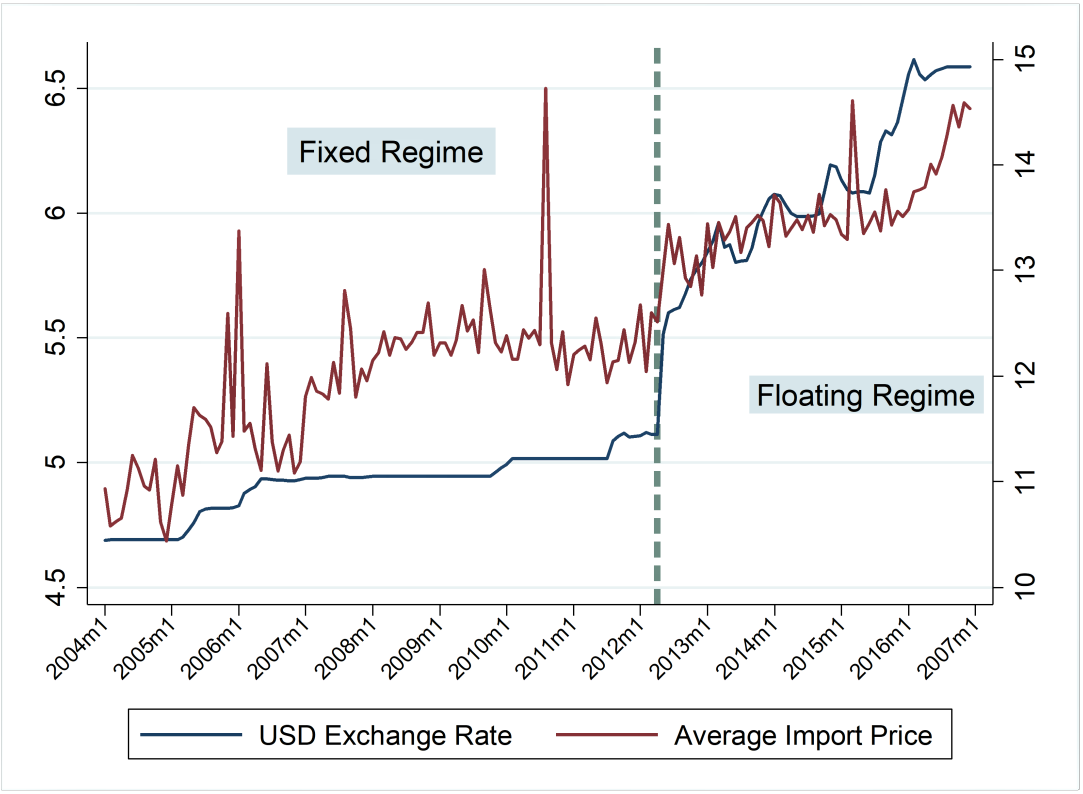
products from low, middle and high-income countries and (3) estimate pass-through across industries.

Recent empirical studies have turned to unpublished customs data to investigate the degree of exchange rate pass-through at a highly detailed level. Most of these studies have been from an advanced country perspective except for Casas, Diez, Gopinath, and Gourinchas (2017b) who used Colombian data in testing a "dominant current paradigm" for a small open economy where pricing is not solely in the producer's currency nor the local currency as in the Mundell-Fleming framework. Other studies by using micro data in this literature are Devereux et al. (2017), L. S. Goldberg and Tille (2016), and Donnenfeld and Haug (2003) who use Canadian customs data, Chung (2016) who uses UK export and import transaction data at the customs level, and Gopinath, Itskhoki, and Rigobon (2010) and Donnenfeld and Haug (2008) who both use U.S customs data. The consensus is that exchange rate pass-through varies among microeconomic aspects such as products, exporters' market share, invoice currencies as well as macroeconomic variables such as the domestic price environment of the importer, its country's policy stance on trade, exchange rate and monetary regimes. Further, Barhoumi (2006) shows that the exchange rate regime is among key determinants of exchange rate pass-through to import price. We add to this literature by using customs data of an African country whilst also exploring the effect of a change in the exchange rate policy.

Malawi makes for an interesting analysis as a small open economy, having had a fixed exchange rate policy from the 1980's with several small adjustments (devaluations) conducted. The Malawian Kwacha (MWK) was fixed at K139 per US dollar in May 2006, adjusted to K151.5/US$ in January 2010 then devalued by 10 percent to an average of K162.10 until about April 2012. In this chapter, all observations in April 2012 and prior to that, are considered under the fixed exchange rate regime. As with most of the world post the Bretton Woods system, Malawi

adopted a floating exchange rate regime in May of 2012 (1.1). Concurrent with the change in exchange rate policy, was a liberalized capital account and a 49 percent devaluation. This policy change was a result of political changes in government, pressure from the international community to move to a more flexible regime, a severe foreign exchange crisis characterized by a large import bill, a parallel market, and a continuous depletion of foreign reserves.[1] In this chapter, all observations from May 2012 onwards are categorized as "floating exchange rate regime".

Figure 1.1: Exchange Rate (MWK/USD) and Import Prices: 2004-2016



Note: Left-hand side axis is the natural log of the Malawi Kwacha/U.S. Dollar exchange rate and the right-hand side is the natural log of the average import price (all products). All are monthly series.
Source: IMF, International Financial Statistics and National Statistical Office of Malawi (NSO).

[1]The timeline of Malawi's exchange rate policies has been well summarized by several authors: Ngalawa (2011); Simwaka and Mkandawire (2011); Pauw, Dorosh, and Mazunda (2013); Chiumia (2015)

Figure 1.1 shows that after the regime switch, the Malawian Kwacha began to rapidly depreciate, and import prices were likewise on the rise, increasing almost at the same rate as the exchange rate. There are, however, notable spikes in the average import prices during the fixed exchange rate regime, and although the increase is higher in the floating exchange rate regime, there is evidence of steady and at times sudden increases of import prices before May 2012. These may be responses to announced devaluations during the U.S peg. Exporters' pricing behavior in response to a significant structural change such as this, has not been empirically investigated, mainly due to data unavailability beyond aggregate price levels. We scrutinize these aspects later in the chapter.

Our novel findings are as follows: First, we present evidence that an average of 71 percent of Malawi's imports were invoiced in the US dollar during the fixed exchange rate regime, whilst the euro and the South African Rand accounted for 10.6 percent and 11.6 percent, respectively. The use of exporter's currency in imports from non-U.S countries in the fixed exchange rate regime ranges from 20 percent (France and Japan) to as high as 94.6 percent (Italy). After shifting to the floating exchange rate regime, the share of the US dollar increased to more than 80 percent and there are mixed changes among the countries on exporter currency use. Empirical estimations reveal that exchange rate pass-through of the bilateral exchange rate to import prices increased by nearly 50 percent after the regime switch and is highest among products from high-income countries. A higher market share significantly increases the degree of exchange rate pass-through in the floating exchange rate regime, with a greater impact of overall market share compared to product market share.

The effect of invoicing currency on exchange rate pass-through becomes very high during the floating exchange rate regime in all major currencies except euro-invoiced products, with varying effects across industries. The inclusion of the US dollar exchange rate hardly affects the effect of the bilateral exchange rate but its

own degree of pass-through is more than complete across all imports during the period it was pegged to the Kwacha. For the floating regime, the so-called dominant currency paradigm by Casas et al. (2017b) holds in both euro and US dollar-invoiced products but is weaker in the latter. This shows that the fixed exchange rate regime limits pass-through of the bilateral exchange rate, but devaluations by the monetary authority are fully passed on by exporters, since these are perceived to be permanent. In the floating regime however, there is little difference between the dollar exchange rate and bilateral exchange rate pass-through estimates. These results suggest the importance of micro data analysis in generating implications of exchange rate fluctuations on the price levels especially after a significant structural change. Additionally, a fixed exchange rate regime may not necessarily mean low exchange rate pass-through.

The remainder of this chapter is organized as follows. Section 1.2 outlines the construction of unit prices and gives a descriptive analysis of the data. Section 1.3 discusses empirical model and results of exchange rate pass-through baseline results and the impact of market share. In Section 1.4 we present the empirical strategy and results of exchange rate pass-through and invoice currency choice. Section 1.5 concludes this chapter.

1.2 Data: Unit Price and Invoicing Currency

This chapter uses a monthly series of customs-level transaction data of Malawi's imports from January 2007 to December 2016 obtained from the country's National Statistical Office (NSO). The data contains information on the total value and the number or volume (net kilograms) of each import transaction at the 8-digit Harmonized System (HS) product classification. Information on exporting (source) country is available, but the exporting/importing firm/individual is not identified in any way. More importantly, we can obtain the information on the choice of invoicing currency

for each import transaction, information which is only available in a select number of studies in this line of literature. Other variables such as the exporters' consumer price index (CPI) and the bilateral nominal exchange rates vis-à-vis the U.S. dollar (monthly average) are collected from the International Monetary Fund (IMF), International Financial Statistics (IFS) online.

1.2.1 Unit Prices

To estimate the degree of ERPT, we will use panel data analysis and thus need to have the monthly series of import price data for each import transaction. Since we use highly detailed transaction data, it often happens that the same HS 8-digit product is imported many times from the same source country and in the same invoicing currency in the same month. We closely follow Devereux et al. (2017) and construct a monthly series of a unit price that can be tracked overtime and that is specific to the HS 8-digit product (*pro*), the exporting country *(exc),* the unit of measurement *(msr)* and the invoicing currency *(cur).* Assuming $s = pro, exp, msr, cur$, we can construct a unit price p_{st} of good s in month t, as follows:

Let l be an individual import transaction, and IM_{lst} is defined as an import amount for import transaction l of good s in month t, which is denominated in the Malawian Kwacha. Then, an import unit price per transaction can be expressed as:

$$P_{lst} = \frac{IM_{lst}}{Unit_{lst}} \tag{1.1}$$

where:

p_{lst} = transactions unit price

IM_{lst} = import amount in month t and each l in s

Where $Unit_{lst}$ is the number of units, either in quantity or in weight (kilogram). If the total number of import transactions is n in month t, we can compute a weight of each import transaction l in total import transactions in a month t as:

$$\alpha_{lst} = \frac{IM_{lst}}{\sum_{l=1}^{n} IM_{lst}} \tag{1.2}$$

Then, we can construct an import unit price of product s at month t as:

$$P_{st} = \sum_{l=1}^{n} (\alpha_{lst}\, p_{lst}) \tag{1.3}$$

The raw data includes a total of 2.2 million import transactions for the whole sample period from January 2007 to December 2016. After assembling all import transactions into s products as articulated above, the number of observations are reduced to 392,517 and 378,178 for the fixed and floating regimes respectively. As for the number of panel groups, i.e. individual s products, we have 30,247 for the sample period January 2007 to April 2012, and 36,685 for from May 2012 to December 2016. Our sub-sample selection, apart from being the dates in which the policy was changed, is further confirmed by results from a Chow that confirm the structural break of April 2012. The total number of exporting countries after cleaning the data is 219.

Descriptive Statistics: Invoicing Currency Choice

This subsection presents summary information on the choice of invoicing currency in Malawi's imports. We particularly focus on the evolution of invoicing currency share between fixed and floating exchange rate regimes, by source (exporting) countries, and by industry.

Table 1.1 presents the percentage share of invoicing currency choice in the total imports by source (exporting) country in the fixed and floating exchange rate regimes. On average, the share of U.S. dollar invoiced imports increased from 71.2 percent in the fixed exchange rate regime to 80.6 percent in the floating exchange rate regime. However, the US dollar is not universally a dominant currency in Malawi's im-

ports, if we observe source-country breakdown data. For instance, the South African Rand (ZAR) accounts for the largest share in Malawi's imports from South Africa, the second largest trading partner (exporter) for Malawi, in both regimes. Similarly, the U.K, Italy, and Japan are among the few countries from which products invoiced in the US dollar are less than 50 percent of the value share in the fixed regime. These shares increase however, by 8.7 percent, 41.0 percent and 23.6 percent in the floating regime, respectively. The volume of transactions from China were almost entirely invoiced in the US dollar in both regimes.

Table 1.1: Invoicing Currency Share in Malawi's Imports by Exporting Country (%)

Fixed (Jan 2007 - April 2012)					Floating (May 2012 to Dec 2016)			
	% Share	USD	EUR	ZAR	% Share	USD	ZAR	EUR
South Africa	14.9	41.8	2.9	53.0	13.1	47.0	48.7	2.9
India	11.4	95.6	2.5	0.5	9.3	94.9	0.4	3.2
China	8.7	92.4	2.5	2.6	13.3	93.5	2.5	0.7
UAE	7.9	82.7	12.5	0.1	9.2	92.1	0.1	3.0
Italy	6.2	4.3	94.6	1.0	0.9	45.3	6.2	47.2
USA	5.5	95.1	1.9	2.5	3.8	95.6	2.1	1.5
UK	4.3	48.0	7.7	4.2	3.2	56.7	1.4	4.9
France	3.6	77.4	20.0	2.4	2	86.1	2.3	11.4
Germany	3.5	66.8	29.2	2.1	3.8	51.8	2.1	44.9
Switzerland	3.3	92.9	4.1	0.7	3.8	98.5	0.5	0.4
Japan	2.9	24.2	1.9	5.4	1.9	47.8	11.0	2.2
Other (132)	27.8	86.0	9.0	2.5	35.7	73.6	7.0	11.1
% Cur Share	100.0	71.2	11.6	10.6	80.6	8.9	6.2	100

Note: "Share" refers to the country share and denotes a percentage share of each exporting country in Malawi's total imports.
Source: Authors' calculation from Malawi National Statistical Office (NSO).

The use of exporter's currency in imports from non-U.S countries in the fixed exchange rate regime ranges from 20 percent (France and Japan) to as high as 53.0 percent (South Africa) and 94.6 percent (Italy). These shares are slightly different in the floating regime with mixed changes among the countries. For instance, for Italy the share decreases by 47.4 percent whilst the country's share of total imports also

declined, by a smaller proportion of 5.3 percent in the floating regime. On the other hand, products from Japan and Germany had higher exporter pricing of 16.4 percent and 15.7 percent respectively whilst their total share in Malawian imports slightly increased for Germany (0.3 percent) and slightly dropped for Japan (1 percent). For exports from smaller economies however, there is little evidence of producer currency pricing, even when the share in Malawian imports is sufficiently high (e.g. India, China, and Zambia). This is consistent with literature that attests to less developed countries exporting less differentiated products, hence using exporters' currency less (Fukuda & Ono, 2005).

Table 1.2 presents an industry-breakdown on invoicing currency choice. We use HS 2 categories for industry analysis (detailed description of which products belong to which sectors by HS codes is given in Appendix A, Table A.1).

Table 1.2: Invoicing Currency Share in Malawi's Imports by Industry (%)

Industry	Fixed					Floating				
	%	USD	EUR	ZAR	Others	%	USD	EUR	ZAR	Others
Chemicals	28.9	92.9	2.6	3.5	1.0	30.2	94.6	1.7	3.1	0.5
Machinery	24.5	50.5	31.5	13.4	4.6	20.8	68.7	12.9	13.8	4.7
Ani. and Vegs.	8.4	94.1	2.3	3.2	0.4	11.3	93.4	1.7	2.4	2.5
Stone, Metals	7.7	49.0	4.3	24.1	22.6	7.1	74.9	3.6	19.4	2.1
Miscellaneous	5.8	74.6	7.6	10.9	6.9	6.4	83.9	6.7	5.4	4.0
Transportation	5.5	56.3	9.6	17.0	17.1	5.8	59.5	9.2	17.3	14.0
Plastics etc	4.9	77.6	4.4	15.4	2.6	5.8	84.5	4.3	9.9	1.3
Wood, Rawhides	5.2	65.1	22.6	7.9	4.4	3.9	58.8	23.0	9.0	9.2
Textiles etc	3.7	83.3	2.8	9.9	4.0	4.4	88.3	1.3	6.9	3.5
Mineral Products	3.9	84.8	0.8	10.0	4.3	2.8	78.3	1.0	9.0	11.7
Foodstuffs	1.5	67.5	9.1	18.8	4.6	1.5	78.2	4.6	14.3	2.9

Note: "Share" refers to the industry share and a percentage share of each industry in Malawi's total imports.
Source: Authors' calculation from Malawi National Statistical Office (NSO).

Although invoicing currency choice differs across industries, the share of the US dollar invoiced imports increased in most industries after the regime change. For instance, US dollar invoicing of products categorized as stone/glass and metals

increased by 25.9 percent and for machinery products increased by 18.2 percent after the adoption of the floating regime. However, in a few industries, such as imports of transportation, 17.0 (17.3) percent of the products value are invoiced in the South African Rand, 9.6 (9.2) percent in the euro and 17.1 (14.0) percent in other currencies in the fixed (floating) exchange rate regime.

The descriptive analysis suggests there is a link between the exporter's invoice currency choice, their market shares and the size of the exporting country. The interactions of these factors may differ based on the importers exchange rate regime. We empirically analyze these factors and the implications on import prices later in the chapter.

1.3 Pass-Through and Market Share

1.3.1 Baseline Model

The devaluation of May 2012 and the few months soon after would initially be seen as permanent as the exchange rate was moving from the fixed rate to its market-determined value, after which it may then depreciate less sharply from time to time. The exchange rate pass-through depends both on the expected duration and the size of the exchange rate change (Baldwin & Krugman, 1989). In a fixed exchange rate regime, the size of the change is likely to be small but permanent whilst in a floating exchange rate regime, the movements may be larger but more temporary. Firms set prices in anticipation of shocks. Kasa (1992) in a pricing to market model estimated with US and Canadian customs data and Froot and Klemperer (1989) in investigating pass-through and market share, both demonstrate the transitory component in exchange rates. They suggest that exchange rate changes that are perceived to be temporary are absorbed in the profit margin by exporters, resulting in a low degree of pass-through to import prices.

We estimate pass-through for the full sample, then for industry –level samples at HS 2 categories and then across high, middle and low-income exporters. For each sub-sample, we follow (Devereux et al., 2017) and Kiliç (2016) and set up the following panel specification for exchange rate pass-through estimation at a highly disaggregated transaction level:

$$\Delta_\tau p_{st} = \alpha + \beta \Delta_\tau s_{st} + \boldsymbol{Z_{st}}\gamma + \epsilon_{st} \tag{1.4}$$

where:

$\Delta_\tau p_{st} = \ln P_{st} - \ln P_{s\tau}$ This is the cumulative change in import price of good s expressed in MWK. τ represents the last period in which good s was observed. Since we use highly disaggregated import price data, import goods are not necessarily imported every month and, hence, a lag interval is not always equal to one.

$\Delta_\tau s_{st} = \ln s_{st} - \ln s_{s\tau}$, this is the cumulative change in the log of the exchange rate. s represents the bilateral nominal exchange rate of Kwacha vis-à-vis the exporter's currency

$\boldsymbol{Z_{st}}$ = control variables: Cumulative changes in exporter's CPI: $\Delta_\tau ln(excCPI)_{st}$ as a proxy for exporter's costs, fixed effects for every s product and time-fixed effects for every month t. Since we use a sub sample for the two periods, time fixed effects control for aggregate-level variables

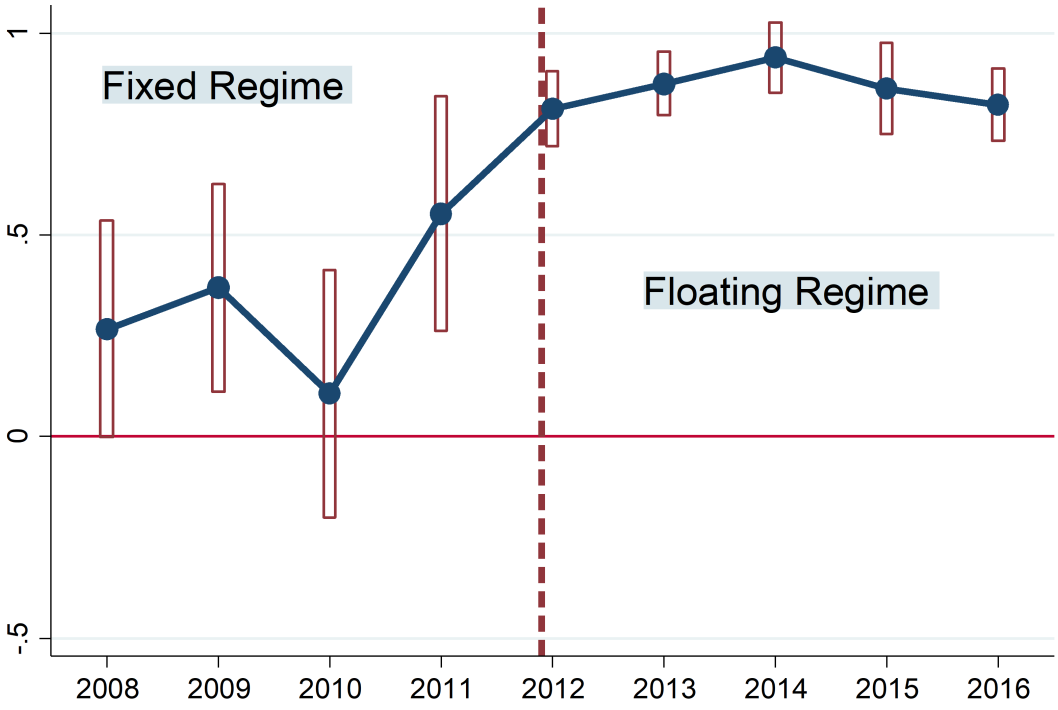
ϵ_{st} = is an error term.

Overall Pass-Through

Figure 1.2 plots the yearly coefficients of the overall exchange rate pass-through of the bilateral exchange rate to all imports as specified in equation 1.4. In the years before 2012, exchange rate pass-through was barely above 50 percent, with an average of approximately 26 percent. From the period of floating exchange rate adoption

however, exchange rate pass-through is far larger and near complete in some years such as 2014, with an average of 73 percent. this initial result seems to be in line with those of Lopez-Villavicencio and Mignon (2016).

Figure 1.2: Overall Exchange Rate Pass-through: Annual Averages 2008-2016



Note: Source: Authors' estimation

Industry-Level Pass-Through

Table 1.3 presents the results of exchange rate pass-through estimation by industry for the fixed and floating regimes. When shifting to a floating exchange rate regime, the degree of pass-through increases in all industries except plastics and rubbers. All pass-through coefficients become positive and statistically significant except for mineral products, whose coefficients remain statistically insignificant in both regimes. These results are consistent with the baseline result, and show that the fixed exchange rate regime may have indeed curbed external exchange rate shocks at least from bilateral

exchange rates of exporter's currencies as the authorities had hoped and may explain the low inflation rate in the country during that period. As we later show however, this response was not universal across products invoiced in different currencies, and when pass-through of other currencies, apart from the bilateral exchange rate, was estimated.

Table 1.3: Exchange Rate Pass-Through by Industry

Industry	Fixed		Floating	
	$\Delta_\tau s_{st}$	(se)	$\Delta_\tau s_{st}$	(se)
Chemicals	0.694***	(0.190)	0.929***	(0.155)
Machinery	0.0388	(0.166)	0.932***	(0.0979)
Animals & Vegetable	0.0240	(0.287)	0.655*	(0.284)
Stone, Glass, Metal	0.143	(0.182)	0.326*	(0.128)
Transportation	-0.0764	(0.254)	0.644***	(0.153)
Plastics & Rubbers	0.544*	(0.273)	0.475*	(0.200)
Wood, Raw, Hides	0.382	(0.267)	0.780***	(0.214)
Textiles	0.306	(0.222)	0.538**	(0.180)
Mineral Products	0.173	(0.642)	0.916	(0.481)
Foodstuffs	0.114	(0.342)	0.990***	(0.242)

Note: Fixed effect panel estimation is separately conducted for each industry. Robust standard errors are in parenthesis. Asterisk(s) denote(s) the significance level: *** for 1%, ** for 5%, and * for 10%.
Source: Authors' estimation.

Pass-Through by Exporter

Across exporters, exchange rate pass-through is highest but increased the least among high-income country exporters (Table 1.4), and lowest among exporters from low-income countries. A possible explanation to this is that first, industrialized countries tend to export more differentiated products and therefore allows them stronger bargaining power. Second, a low-income exporter may consider Malawi as a more significant trading partner, whereas Malawi may constitute a small share of a high-income

country's exports. We will explore this more when analyzing the effect of market share across exporters.

Table 1.4: Exchange Rate Pass-Through by Exporters' Income

	Fixed Regime			Floating Regime		
Variable	Low	Middle	High	Low	Middle	High
$\Delta_\tau s_{st}$	0.395	0.317***	0.685***	0.569***	0.801***	1.022***
	(0.430)	(0.0901)	(0.129)	(0.112)	(0.0379)	(0.0440)
$\Delta_\tau ln(excCPI)_{st}$	1.159***	1.809***	2.682***	1.414***	1.622***	0.957*
	(0.252)	(0.131)	(0.481)	(0.273)	(0.124)	(0.489)
Constant	0.0259	0.183***	0.283***	0.0835	-0.180***	-0.149**
	(0.186)	(0.0489)	(0.0965)	(0.0885)	(0.0351)	(0.0606)
Obs.	18960	207941	70097	19588	218328	73156
R^2	0.00973	0.00248	0.00374	0.0318	0.0121	0.0262

Note: Panel estimation is separately conducted for each income group. Robust standard errors are in parenthesis. Asterisk(s) denote(s) the significance level: *** for 1%, ** for 5%, and * for 10%.
Source: Authors' estimation.

1.3.2 Effect of Market Share

Recent studies[2] highlight a positive relationship between market share and the degree of pass-through. We advance this line of research by considering different types of market share and estimating their effects on the degree of exchange rate pass-through. MS_{kt} denotes an exporter's share in Malawi's total imports with k-type of market. We set up three types of k as defined as MS_{ot} MS_{ct} and MS_{pt} for overall (o), sector (c) and product (p) market shares respectively. These are calculated by simply getting the total value shares in all imports for an exporting country for a particular month (overall), an exporter's value share in a month in an HS-2 sector (sector) and an exporter's value share for a specific HS-8 product (product). In the absence of firm

[2]Devereux et al. (2017), for instance

identifiers in the data, this allows us to assess varying degrees of bargaining power. We estimate this effect as follows:

$$\Delta_\tau p_{st} = \delta_0 + \beta_0 \Delta_\tau s_{st} + \delta_1 [\Delta_\tau s_{st} MS_{kt}] + \boldsymbol{Z_{st}}\gamma + \epsilon_{st} \tag{1.5}$$

where:

$\Delta_\tau p_{st} = \ln P_{st} - \ln P_{s\tau}$ Change in price of s in MWK. τ last period when the price of good s was observed.

$\Delta_\tau s_{st}$ = cumulative change in the log of the exchange rate.

ϵ_{st} = is an error term

MS_{kt} = is market Share, where k is MS_{ot}, MS_{ct} and MS_{pt} for overall (o), sector (c) and product (p) ms respectively

$\boldsymbol{Z_{st}}$ = control variables: exporter's CPI, fixed effects time-fixed effects for every month t.

In alternative specifications, we include an interaction term between the exchange rate and the square of the market share variable to test the U-shaped relationship demonstrated by Devereux et al. (2017). Again, we estimate whether market share's effect on pass-through is different between the two exchange rate regimes and between high, middle- and low-income exporters. Exporters with a high product market share represent some monopoly power and/or high product differentiation. This suggests such exporters have higher bargaining power and we can expect a larger effect on the pass-through elasticity.

Product, Industry and Overall Market Share

Table 1.5 presents the estimated results of equation 1.5. The market share variable is positive and statistically significant in both regimes across all market share measures except for the overall market share in the floating regime. The largest coefficient in magnitude is the product share, suggesting that import prices are higher when

an exporter has a larger share in a specific HS 8-digit level product. An exporter with high product-specific market share is likely to quote higher prices, compared to sectoral or overall market share since this implies highly differentiated specific products. This may not extend to the industry level or overall market share per se. Market share has a positive effect on the degree of pass-through in the floating regime and is highest for the overall market share. This suggests that products from an exporter with a higher overall market share will have higher prices in the event of an exchange rate depreciation. Exporters with a higher product share, may have lower exchange rate pass-through but the differentiated product price is in itself already high such that increasing market share yields a lower increase of pass-through behavior (i.e. such exporters able to absorb exchange rate shocks in their margins).

Table 1.5: Market Share and Exchange Rate Pass-Through

	Overall		Sector		Product	
Variable	Fixed	Floating	Fixed	Floating	Fixed	Floating
$\Delta_\tau s_{st}$	0.307**	0.580***	0.292*	0.681***	0.317*	0.617***
	(0.113)	(0.070)	(0.114)	(0.075)	(0.128)	(0.079)
MS_{kt}	0.228***	0.030	0.177***	0.106*	0.698***	0.803***
	(0.069)	(0.122)	(0.043)	(0.048)	(0.018)	(0.020)
$\Delta_\tau s_{st} MS_{kt}$	-0.311	1.881***	-0.165	0.485	-0.0982	0.255*
	(0.432)	(0.520)	(0.363)	(0.343)	(0.177)	(0.126)
Constant	(0.008)	0.232***	0.011	0.222***	-0.300***	-0.106**
	(0.046)	(0.041)	(0.040)	(0.035)	(0.040)	(0.035)
Obs.	317328	303833	317328	303833	317328	303833
R^2	0.001	0.003	0.001	0.003	0.004	0.006

Note: Robust standard errors are in parenthesis. Asterisk(s) denote(s) the significance level: *** for 1%, ** for 5%, and * for 10%.
Source: Authors' estimation.

These results are in sharp contrast with the findings of Devereux et al. (2017) where the coefficients on the interaction between market share and exchange rate variables were negative. In their paper, they include an interaction term between the exchange rate and market share squared and the sign on that coefficient was

found to be positive. We conduct a similar exercise and extend this by estimating coefficients using product market share with industry level sub-samples using only the floating exchange rate regime sample (Table A.2 in Appendix A) and find that our overall results still hold: $\Delta_\tau s_{st} MS_{kt}$ remains positive across the industries whilst $\Delta_\tau s_{st} MS^2_{product,t}$ is consistently negative. The non-linear interaction term suggests a Kuznets curve and not a U-shaped relationship.

We suspect this to be a result of the contrast of the sample of importing countries between our two studies: Canada in their study and Malawi in ours, where the environment is more uncertain in the floating regime.

Market Share and Exporters

The results on the effect of market share in the fixed exchange rate regime, differ substantially between middle- and high-income exporters. For products from middle income countries, a higher share in the overall import market leads to lower exchange rate pass-through, whilst the result is in the opposite direction for high-income countries (Table 1.6). The former is in line with the results of Devereux et al. (2017) while the latter resonates the results of Table 1.5. Table 1.6 only presents results from overall market share variable as country income levels are a macro phenomenon, and so is this measure of market share. What we can infer from these results is that when the exchange rate is more stable and predictable, i.e. artificially fixed, exporters with high market share can adjust their mark ups and pass-through less of exchange rate changes.

In the floating exchange rate regime however, we only see an effect for products from middle- income countries, which are again consistent with the results of Table 1.5: higher market share, higher ERPT. This is dissimilar to a result found by Froot and Klemperer (1989) using U.S import data, where an uncertain future exchange rate (in this case we can say floating regime period), can cause a possible

Table 1.6: Market Share and Exporter's Income level

	Fixed			Floating		
	Low	Middle	High	Low	Middle	High
$\Delta_\tau s_{st}$	0.406	0.621***	0.525***	0.523***	0.721***	1.061***
	(0.495)	-0.157	(0.160)	-0.173	-0.0569	-0.0542
MS_{ot}	1.537	0.0865***	0.526***	9.328*	0.0434	0.939**
	-3.026	-0.0182	(0.201)	-5.529	-0.0422	-0.427
$\Delta_\tau s_{st} MS_{ot}$	-0.986	-1.421**	5.762*	3.528	0.746**	-1.835
	-23.9	-0.614	(3.307)	-9.915	-0.356	-1.551
Constant	0.018	0.155***	0.263**	-0.0738	-0.211***	-0.169***
	-0.186	-0.0494	(0.0968)	-0.124	-0.037	-0.0617
Obs.	18960	207941	70097	19588	218328	73156
R^2	0.00392	0.00253	0.00976	0.032	0.0121	0.0263

Note: Estimation is conducted separately for each income group. Control variables not reported. Robust standard errors are in parenthesis. Asterisk(s) denote(s) the significance level: *** for 1%, ** for 5%, and * for 10%.
Source: Authors' estimation.

decrease in prices as firms value market share relatively more in such a situation. This remains the case when we estimate this regression with an interaction term between the exchange rate and the squared term of the market share (results of which are in Table A.3 in Appendix A) which has a negative sign.

This shows the need for separate estimates for different exporting countries and again suggests a Kuznets curve relationship in the case of a developing country. The different results with literature is likely due to the small market and economy Malawi is compared to Canada or the U.S. Just as pass-through is different with exporters based on their income levels, we can likewise expect heterogeneity when market players in these countries are importing.

1.4 Invoicing Currency and ERPT

1.4.1 Pass-through of the bilateral Exchange Rate

As shown in the previous section, the share of U.S. dollar invoicing increased in Malawi's imports when moving from the fixed exchange rate regime to the floating exchange rate regime. Exchange rate pass-through is closely linked with the choice of invoicing currency at least in the short-run (see, for instance Gopinath et al. (2010)). To our knowledge, however, there have been no studies that empirically investigate possible difference in the degree of exchange rate pass-through between fixed and floating exchange rate regimes at a disaggregated level, and whether the choice of invoicing currency affects the degree of exchange rate pass-through differently between fixed and floating exchange rate regimes. To test the hypothetical relationship between two different exchange rate regimes, we employ another panel specification proposed by Devereux et al. (2017) as in equation 1.6 below. We extend the analysis by comparing results in the two regimes and across exporters.

$$\begin{aligned}\Delta_\tau p_{st} = c + \lambda_1 D_{USD} + \lambda_2 D_{ZAR} + \lambda_2 D_{EUR} + \beta_1 \Delta_\tau s_{st} + \\ \beta_2(\Delta_\tau s_{st} D_{USD}) + \beta_3(\Delta_\tau s_{st} D_{ZAR}) + + \beta_4(\Delta_\tau s_{st} D_{EUR}) + \\ \boldsymbol{Z_{st}}\gamma + \epsilon_{st} \quad (1.6)\end{aligned}$$

where:

D_j = a dummy variable for an invoice currency j

β_1 = ERPT for goods in other currencies

$\beta_1 + \beta_2$ = ERPT for USD priced goods

$\beta_1 + \beta_3$ = ERPT for ZAR priced goods

$\beta_1 + \beta_4$ = ERPT for EUR priced goods

Effect on Overall Pass-Through

Table 1.7 presents summary results of the overall pass-through estimation of equation 1.6. The result show that the pass-through coefficient for US dollar-invoiced imports, $\beta_{USD} = \beta_1 + \beta_2$, during the fixed exchange rate regime is 26 percent, the same as the overall pass-through coefficient. For euro invoiced products however, it is much higher at 88 percent. During the floating exchange rate regime, the estimated pass-through coefficients become larger for US dollar invoiced goods (69 percent) but decline for euro invoiced products (70 percent). This result may be due to Tables 1.1 and 1.2, where the U.S. Dollar invoicing share increased whilst the euro share declined after the regime switch.

Table 1.7: ERPT by Invoicing Currency

	Fixed		Floating	
USD	0.255***	(0.124)	0.688***	(0.086)
ZAR	0.036	(0.117)	0.833***	(0.103)
EUR	0.876*	(0.417)	0.696***	(0.227)
MWK	0.335	(0.667)	-1.230	(0.748)

Note: Robust standard errors are in parenthesis. Asterisk(s) denote(s) the significance level: *** for 1%, ** for 5%, and * for 10%.
Source: Authors' estimation.

On the other hand, the coefficient on South African Rand invoiced products becomes high and statistically significant at 83 percent while the Malawian Kwacha invoiced products are not affected by exchange rate changes between exporting country and Malawi. These results are robust among various specifications. For instance, pass-through for U.S. Dollar invoiced goods remains about the same in magnitude and level of significance regardless of whether the bilateral or US dollar exchange rate was used. The effect of the two when estimated in the same regression, however, is further explored in Section 4.2 in our test of the dominant currency paradigm.

Effect on Industry level Pass-Through

Tables 1.8 and 1.9 presents the estimated results for the fixed and floating regimes respectively, of equation 1.6 for each industry.

Table 1.8: ERPT and Invoicing Currency by Industry-Fixed Regime

Industry	USD	(se)	ZAR	(se)	EUR	(se)
Chemicals	0.653*	(0.256)	0.647*	(0.272)	2.035***	(0.617)
Machinery	0.248	(0.258)	-0.455	(0.255)	0.688	(0.603)
Animals & Vegetable	0.208	(0.313)	-0.321	(0.362)	1.536	(1.581)
Stone, Glass, Metal	-0.0596	(0.278)	0.140	(0.246)	-0.275	(1.143)
Transportation	-0.388	(0.335)	0.112	(0.566)	0.698	(1.220)
Plastics & Rubbers	1.262**	(0.428)	-0.426	(0.386)	-0.582	(1.380)
Wood, Raw, Hides	0.468	(0.368)	0.0973	(0.399)	0.804	(1.144)
Textiles	0.226	(0.307)	0.144	(0.395)	-0.165	(0.345)
Mineral Products	-0.592	(1.005)	0.874	(0.793)	5.363	(3.356)
Foodstuffs	0.244	(0.425)	-0.175	(0.406)	5.009	(2.824)

Note: Fixed effect panel estimation is conducted separately for each industry. Robust standard errors are in parenthesis. Asterisk(s) denote(s) the significance level: *** for 1%, ** for 5%, and * for 10%.
Source: Authors' estimation.

Table 1.9: ERPT and Invoicing Currency by Industry-Floating Regime

Industry	USD	(se)	ZAR	(se)	EUR	(se)
Chemicals	1.104***	(0.195)	0.994***	(0.242)	0.0306	(0.445)
Machinery	0.753***	(0.132)	0.960***	(0.180)	1.161***	(0.243)
Animals & Vegetable	0.578	(0.338)	1.013**	(0.380)	1.253*	(0.509)
Stone, Glass, Metal	0.338*	(0.164)	0.253	(0.224)	0.355	(0.410)
Transportation	0.820***	(0.193)	0.997*	(0.391)	1.217**	(0.413)
Plastics & Rubbers	0.566*	(0.255)	0.398	(0.289)	0.512	(0.586)
Wood, Raw, Hides	0.840**	(0.265)	0.763	(0.391)	1.483*	(0.701)
Textiles	0.147	(0.242)	1.083***	(0.280)	1.073	(1.034)
Mineral Products	0.473	(0.587)	1.721*	(0.692)	2.846	(3.584)
Foodstuffs	1.152***	(0.272)	0.673*	(0.326)	4.817*	(2.359)

Note: Fixed effect panel estimation is conducted separately for each industry. Robust standard errors are in parenthesis. Asterisk(s) denote(s) the significance level: *** for 1%, ** for 5%, and * for 10%.
Source: Authors' estimation.

The results of which are almost in line with Table 1.3. In the fixed exchange rate regime, only goods in the Chemicals and Allied Industries classification display a positive response of import prices to exchange rate changes for goods invoiced in all the three major currencies. The highest effect being euro invoicing with pass-through of over 200 percent, which may explain the result of Table 1.7 as these products have the largest value share. In the floating exchange rate regime, pass-through becomes very high and statistically significant across both currencies and products. Textiles, minerals and animals and vegetables are the only industries whose US dollar invoiced products do not respond to exchange rate changes in the floating regime. Since all three sectors have relatively low share of imports, and relatively high US dollar share (See Table 1.3), we conclude that this is due to the specifics of the products, and/or exporters.

Effect across Exporters

Interesting results emerge when pass-through analysis is conducted across both exporters and invoice currencies in Table 1.10.

Table 1.10: Effect of Invoice Currency Choice across Exporters

Exp. In.	Fixed				Floating			
	USD	ZAR	EUR	MWK	USD	ZAR	EUR	MWK
Low	0.523	-3.738	14.65**	-1.323	0.490**	-0.238	4.299***	0.00526
	(0.670)	(3.302)	(7.122)	(3.204)	(0.194)	(1.340)	(0.828)	(0.583)
Middle	0.475***	0.0904	0.912	-2.416***	0.821***	0.778***	1.042***	0.437
	(0.123)	(0.125)	(0.616)	(0.810)	(0.0469)	(0.0572)	(0.200)	(0.485)
High	0.481**	0.474**	0.772**	-4.522	1.100***	0.884***	0.900***	-0.665
	(0.201)	(0.239)	(0.334)	(2.929)	(0.0574)	(0.0699)	(0.0753)	(0.721)

Note: Fixed effect panel estimation is conducted separately for each income group. Robust standard errors are in parenthesis. Asterisk(s) denote(s) the significance level: *** for 1%, ** for 5%, and * for 10%.
Source: Authors' estimation.

Import prices of products from high income countries responded the most to exchange rate changes across the three major currencies (77 percent). As a region, since the EU is the largest trading partner, this may indicate that EU exporters opted for the euro when the Kwacha was pegged to the U.S. Dollar. The Kwacha invoiced goods in Table 1.10 show a negative sign implying a loss on the exporter's part. Results in the floating regime mimic those of Table 1.4 and Table 1.6, with high pass-through estimates for products from high-income countries and products invoiced in the US dollar. We can observe that US dollar invoiced products' prices respond by more than 100 percent to an exchange rate change when the exporter is from a high-income country.

1.4.2 The US dollar and euro exchange rates

Casas et al. (2017b) propose the so called "dominant currency paradigm" (DCP), where a small number of dominant currencies are the ones in which most of global trade is invoiced in. In their model, the pass-through of the dominant currency is high, regardless of exporter or product. Our descriptive analysis has shown that Malawian imports are indeed invoiced in a few number of currencies. However, there are some changes in the pattern of invoicing due to the exchange rate regime change, and consequently, whether this DCP holds in both regimes remains unknown. With this backdrop, we use the US dollar and the euro to test the model in Malawian imports. Apart from this extension to the empirical analysis of DCP, we separate products into sub-samples of invoicing currency based on the relevant "dominant currency". Thus, if testing for the dominance of the euro exchange rate for instance, we analyze all imports on one hand and euro invoiced products on the other as in the equation below:

$$\Delta_\tau p_{st} = \alpha + \beta_1 \Delta_\tau s_{st} + \beta_2 \Delta_\tau s_{jt} + \boldsymbol{Z_{st}}\gamma + \epsilon_{st} \tag{1.7}$$

where:

s_{jt} = is the change in the log of the exchange rate of MWK against the invoicing currency j

We conduct this estimation for all products s invoiced in currency j. All other variables are as previously described.The key in this case is that although the dominance of the U.S. Dollar is prevalent, exchange rate pass-through for products invoiced in other currencies may respond more to the changes in the exchange rate of that currency than the dominant currency. Thus, we do not separate exporters as in the previous study, but rather products.

DCP across Exchange Rate Regimes

We first test the DCP in its baseline using the US dollar and euro exchange rates. Table 1.11 displays the results which show distinct differences between the pass-through coefficients on the dollar exchange rate variables in the two periods. In the period of the de facto peg to the dollar, the inclusion of the US dollar exchange rate does knock down the bilateral exchange rate effect as the DCP empirical results for Colombia, but by a mere four percentage points (from 26 percent in our baseline estimates to 22 percent in Table 1.11, while the effect of the dollar exchange rate shows that pass-through is more than complete. This indicates that although low pass-through has been so far observed for the fixed exchange rate regime, exporters may have leveraged the irregular devaluations the monetary authorities conducted in the period, such that the dock prices were (more than) fully responsive to the exchange rate changes.

As for the euro exchange rate, the inclusion thereof actually increases the bilateral exchange rate effect (26 percent to 30 percent), in the fixed exchange rate regime, while for the floating regime, the impact is slightly less than that of the U.S. Dollar. These results are in line with findings of Beirne and Bijsterbosch (2009) for

Central and Eastern Europe, where the pass-through to consumer prices was higher in countries with a fixed exchange rate.

Table 1.11: Testing the DCP

Variable	Fixed	Floating	Fixed	Floating
$\Delta_\tau s_{st}$	0.224***	0.427***	0.303***	0.519***
	(0.0767)	(0.0724)	(0.0793)	(0.0701)
$\Delta_\tau s_{USD,t}$	1.116***	0.484***		
	(0.208)	(0.0735)		
$\Delta_\tau s_{EUR,t}$			0.338***	0.413***
			(0.117)	(0.0759)
$\Delta_\tau ln(excCPI)_{st}$	1.234***	0.882***	1.503***	1.001***
	(0.133)	(0.122)	(0.121)	(0.116)
Constant	0.184***	-0.0263	0.201***	-0.00683
	(0.0430)	(0.0417)	(0.0429)	(0.0418)
Obs.	297052	317252	297052	317252
R^2	0.00228	0.0149	0.00217	0.0148

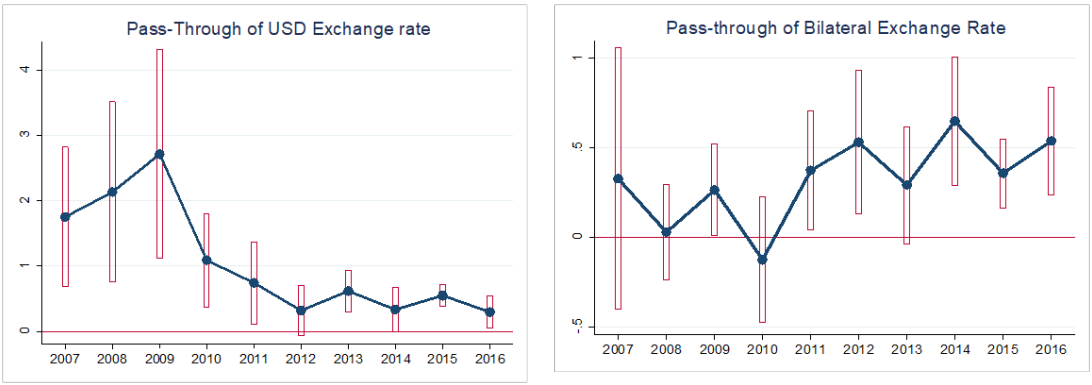
Note: Robust standard errors are in parenthesis. Asterisk(s) denote(s) the significance level: *** for 1%, ** for 5%, and * for 10%.
Source: Authors' estimation.

Figure 1.3 shows that the dollar exchange rate pass-through in the fixed exchange rate regime was indeed very high and exceeded 200 percent in 2009. However, the pass-through dropped significantly after adopting a floating exchange rate regime, contrary to the analysis of the bilateral exchange rate on dollar invoiced products. The US dollar pass-through coefficient is almost the same in magnitude as the bilateral exchange rate in the floating regime.

The results from the floating regime, do not support the dominant currency prediction that the dominant currency exchange rate pass-through is high.. The inclusion of the dollar exchange rate does decrease the effect of the bilateral exchange rate, but the pass-through of the dollar itself is not high. The effect of the inclusion of the euro exchange rate the on bilateral exchange rate is smaller than the dollar but the coefficient on the euro exchange rate itself is also quite low. We may thus say the

dominant currency paradigm in the fixed exchange rate regime weakly holds for the US dollar exchange rate, does not for the euro exchange rate but again weakly holds for both currencies in the floating regime.

Figure 1.3: Annual Average of Pass-Through



Note: Source: Authors' estimation

DCP across dollar and euro invoiced products

Finally, on the issue of DCP, we analyze separately euro and dollar-invoiced products as specified in equation 1.7. The premise is that the dominant currency paradigm may be more applicable for the goods invoiced in that currency and not all imports. Indeed, if the share of that currency is large, we expect that to have an impact on all import prices, but that impact ios different for products invoiced in that currency compared to products invoiced in other currencies, despite the dominant currency's large share in imports. This is an extension not explored in (Casas et al., 2017b).

As shown in Table 1.12, this difference is notable for euro invoiced products. When separated, the bilateral exchange rate pass-through coefficient is not statistically significant, and import prices change by more than 100 percent change of the euro exchange rate during the fixed regime. After the regime switch, although by a lesser magnitude, DCP holds for dollar-invoiced products, but the same cannot be

said for the euro invoiced goods. Thus, we may deduce that the invoicing currency matters more than the dominant currency.

Table 1.12: DCP across euro and dollar-invoiced Products

	Var	USD Invoiced Goods			Euro Invoiced Goods		
Fixed	$\Delta_\tau s_{st}$	0.553***		0.229*	0.744**		-0.200
		(0.107)		(0.119)	(0.322)		(0.322)
	$\Delta_\tau s_{jt}$		1.897***	1.592***		1.402***	1.602***
			(0.276)	(0.317)		(0.373)	(0.480)
	Obs.	126445	126443	126445	10368	10368	10368
	R^2	0.00316	0.00341	0.00345	0.0134	0.0143	0.0144
Floating	$\Delta_\tau s_{st}$	0.911***		0.316***	0.821***		0.376
		(0.0355)		(0.106)	(0.0815)		(0.480)
	$\Delta_\tau s_{jt}$		0.982***	0.643***		0.867***	0.476
			(0.0367)	(0.111)		(0.0856)	(0.504)
	Obs.	146051	143471	146051	13857	13857	13857
	R^2	0.0168	0.0182	0.0171	0.0284	0.0284	0.0285

Note: Fixed effect panel estimation is conducted separately for each group of products by invoice currency. Robust standard errors are in parenthesis. Asterisk(s) denote(s) the significance level: *** for 1%, ** for 5%, and * for 10%.
Source: Authors' estimation.

1.5 Concluding Remarks

By using a unique data set of import transactions at the customs level in Malawi, we have presented several results from various perspectives on exchange rate pass-through and invoice currency across two exchange rate regimes. Our novel findings are that the share of dollar invoicing in Malawian imports and the impact thereof on import prices markedly differs in the floating exchange rate regime. This finding is supported by analysis and panel estimation for individual industry and different exporters grouped by national income level.

The effect of market share in the fixed regime is only observed among products from middle income countries, whilst in the floating exchange rate regime, a

higher share in a specific HS 8-digit product increases pass-through though by a lesser magnitude than an overall market share. Non-linearity suggests an N-shaped as opposed to a U-shape relationship between market share and exchange rate pass-through. The dominant currency paradigm is weakly supported in the fixed exchange rate regime, where the pass-through of the U.S. Dollar exchange rate is more than complete but inclusion thereof hardly affects the effect of the bilateral exchange rate across all imports. For euro invoiced products, only the euro exchange rate pass-through matters for exchange rate pass-through in the fixed regime while for floating regime, the dominant currency paradigm holds in both euro and dollar-invoiced products, albeit again, weakly in the latter.

The results suggest exporters pricing behavior is different across the two exchange rate regimes. These differences are pronounced among exporters of varying market share and depending on the currency in which they choose to invoice their products. The results fall into the literature showing the importance of both microeconomic and macroeconomic aspects in exchange rate pass-through and in determining the optimality of a peg or a float in an open economy. Further studies, however, may follow in extending the study and building a model in the context of a structural and macroeconomic change.

Chapter 2

Tariff Effects on Exporter Pricing and Invoice Currency Choice: Evidence from EU Exports

2.1 Introduction

Understanding exporters' choice of invoicing currency reveals one of the key mechanisms to explain heterogeneity in exchange rate and by extension tariff pass-through, and the role of the currencies themselves in the global market. Trade prices are a principal channel through which movements in the exchange rate and changes in import taxes affect domestic variables for an open economy. For exporters, this may influence their pricing behavior differently which has implications for the destination prices of their exports. As such, understanding determinants of invoice currency choice, has implications both for the prices of goods and for the currencies used in trade invoicing. It is therefore important to understand how exchange rate and tariff changes affect exporters mark-ups and invoice currency choice for the same product. This is the main objective of this chapter.

Although trade integration has been on the rise in recent years, developing countries still have high tariffs for products which may be deemed for instance harmful to the environment or to infant industries. Simultaneous estimation of exchange rate and tariff pass-through has been done by few studies: Feenstra (1989) being among the first followed by few others (Baghdadi, Kruse, and Martínez-Zarzoso (2016) and Menon (1996)). Exchange rate depreciations increase import prices both at the dock (export prices in local currency) and after the tariff is applied, while an increase in tariff reduces exporter prices in case of incomplete tariff pass-through (see for instance Hayakawa and Ito (2015) and intuitively, increase the tariff-inclusive import prices. These studies however have mainly been on trade among advanced economies and little is known on exchange rate pass-through nor tariff pass-through when advanced economies trade with developing countries.

As for invoice currencies and exchange rate pass-through, empirical literature concludes that pass-through varies among products invoiced in different currencies and market structure.[1] Optimal choice of price-setting currency is theorized to depend on such factors as the exporting firm's market share in the foreign market, the volatility of the currency itself, among others. Small open economy studies are Boz, Gopinath, and Plagborg-Møller (2017) and Casas, Diez, Gopinath, and Gourinchas (2017a) who study imports of Turkey and Columbia respectively. They conclude that the dollar exchange rate quantitatively dominates the bilateral exchange rate in price pass-through in the former and the dominant currency pass-through is high in the latter. However, there is nearly no literature that examines invoice currency choice and tariff pass-through, although both tariffs and exchange rates affect exporters' mark ups. Further, little is known on invoice currency patterns in imports in African countries at a detailed level.

[1]See for instance Devereux et al. (2017), Auer and Schoenle (2015), T. Zhang (2017)

Feenstra (1989) touches on the invoice currency issue in optimal price modelling for price pass-through of exchange rates and tariffs, but the sample used was of automobile imports into the U.S. and almost entirely invoiced in the U.S. Dollar and thus does not analyse the issue. Subsequent studies on exchange rate pass through have dealt with the invoice currency choice in relation to the exchange rate using transaction level data (Devereux et al. (2017); Casas et al. (2017b)), the invoice currency choice and its determinants (Ligtharty and Werner (2012); Gopinath (2016)) or the tariff-pass through behavior separately (Hayakawa and Ito (2015)). This chapter brings together these exporter decisions and analyse the effects on the destination prices using richer transaction level data with applied import duty rates for each import transaction.

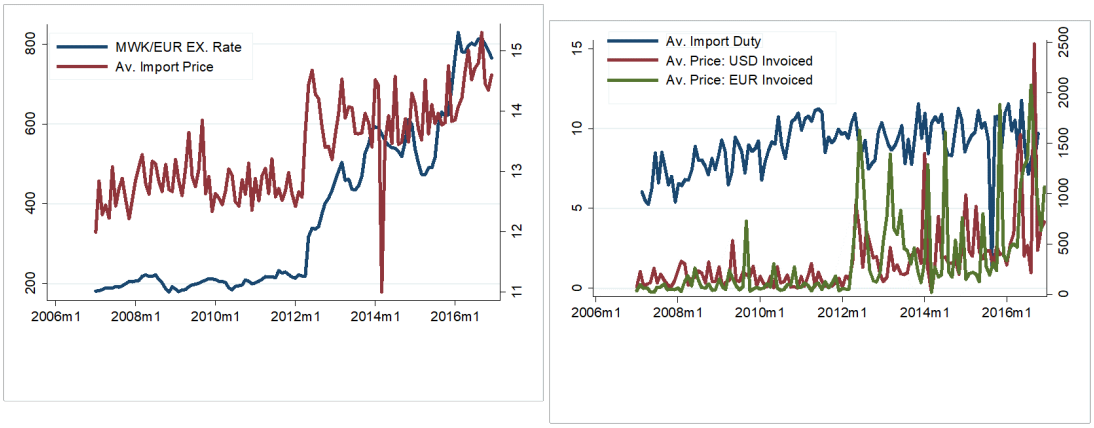
Studies on EU trade and euro internationalization have mainly been done with a sample of advanced economies. One key factor is due to the lack of data that details invoicing currencies used for both advanced and developing economies. L. S. Goldberg and Tille (2005) found that non-euro area countries have higher U.S. Dollar invoicing while euro area countries are more likely to invoice in the euro. L. S. Goldberg (2008) found that the euro is mainly used by countries with geographic proximity to the euro area, but not extensively used elsewhere. Kamps (2006) empirically showed that a country's membership or prospective membership of the EU increases the probability of choosing the euro as an invoicing currency. Ligtharty and Werner (2012) found that the euro tends to be chosen more frequently and has overtaken the U.S. dollar as a role of vehicle currency in Norwegian imports. This chapter extends these studies by using invoicing currency data on bilateral trade transactions to analyze the use of the euro in producer currency pricing and as a vehicle currency by EU and non-EU European exporters in trading with an African country, Malawi.

Malawi has strong ties with the EU dating back to 1975 when the EU signed the Lomé I Convention between 46 African, Caribbean and Pacific (ACP) countries

and 9 EU countries. Since then, Malawi has signed subsequent ACP-EU Lomé Conventions at five-year intervals. Between 2004 and 2016, imports from the EU displayed an increasing trend, averaging 13 percent of total Malawian imports. This important partnership inevitably leaves Malawi susceptible to shocks that may take place in the region and at the same time leaves EU exporters' profits to in part, depend on Malawi's trade and exchange rate policies.

Figure 2.1 below plots prices of imports from the EU and the average duty applied to them. The graph shows that the average prices of EU goods invoiced in the U.S Dollar differs from imports invoiced in the euro. The blue series is the average import duty charged on EU imports which between 2004 to 2016 were just under 20 percent with very large variations among products. From April 2012, Malawi adopted a flexible exchange rate regime, hence the noisier movements after this period in the graph. This structural change is accounted for in the empirical analysis.

Figure 2.1: Import Prices, Exchange Rates and Import Duty 2004-2016



Note: LHS axis for import duty. RHS axis are import prices in natural logs. All are monthly series.
Source: National Statistical Office of Malawi (NSO).

This chapter advances the pass-through literature by using a simple mark-up model, building testable hypotheses and providing from my knowledge the first empirical evidence on: the role of invoicing currencies in both exchange rate and

tariff-pass through to destination prices of EU exports in a developing and African country context; and secondly on the use of the euro in trade invoicing by exporters within and outside the EU. The three hypotheses that we make in the paper using a simple mark-up framework, are as follows: first, an exporter with low exchange rate pass-through will have high tariff pass-through when tariffs and exchange rates are not fully passed on; second, exporters invoicing a product in the currency that reveals low (high) exchange rate pass-through will have high (low) tariff-pass through for the same product; and finally, an increase in tariff will decrease the share of the currency that implies high exchange rate pass-through by that exporter, and vice versa, all else being equal. We test these using highly disaggregated customs level data and constructing unit values measured at the level of a transaction, as opposed to aggregated unit values. We carefully construct before-tariff prices and analyze a price change between the periods in which a product is imported, and products are separated based on an exporter's eurozone status.

The key findings of the chapter are as follows: empirical test of the first hypothesis of the chapter is found to hold when analysis is conducted across industries. Second, an increase in import duty lowers the before-tariff import price, with the least (if any) response in euro invoiced products. Exporters with the highest (lowest) exchange rate pass-through in a currency of invoicing, have the highest (lowest) response in their prices to a tariff change (low tariff pass-through). Third, an increase in the import duty results in a decline in the share of euro invoicing, while an increase in market share and being in the euro area longer leads to an increase thereof. This suggests that euro area exporters opt to switch invoice currencies when there is an increase in tariffs. Fourth, as a vehicle currency in non-EU exports to Malawi, both the growth in membership of the euro area and that of the EU matter in increasing the probability of euro invoicing in non-EU trade. Non-EU European countries are more likely to invoice in the euro than all other exporters from the rest

of the world. The empirical findings imply that a higher share of the euro is beneficial to importers as far as prices are concerned, whether tariffs are partially or fully borne by the importer.

The rest of this chapter is organized as follows: Section 2.2 outlines the data handling, data sources and the descriptive analysis. A theoretical model is presented in Section 2.3. In Section 2.4 and 2.5 the empirical estimations and results on exchange rate and tariff pass-through and invoice currency choice are discussed respectively. Finally, Section 2.6 concludes this chapter.

2.2 Data and Panel Design

2.2.1 Customs Data

This chapter uses a monthly series of customs-level transaction data for Malawi's imports from the EU between January 2007 to December 2016. The data is obtained from the Malawi National Statistical Office (NSO). The data contains individual transactions made within each month at the HS-8-digit product level. Each transaction contains information on exporting country, the currency in which each transaction was invoiced in, the before tariff value of the transaction, all the applicable import taxes for the transaction and the quantity of the products. The import taxes vary based on various factors including the importing institution/firm, trade agreements with exporting countries, types of good and any other change in trade policy.

A key challenge with the data in a single month, transactions of products with very similar characteristics have different tariff rates. Since the data does not provide importer and exporter identifiers, in order to have consistent prices and tariffs for each time the product appears in the data, the described mechanism in sub-section 2.2.2 is used to ensure that we are observing actual changes in tariff rates as opposed

to changes due to importer characteristics or other unobservable information from the data. A single tariff must be selected as being applied when constructing prices for the tariff pass-through analysis without having to average out different rates applied to various transactions in a month.

2.2.2 Product Definition and Price Construction

Since customs level data is used, it means that in a single month, a product with the same HS-8 code, from the same country invoiced in the same currency can be imported several times and different tariff rates applied to each transaction. This implies that in a month, there are several transactions of similar characteristics with a different tariff rate and a different unit price per transaction. This makes it challenging to identify changes in tariff rates for the same good at different times.

Closely following Devereux et al. (2017), we define a product and its related price that can be tracked over time. This chapter's data differs from the Devereux et al. (2017) study in that we are also analyzing import duty on each transaction. Since the only information missing is importer identifier, it is assumed that the differences in tariff arise based on importer characteristics. In addition, similar products may be measured using different units of measurement. In order to conduct panel estimation with a monthly series, the first step is to identify a unique product in a month for which a single price and tariff rate can be applied from the transaction data.

In any given month t, let L be a set of transactions with the same HS 8-digit code (HS), from the same exporting country (exp), invoiced in the same currency (cur) and measured in the same units (u). Such that $L = (HS, exp, cur, u)$. For a given $l \in L$, the unit price per transaction will be:

$$P_l = \frac{M_l}{q_l} \tag{2.1}$$

where:

M = is the total value of each transaction before the tariff is applied

q = is the total quantity per transaction l

As it is possible that in a month, transactions within the set L have different tariff rates applied, we define R as the set of all possible tariff rates applied to the transactions of L. Then for any $r \in R$, we can define L_r as: $L = (HS, exp, cur, u)$ be a set of transactions in t such that

$$L_r = \{l \in L \text{ having tariff } r\} \tag{2.2}$$

where:

$L = U_{r \in R} L_r$

The goal then is to select L_r : transactions within L with the exact same tariff rate applied each time they appear in the data. To arrive at a consensus for the tariff rate without having to average the rates within the set L , we select the tariff rate and transactions that most represent the transactions in the set. Let $|\dots|$ denote the number of transactions in any class, L or R . The consensus algorithm, which we shall call C , is mathematically represented in equation 2.3 below:

$$C = \max\left(\frac{1}{|L|}\left\lfloor \max_{r \in R}\left(|L_r| + \frac{\sum_{l \in L_r} M_l}{\sum_{l \in L} M_l}\right)\right\rfloor, \max_{r \in R} \frac{\sum_{l \in L_r} M_l}{\sum_{l \in L} M_l}\right) \tag{2.3}$$

The left-hand side is the ratio for the L_r with the highest count of transactions as defined in the expression 2.2 (and in case of equality, the set with the highest transaction value). The right-hand side term is the ratio for the L_r with highest total transaction value. We define $\tilde{r}$ as the $r \in R$ which yields this consensus C . This is then the selected tariff rate that will be analyzed, and consequently we only analyze transactions with $\tilde{r}$ applied.

We can then define a product g which corresponds to L_r and is defined if and only if $C \geq 0.9$. If $C < 0.9$, then all the transactions in the set are discarded and the process starts again for the next set and so on. After this process, about 3.5 percent of transactions were discarded during this procedure. These transactions that fit in this criteria can be observed at most once in a month and enables empirical analysis using a large panel data set. We may thus proceed to construct a price index for this product. First, we calculate the weight α , for each transaction:

$$\alpha_{lst} = \frac{M_{lg}}{\sum_{x \in L_{\tilde{r}}} M_x} \tag{2.4}$$

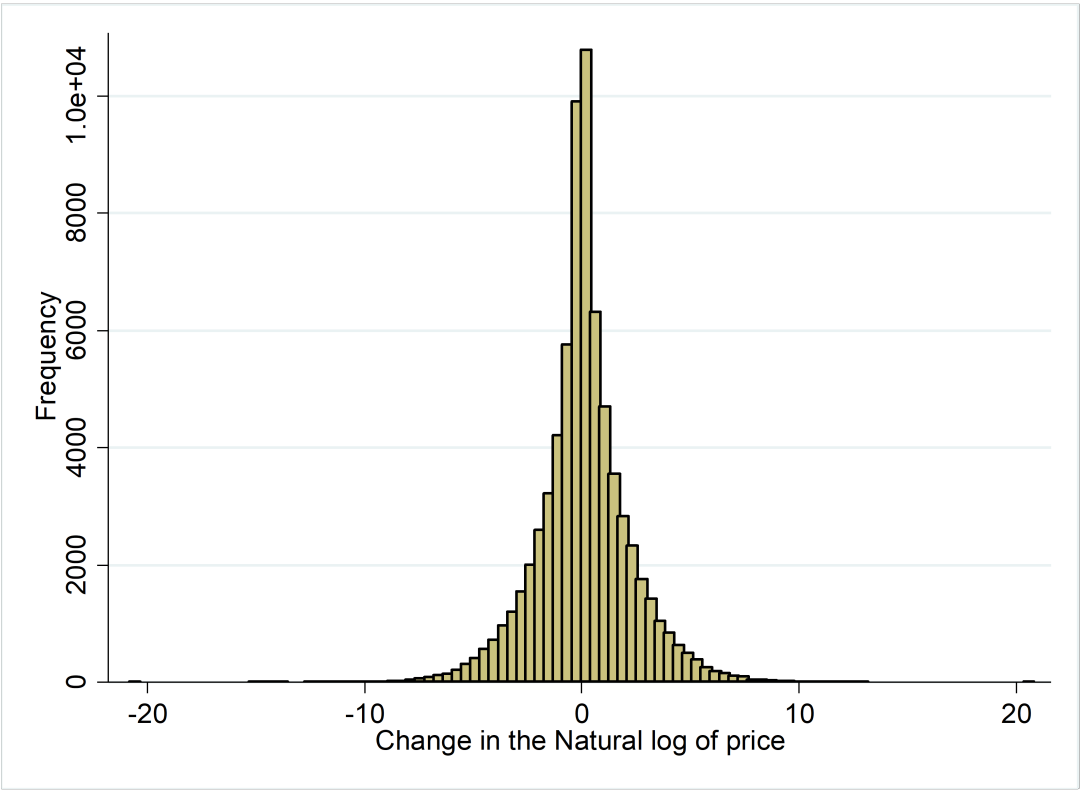
Then the weighted price for the product in each month t will be:

$$P_{gt} = \sum_{x \in L} (\alpha_{lt} * p_{lt}) \tag{2.5}$$

This is a unique HS 8-digit level product price that can be tracked over time and across time invariant information about the industry and exporter country. In this way, there can only be one product g in a month, allowing for a panel identifier in the data set. This enables the analysis of exporters' response to a tariff change. In the empirical analysis, as a robustness check, a price calculated using number of units (quantity) instead of the value weight using M_{lg} in equation 2.4 is used.

Figure 2.2 below plots the frequency of the dependent variable: changes in the p_g between the current month such a product is observed and the next time it is imported. The histogram shows that the price changes are a bell–shaped curve signaling a somewhat normal distribution around the mean.

Figure 2.2: Histogram of Price Changes



Note: Number of bins is 98
Source: Authors' calculation from National Statistical Office of Malawi (NSO).

2.2.3 Descriptive Statistics

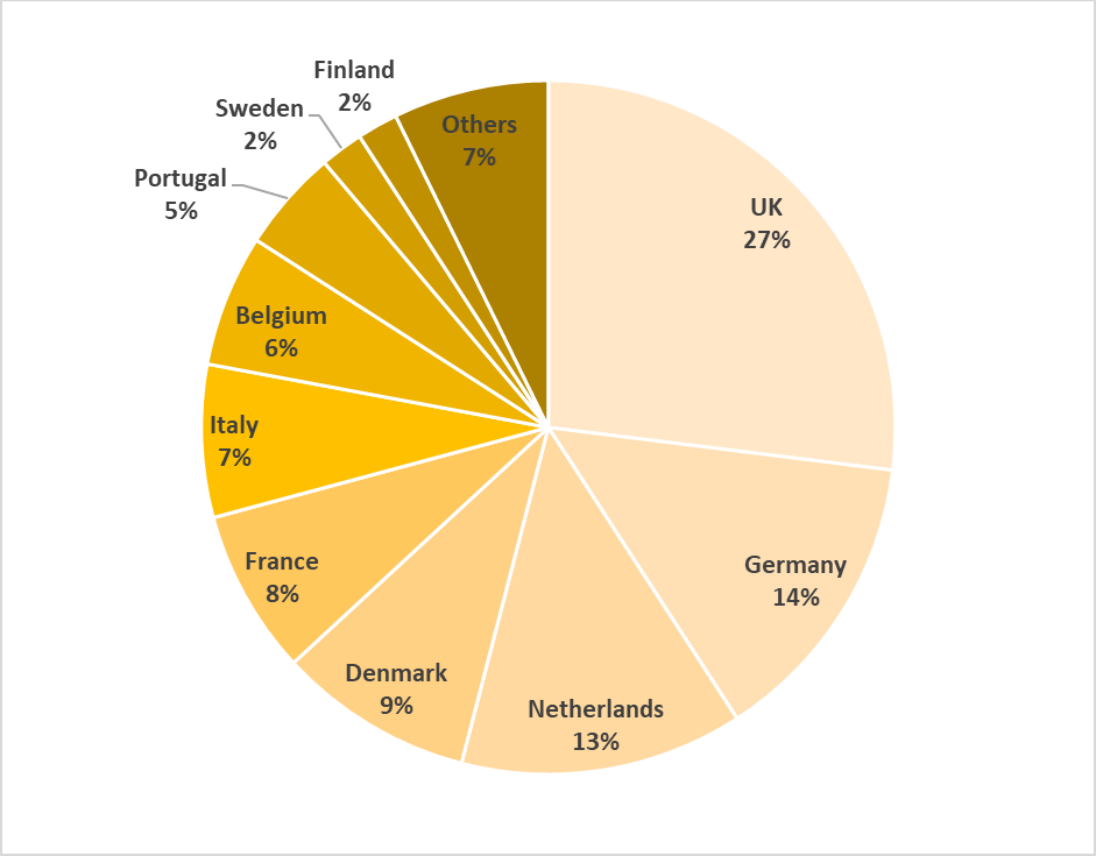
Exporter Share and Product Type

The sample includes 28 EU member countries (See Table B.2 in the Appendix). Each country is grouped into one of three groups apart from being a member of the EU: (1) Eurozone member, (2) Prospective members, which are countries that have either committed to join the euro area or are preparing to join and (3) Non-Members, for the countries that are part of the EU but have negotiated to opt out of the euro area.[2]

[2]Since some countries joined the euro area during the sample period, we do not group prospective members with existing members solely based on the dates joined but also based on number of observations in the two periods. If for instance a country has more observations in the time period before joining the euro area, then they are considered a prospective member even for the period they become an Eu member.

The top 10 EU exporting countries to Malawi made up over 90 percent of all trade from the region in value (Figure 2.3, the largest share in value of imported products originating from the UK with 27 percent).[3] On average, 59 percent of the imports were from eurozone members. These were seconded by the two members who have opted out of the euro (United Kingdom and Denmark) with a share of 36 percent. The remainder of EU imports (5 percent) were from the prospective eurozone members.

Figure 2.3: EU Exporting Country Share (Average 2004-2016)



Source: Authors' calculation from National Statistical Office of Malawi (NSO).

For a sectoral analysis of the imported products, the products are grouped into categories based on a selected set of 2-digit HS codes. The products themselves are not aggregated to 2-digit HS codes, but merely grouped so. Majority of the

[3]Brexit: As indicated by the European Commission, the U.K is still being treated as part of the EU and we do likewise in this study.

imports in the sample are among the chemicals and allied industries which account for approximately 31 percent of imports from the EU (Table 2.1). These include products such as pharmaceuticals and fertilizers. This was the largest share of products in imports from across the exporter groups. At a country-level breakdown however, this was the case for 11 of the 28 countries, the top being Latvia for which Chemicals and Allied Industries made up 97 percent of all exports to Malawi in the sample period, although the Netherlands supplied the largest share in value (23 percent). For the next 9 countries, the largest share of their imports were machinery and electrical products, which were also the largest share of Italian exports to Malawi (73 percent) and Italy as the largest contributor (24 percent).

Table 2.1: Average Share of Import Products from the EU: 2004-2016

Sector	All EU	Euro Users	Prospective	Non-Members
Chemicals & Allied Industries	31.2	32.0	27.1	34.3
Machinery, Electrical	21.9	22.5	28.8	12.6
Wood, Raw hides	15.2	3.5	6.4	19.8
Transportation	8.6	4.8	3.7	9.2
Animal and vegetables	5.3	10.4	7.1	7.0
Textiles Footwear Headgear	4.8	14.2	14.5	2.4
Plastics, Rubbers	4.6	3.4	1.7	5.6
Miscellaneous	4.0	3.1	4.6	6.4
Stones and Metals	2.6	2.8	1.7	1.6
Foodstuffs	1.3	1.1	4.6	0.9
Mineral Products	0.5	2.3	0.0	0.2
Total	100	100	100	100
% Share in imports from EU		58.9	5.0	36.1

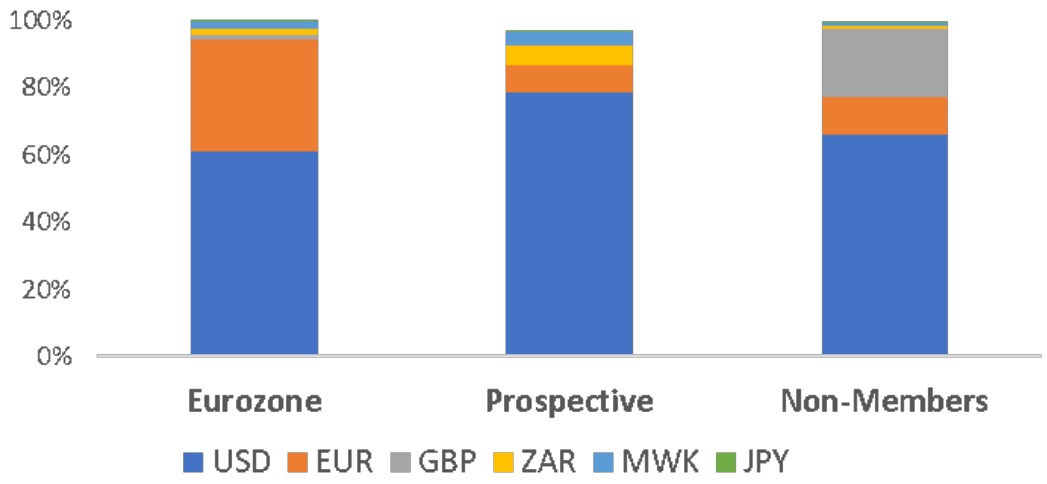
Source: Authors' calculation from National Statistical Office of Malawi (NSO).

Invoice Currency

According to Bacchetta and Wincoop (2005), the currency of a monetary union tends to be used most for trade invoicing by members. Although true that among euro invoiced products from the EU, 86 percent originated from countries in the euro area,

the U.S. Dollar surpasses the euro in terms of the total value share of imports. On average, between 2004 and 2016, imports from the EU region were dominated by the U.S. Dollar invoicing (63 percent) while the share of euro invoiced imports were approximately 23 percent. As illustrated in Figure 2.4, eurozone countries had an average share of 33 percent of products invoiced in the euro. While this share is larger than prospective (8 percent) and non-members (12 percent), the U.S. Dollar is still more frequently used by euro area countries, than the euro in exporting to Malawi. The total number of currencies used was 33. Notably, countries yet to adopt the euro had 6 percent and 4 percent of their exports in the South African Rand and Malawi Kwacha respectively, not much smaller than the euro share. For non-member countries, the pound averaged 20 percent of imports mainly due to the presence of the U.K in that pair of countries.

Figure 2.4: Percentage Share of Invoicing Currencies



Source: National Statistical Office of Malawi (NSO).

The industry breakdown on currency invoicing is detailed in Appendix B.1. The dollar still dominates. However, notably low shares of dollar invoicing are observed in industries such as mineral products (11.9 percent), transportation (21.6 percent), foodstuffs (32.8) and machinery (34.9 percent). In these sectors, the euro

and the pound are more dominant. For instance, for transportation, mineral products and foodstuffs the largest share in values were invoiced in the Pound (44 percent), the euro (41 percent) and the Malawi Kwacha (43 percent) respectively. These statistics are unlike Norwegian imports in which the euro was reported to have overtaken the U.S. Dollar (Ligtharty & Werner, 2012).

Import Duty

Import duties ranged from 0 percent in products such as pharmaceuticals within chemicals and allied industries, to as high as 90 percent in some vehicles (mainly older, second hand cars). As mentioned earlier, there are a lot of factors as to the variations in the duty rates of imports. This chapter does not analyze this but instead, considers the existing tariff that is applied at the time the product reaches the border and how a change in that rate affects the before tariff price i.e. the exporter's response to a change in tariff. Although the world has been heading towards free trade, developing countries such as Malawi still have considerably high tariffs.

2.3 Exporter Pricing: A Simple Model

2.3.1 Exchange rates and Tariffs in the Mark-up

In this chapter, we assume a model of monopolistic competition as in standard pass-through literature (Feenstra (1989); Devereux et al. (2017)). As Menon (1996) notes, incomplete pass-through is mainly associated to imperfectly competitive market structures where firms charge a mark-up on costs.

Let ER be the exchange rate between exporting country i and importing country h at time t. This is expressed as the home currency per one unit of exporter currency such that an increase means a depreciation of the domestic currency. Let the exporter's price in the importers currency for a product be denoted by PM while

PX is the exporters price in the exporter's currency. Note that PM is the dock price before any tariff is included in the price. The exporter then is assumed to set a price as a mark-up, π on production costs C as follows:

$$PX = \pi C \tag{2.6}$$

PX is charged having considered destination country variables and market variables. Then the destination prices for products from the exporter country in the importer's currency are simply:

$$PM = PX * ER \tag{2.7}$$

We may substitute 2.6 into 2.7 as follows:

$$PM = (\pi C) * ER \tag{2.8}$$

The profit mark-up is theorized to depend on macroeconomic conditions, price of competing products in the domestic market and in the import market. As well documented in the literature survey by P. K. Goldberg and Knetter (1997), incomplete pass-through implies that the difference between the estimated coefficient and full pass-through is offset by changes in the markup when a cost measure is included as a control variable. Based on the findings of Hayakawa and Ito (2015) and the theoretical model of Feenstra (1989), an increase in tariff leads to a decrease in the exporters price if the tariff is less than fully passed through in the import price, all else being equal. If the tariff inclusive import price that importers pay is $P_T = PM*(1+T) = (\pi CER)*(1+T)$ which is simply dock prices in the destination currency multiplied by the tariff rate T : $PM * (1+T) = P_T$, then an increase in tariffs decreases the price that the exporter receives since $PM = \frac{P_T}{(1+T)}$ (as defined in Feenstra (1989) and Marchand (2012)).

On one end of the spectrum, if the tariff is fully passed through, then the exporter's price is unaffected by the change and the effect of the trade policy is fully borne by the price paid by the importer i.e. $\pi CER = \frac{\uparrow P_T}{(1+\uparrow T)}$. In the extreme case of no tariff pass-through, $\downarrow \pi CER = \frac{P_T}{(1+\uparrow T)}$, the price the exporter receives decreases proportional to the increase in tariffs. Keeping this in mind, the mark-up is therefore dependent on the exporters desired pass-through of exchange rates and the tariff. If both exchange rates and tariffs change, we can incorporate these variables in the mark-up equation similar to Menon (1996) as follows:

$$\pi = \Big(\frac{PH}{C * ER}\Big)^{\alpha}\Big(\frac{1}{1+T}\Big)^{\beta} \tag{2.9}$$

Where PH represents macroeconomic conditions, price of competing products in the domestic market and in the import market. The exporter then will choose to incorporate changes of both ER and $1+T$ into π . Substituting 2.9 into 2.8 and taking the lower-case letters to represent natural logs yields:

$$pm = \alpha ph + (1-\alpha)(er + c) - \beta(1+t) \tag{2.10}$$

If $\beta = 0$, then it is complete tariff pass-through (TPT), whereas if $\beta = 1$, the exporter bears the full impact of the tariff change through their mark-up adjustments (zero tariff pass-through). On the other hand, if $\alpha = 0$, then exchange rate pass-though (ERPT) will be complete whilst there is zero pass-through if $\alpha = 1$. At this point we assume that the exporter prices in their own currency (currency of country i). We assume in this chapter that exporters would like to limit their exposure, such that if the exporter bears much of the exchange rate risk (low exchange rate pass through), they are unlikely to also have low tariff pass-through and bear a large part of the increase in tariff in their mark up. This assumption implies that both

exchange rate pass-through and tariff pass-through are exporters choice variables. We can hypothesize as thus concerning α and β in equation 2.10:

Hypothesis 1: *For the same product sold in the domestic market by the same exporter, α and β move in opposite directions. Such that an exporter with low exchange rate pass-through (an α that tends to 1) will have high tariff pass-through (a β that tends to 0) when tariffs and exchange rates are not fully passed on.*

The period in which the exporter makes a choice is assumed to be between one sell and the next one as demonstrated in the data handling and empirical section when testing this hypothesis. As tariffs change far less often than exchange rates, the assumption is that the exporter's tariff pass-through behavior is made after the invoice currency and exchange rate pass-through has been chosen. As such, we can reasonably assume exporters are able to (if they can, as later discussed in the next section) to make changes in their pricing strategy following a change in the importers trade policy since tariff changes are usually announced and known compared to exchange rate changes which are more market oriented.

2.3.2 Invoice Currency Choice and Pass-Through

The exchange rate pass-through in the short-run will depend on the currency of invoicing and will be high. As documented by Gopinath (2016), there is little difference in short-run and long run pass-through estimates when invoice currencies are considered. Let δ_i^k be the fraction of a small economy's (h) imports from country i, invoiced in k currency in a given period. Where $k = h$ if invoiced in the importers currency (local currency pricing, LCP); $k = i$ if invoiced in the exporters currency (producer currency pricing, PCP); $k = v$ if invoiced in a vehicle currency (vehicle currency pricing, VCP).

As documented in the literature, δ_i^h means that $PM = PX$. If exporters choose PCP or VCP, then PM is dependent on the effect of ER depending on the exchange rate between the importers currency and the invoice currency choice. An exporter with higher exchange rate pass-through is more likely to invoice transactions in its own currency, or in a vehicle currency while a firm with low pass-through is more likely to invoice in the importer's currency (See for instance Casas et al. (2017a); Devereux et al. (2017)). Thus, both pass-through and invoice currency are choice variables. The data described in the previous section shows very low LCP but sufficiently high VCP and some PCP. Gopinath, Itskhoki, and Rigobon (2008) show that even when exporters have the same desired pass-through, the invoicing currency will differ depending on the differences in the frequency with which they adjust.

As both tariffs and exchange rates shift the producer price howbeit not in the same direction (equation 2.10), going back to the first hypothesis, the above discussion then means that as long as invoice currency affects the exchange rate pass-through, tariff pass-through rates will likewise differ for products invoiced in different currencies by the same exporter, leading us to the next testable hypothesis:

Hypothesis 2*: Exporters invoicing a product in the currency that reveals low (high) exchange rate pass-through will have high (low) tariff-pass through for the same product invoiced in that currency of invoicing vis-à-vis other currencies.*

This is simply the first hypothesis in the context of invoicing currencies. We can use the following hypothetical example and what this predicts: from (2.9), if $k = i \Rightarrow\downarrow \alpha$ (that is, high ERPT exporter chooses to invoice in exporter's currency i for a particular product) then it follows from the first hypothesis that $k = i \Rightarrow\uparrow \beta$ (low TPT i.e. a larger decrease in the before tariff price) for that product. Similarly, if $k = v \Rightarrow\uparrow \alpha$ (that is, a low ERPT exporter chooses to invoice in a vehicle currency

v for a particular product), then $k = i \Rightarrow\downarrow \beta$. Therefore, products invoiced in different currencies will have varying degrees of tariff pass-through, if and only if invoice currency choice affects exchange rate pass-through.

2.3.3 Tariffs and Invoice Currency Switching

What then is the role of tariffs in determining δ_i^k : the share of invoice currencies? As demonstrated by Goldberg and Tille (2005), exporters are not restricted to invoice entirely in one currency, and this is supported in the data. Such that for any one product, an exporter will have $\delta_i^h + \delta_i^i + \delta_i^v = 1$. It follows from the previous discussions that an exporter faced with a tariff change will be in one of two positions: (1) can choose to change the currency of invoicing or not (2) cannot or chooses not, to change. The inability to change the currency of invoicing may be due to reasons such as pre-set contract agreements among others. In the literature, the effect of tariffs on invoice currency choice has not been explored, hence the introduction in this chapter.

As before, let's once again suppose that invoicing in the exporters' currency, $k = i \Rightarrow\downarrow \alpha$ (high ERPT) and further suppose that vehicle currency pricing, $k = v \Rightarrow\uparrow \alpha$ (low ERPT). Both these conditions imply $k = i \Rightarrow\uparrow \beta$ (low TPT) and $k = v \Rightarrow\downarrow \beta$ (high TPT) respectively for the same good, based on hypothesis. If an increase in import tariffs for that product is announced in the destination country, before the next sale, the exporter has a decision as to whether to maintain the chosen levels of δ_i^k . If the exporter cannot change the invoice currency choice, then the implied conditions on β hold for products invoiced in that currency: there is no change in δ_i^k (no switching of k, no change in the invoice currency share) due to the tariff and the exporters response is fully reflected in the tariff pass-through behavior, i.e. they change their prices based on their desired pass-through.

If, however, the exporter can and/or chooses to change the invoicing decision, then we can see that:

If $k = i$, $\uparrow T \Rightarrow$ switch of k from i to $v \Rightarrow \downarrow \delta_i^i$, and

If $k = v$, $\uparrow T \Rightarrow$ switch of k from v to $i \Rightarrow \uparrow \delta_i^i$

Hypothesis 3*: Assuming a high pass-through exporter chooses to change the currency of invoicing, an increase in tariff will decrease the share of the currency that implies high exchange rate pass-through by that exporter, and vice versa all else being equal.*

In general, the share of invoice currency will be affected in one direction or the other depending on the implications for ERPT for products invoiced in that currency. We can expect that if a change in tariff affects the share of a particular invoicing currency, then it's an indication that exporters prefer or find it more convenient to change invoicing currencies and minimize the response in the change of prices in response to tariffs (β). On the other hand, if exporters do not respond to a tariff change by changing invoice currencies, we can expect to see minimal or no significant changes in the share of invoicing as a result of tariff changes.

2.4 Exchange Rate and Tariff Pass-Through

2.4.1 Overall Pass Pass-Through

Econometric Specification

We now turn to the empirical analyses of the hypotheses. With the following basic panel specification, we can estimate exchange rate pass-through and tariff pass-through into p_g prices by estimating the following:

$$\Delta_\tau p_{gt} = \alpha + \beta \Delta_\tau e_{it} + \gamma \Delta_\tau \ln(1 + T_{gt}) + \theta \Delta_\tau \boldsymbol{Z}_{it} + \epsilon_t \tag{2.11}$$

where:

$\Delta_\tau p_{gt}$ = $\ln P_{gt} - \ln P_{g\tau}$, the cumulative change in import price of good j or g expressed in MWK and as calculated in 2.5

τ = the change between the current month t and the last month the good was imported.

$\ln(1 + T_{gt})$ = cumulative change in the log of the tariff rate

$\Delta_\tau e_{it}$ = the change in the natural log of the bilateral nominal exchange rate of the Malawi Kwacha vis-à-vis exporter i's currency.

ϵ_{st} = is an error term.

$\theta \Delta_\tau Z_{it}$ = is a vector of control variables as follows: cumulative changes in the natural log of exporter's CPI as a proxy for exporter's production costs; a dummy variable representing the period when the Malawian Kwacha was pegged to the U. S. Dollar to account for the structural change of May 2012; an interaction term between the exchange rate and the dollar peg regime; fixed effects for every g product and time fixed effects for every month t. Time fixed effects control for business cycle and unobservable time fluctuations.

ϵ_t = error term.

Results

Estimations from equation 2.11 are presented in Table 2.2 which show that there is on average about 90 percent of exchange rate pass-through to import prices from the EU region. The close to complete pass-through is comparable to results of Colombia found by Casas et al. (2017b). The fixed exchange rate period affected pass-through for imports from the euro area but the coefficient on the interaction term between

U.S. Dollar peg period and changes in the exchange rate is not statistically significant for prospective and non-members, suggesting the EU results are influenced by the eurozone countries' estimates.

Eurozone exporters decrease the before-tariff price less than non-members in response to a tariff increase. Specifically, a 10 percent increase in the tariff rate leads to a 0.4 percent and 1.2 percent decline in prices of goods from the euro area and non-members respectively. The coefficient for prospective members is not statistically significant. These results seem contrary to what the first hypothesis predicts, that higher exchange rate pass-through (eurozone) implies low tariff pass-through (non-members). We do not see this connection yet in Table 2.2.

Table 2.2: Tariff and Exchange Rate Pass-Through

Variable	EU	Eurozone	Prospective	Non-Members
$\Delta_\tau \ln(1+Tariff)$	-0.101***	-0.0379*	0.0437	-0.123***
	(0.0113)	(0.0206)	(0.0815)	(0.0135)
$\Delta_\tau ExchangeRate$	0.882***	0.963***	0.884***	0.825***
	(0.0563)	(0.0832)	(0.254)	(0.0887)
$\Delta_\tau ExporterCPI$	2.402***	2.019*	2.024	2.627***
	(0.528)	(1.039)	(1.777)	(0.692)
USD Peg Period	0.217	-0.141	1.895	0.474**
	(0.199)	(0.396)	(1.990)	(0.238)
USD Peg * $\Delta_\tau ER$	-0.483**	-0.834***	0.392	-0.148
	(0.195)	(0.215)	(1.050)	(0.318)
Constant	0.0532	0.277	0.684	-0.209
	(0.124)	(0.191)	(0.704)	(0.166)
Observations	72518	28955	2349	41214
Within R^2	0.0147	0.0183	0.0700	0.0190
Overall R^2	0.0195	0.0247	0.0773	0.0227
Between R^2	0.0500	0.0517	0.113	0.0591

Note: Robust standard errors are in parenthesis. Asterisk(s) denote(s) the significance level: *** for 1%, ** for 5%, and * for 10%.
Source: Authors' estimation.

However, analyzing across industries in Table 2.3 reveals that the first hypothesis can be observed, as products with highest exchange rate pass-through (wood

and rawhides) have lowest tariff pass-through for both eurozone countries and non-member countries of the euro area. A 10 percent increase in import duty for wood, rawhides imports from eurozone countries leads to a 1.2 percent decline in the prices. On the other hand, ERPT for machinery products is lowest for both sets of countries and the coefficient on the tariff variable is not statistically significant, meaning full tariff pass-through which is the highest possible. Any change in import duty for these products will be fully bourne by the importers. A test of statistical difference between the exchange are and tariff pass-through coefficients showed that these differences in the coefficients are statistically significant.

Table 2.3: ERPT and TPT by Product and Exporter: Baseline

	Eurozone		Non-members	
Variable	Machinery	Wood; rawhides	Chemicals	Wood; rawhides
$\Delta_\tau ExchangeRate$	0.857***	1.331***	0.493**	1.109***
	(5.66)	(3.95)	(1.99)	(3.03)
$\Delta_\tau \ln(1+Tariff)$	-0.00418	-0.128**	-0.0167	-0.163***
	(-0.11)	(-1.99)	(-0.27)	(-3.37)
$\Delta_\tau ExporterCPI$	5.127**	-2.588	4.840**	-0.341
	(2.53)	(-0.70)	(2.42)	(-0.13)
Constant	0.566	-0.610	0.245	1.274
	(0.94)	(-0.96)	(0.44)	(1.44)
Observations	9337	1315	3239	2621
Within R^2	0.0288	0.0886	0.0482	0.0684
Overall R^2	0.0342	0.108	0.0556	0.0673
Between R^2	0.0564	0.271	0.133	0.0250

Note: Prospective members are excluded due to very low number of observations. Robust standard errors are in parenthesis. Asterisk(s) denote(s) the significance level: *** for 1%, ** for 5%, and * for 10%.
Source: Authors' estimation.

At this point, we have the expected negative sign on the duty rate variable (Hayakawa & Ito, 2015). As pass-through is dependent on the currency of invoicing, further estimations are necessary especially in order to empirically test the second hypothesis. The baseline results do, however, reveal what are from the author's

knowledge, the first such estimates for overall exchange rate and tariff pass-through estimates for EU exports to a developing African country.

2.4.2 The Role of the Invoicing Currencies in ERPT and TPT

Econometric Specification

$$\Delta_\tau p_{gt} = \alpha + \sum_k (\Omega_k D_k) + \phi_1(\Pi_k(1 - D_k)\Delta_\tau e_{it}) + \sum_k (\beta_k(\Delta_\tau e_{it} * D_k)) + \phi_2(\Pi_k(1-D_k)\Delta_\tau \ln(1+T_{gt}) + \sum\nolimits_k (\gamma_k(\Delta_\tau \ln(1+T_{gt}) * D_k)) + \theta\Delta_\tau \boldsymbol{Z}_{it} + \epsilon_t \quad (2.12)$$

where:

k = is the currency to be analysed

D_k = takes the value 1 if a product is invoiced in k and 0 otherwise

$\phi_1 \text{and} \phi_2$ = ERPT and TPT of products not invoiced in k

$\beta_k \text{and} \gamma_k$ = directly pick up estimates for goods invoiced in k

In this case, D_k represents D_{USD} , D_{EUR} , D_{GBP} : dummy variables for observations of transactions invoiced in the U.S. Dollar, the euro and the pound respectively.

Results

The results of equation 2.12 are presented in Table 2.4 below to test the second hypothesis. The magnitude of pass-through of both exchange rates and tariffs is mainly attributable to the invoice currency. Ideally, we should see imports invoiced in the euro have the least response if any, to changes in the tariff based on the results of low pass-through for euro invoiced products. We see this for the results across both exporters and products in the estimates: euro invoiced products have in all but one case, no response to tariff changes with the coefficients not statistically different from

zero. On the other hand, the prices of pound invoiced products, whose exchange rate pass-through is highest, decrease the most as a result of a duty rate increase (low tariff pass-through).

In all cases, both exchange rate and tariff pass-through are highest for pound invoiced products and lowest in euro invoiced products. We can thus conclude that the second hypothesis, for the most part, holds: products with the highest (lowest) exchange rate pass-through in a currency of invoicing from the same exporter, have the lowest (highest) tariff pass-through in that currency. By extension then, the first hypothesis holds, when estimations are done in sub samples based on the currency of invoice. Even when tariffs are fully borne by the importer, considering exchange rates change far more frequently than tariffs, importers pay a lower price when imports are invoiced in the euro. An increase in the share of the euro, therefore, may further the internationalization of the currency while also benefiting Malawian importers, relative to the U.S Dollar or the Pound.

As a robustness check, we estimate equation equation 2.12 with imports grouped as being from the eurozone and non-eurozone and invoicing currencies being either euro and non-euro invoiced. The results are in Table B.5 in the Appendix B. For the EU as a region, tariff changes least affect prices of products invoiced in the euro (4.3 percent) vis-à-vis non-euro currencies (11.4 percent) and exchange rate pass-through is still lower for euro invoiced products by 9.3 percentage points. However, for the euro area, although exchange rate pass-through is lower for the euro, an increase in tariff decreases the prices of euro invoiced products by about 5 percent, but there is no response to a tariff change for non-euro invoiced products. For non-euro area countries, the coefficient on both the exchange rate and tariffs is not statistically significant thus no comparison can be made with non-euro invoiced goods.

There is a significant difference in the sample size of products invoiced in the euro and non-euro between eurozone and non-eurozone countries. For the euro

Table 2.4: ERPT and TPT and Invoicing Currency

	EUR		USD		GBP	
	ERPT	TPT	ERPT	TPT	ERPT	TPT
	Across Exporters, All Products					
EU	0.914***	-0.0383	1.111***	-0.0466*	1.168***	-0.137***
	(0.0706)	(0.0238)	(0.0753)	(0.0251)	(0.0800)	(0.0154)
Eurozone	0.961***	-0.0479*	1.203***	0.00334	1.278***	-0.138
	(0.0816)	(0.0257)	(0.111)	(0.0417)	(0.345)	(0.128)
Prospective	0.443	0.219	0.902***	0.0540	0.256	0.0276
	(0.441)	(0.285)	(0.321)	(0.0853)	(0.971)	(0.328)
Non-Members	0.755***	-0.00302	1.061***	-0.0800**	1.164***	-0.133***
	(0.175)	(0.0586)	(0.112)	(0.0320)	(0.0861)	(0.0154)
	Across Products, All EU exporters					
Machinery	0.938***	0.0413	1.068***	-0.0926*	1.201***	-0.128***
	(0.119)	(0.0454)	(0.134)	(0.0502)	(0.154)	(0.0323)
Chemicals	0.839***	-0.00952	0.936***	0.0211	0.987***	-0.00603
	(0.183)	(0.0834)	(0.191)	(0.0978)	(0.259)	(0.0778)
Transportation	0.921***	-0.0921	1.020***	-0.113***	1.316***	-0.185***
	(0.211)	(0.0820)	(0.184)	(0.0365)	(0.217)	(0.0408)
Textiles	0.293	-0.109	0.559**	0.0506	1.163***	-0.153***
	(0.255)	(0.0763)	(0.246)	(0.102)	(0.208)	(0.0374)

Note: Robust standard errors are in parenthesis. Asterisk(s) denote(s) the significance level: *** for 1%, ** for 5%, and * for 10%.
Source: Authors' estimation.

area, non-euro currencies account for nearly 77 percent of exports to Malawi, hence their effect is somewhat drowned if analyzed as simply "non-euro". Similarly, the pass-through behavior of prospective members of the eurozone and the countries that have opted out are different, as Table 2.4 shows that the pass-through coefficient for countries that have opted out is in fact statistically significant. Again, the sample size plays a role here. All in all, this emphasizes that separating both exporters and invoice currencies, allows us to make more meaningful analysis and conclusions on the interplay of pass-through behavior of exchange rates and tariffs. These results from the additional estimates therefore justify the sample selection.

2.5 Invoice Currency Choice

2.5.1 Currency Invoicing in EU exports to Malawi

The second main objective of this chapter, having analyzed exchange rate and tariff pass-through in products invoiced in different major currencies by EU exporters, is to then evaluate some factors that lead to the choice of those currencies, with specific focus on tariffs and the euro. In exploring the factors that affect the use of the euro in producer currency pricing, we first estimate determinants of δ_{it}^{k} when $k = EUR$ and compare to a sub-sample where $k = USD$ for EU exports to Malawi. For eurozone countries, $k = EUR$ gives insight into producer currency pricing while for the rest of EU exporters, these are the determinants for the use of the euro as a vehicle currency when trading with Malawi.

The following estimation strategy is then set up:

$$\delta_{gt}^{k} = \alpha + \beta\Delta_{\tau}e_{euro,t} + \upsilon\Delta_{\tau}\ln\left(1+T_{gt}\right) + \Omega_{0}ms_{git} + \nu_{0}l_{EU} + \nu_{I}l_{eurozone} + \theta\Delta_{\tau}\boldsymbol{Y}_{it} + \epsilon_{t} \tag{2.13}$$

where:

$e_{euro,t}$ = is the MWK/EUR exchange rate

ms_{git} = is country i's share in imports of product g in a month, calculated as $\frac{\sum l_{HS,it}}{\sum l_{HS,t}}$

l_{EU},$l_{eurozone}$ = time in the EU and eurozone respectively, measured by the number of months

$\theta\Delta_{\tau}Y_{it}$ = a vector of control variables: cumulative changes in natural log of euro area CPI; a dummy variable representing the period of the Kwacha peg to the U. S. Dollar; fixed effects for every g product and time fixed effects for every month t

Based on hypothesis 3, an increase in the import duty should decrease the share of the euro, since euro invoiced products have the lowest exchange rate pass-through coefficients. If exporters do not switch invoicing currencies however, we expect the coefficient on the tariff variable to not be statistically different from zero.

The Share of the euro

The estimations from equation 2.13 are displayed in Table 2.5 The column with the eurozone results allows us to discuss on euro usage in producer currency pricing. Our key variable of interest is the import duty. The coefficient is the expected sign and statistically significant: an increase of 10 percent in the import duty will lead to a 3 percent decline in the share of euro invoicing for any product g . This suggests that euro area countries prefer to switch from the euro to another currency when tariffs increase. A depreciation of the Kwacha against the euro also leads to a drop in the euro share. While the result on the length of time in the EU is ambiguous, the length of time in the eurozone positively affects the share of the euro. We may thus conclude that being a eurozone member matters more than being an EU member for euro invoicing. The result on the market share variable is positive as expected.

An extension of the analysis of the euro in producer currency pricing was done without the variable of interest, tariff, to serve as a robustness test to model specification. The results are displayed in Table B.6 of Appendix B and show an all-round consistency for all the variables in terms of signs and significance levels. The U.S. Dollar exchange rate was used instead on the euro, and the results suggest that the effect on the share of the euro is the same. This speaks to the co-movement of the currencies and suggests exporters invoice currency choice has more to do with the importing country's currency strength against major currencies.

The third and fourth columns of Table 2.5 reveal euro usage as a vehicle currency by prospective and non-members of the euro area. In these cases, an increase

Table 2.5: Euro Share in EU exports to Malawi

Variable	EU	Eurozone	Prospective	Non-members
Δ_τ Euro Exchange Rate	-0.0214***	-0.0314***	0.0630**	-0.0170***
	(0.00467)	(0.00856)	(0.0271)	(0.00295)
Δ_τ Eurozone CPI	-0.0248	-0.146	-0.309	0.270***
	(0.0595)	(0.107)	(0.378)	(0.0370)
$\Delta_\tau ln(1 + Duty)$	-0.000565	-0.00308*	0.00320	0.000350
	(0.000504)	(0.00168)	(0.00896)	(0.000287)
Δ_τMarket Share	-0.00483*	0.0169***	-0.00167	0.000436
	(0.00266)	(0.00612)	(0.0205)	(0.00167)
Time in EU	0.000470***	-0.000250***	0.0000948	-0.000358***
	(0.0000179)	(0.0000271)	(0.000122)	(0.0000318)
Time in the Eurozone		0.00164***		
		(0.000109)		
USD Peg Period	0.0167***	0.0587***	0.0549***	-0.0193***
	(0.00239)	(0.00671)	(0.0126)	(0.00159)
Constant	0.0148	0.277***	0.102***	0.234***
	(0.0106)	(0.0228)	(0.0247)	(0.0161)
Observations	78208	34121	2390	41631
Within R^2	0.000976	0.00558	0.00600	0.00491
Overall R^2	0.125	0.0162	0.0415	0.00677
Between R^2	0.0670	0.0454	0.0164	0.00951

Note: Robust standard errors are in parenthesis. Asterisk(s) denote(s) the significance level: *** for 1%, ** for 5%, and * for 10%.
Source: Authors' estimation.

in the duty rate does not significantly affect the share of euro invoicing in the exports from these set of EU countries. This is consistent with results from Table 2.4, where the prices of euro invoiced products were not responsive to a tariff change (no tariff pass-through). This suggests that prospective and non-members opt to maintain the euro (or they are unable to switch from the euro) when there is an increase in import duty rates.

The Share of the U.S. Dollar

As revealed in the descriptive statistics, the U.S. Dollar has a majority share across all the imports from the EU in the sample. Furthermore, exchange rate pass-through

in U.S. Dollar invoiced products is higher than euro invoiced products, while the price decreases more in response to a tariff increase compared to euro invoiced products. Thus, we can expect that a tariff increase will also increase the share of U.S. Dollar invoicing. Table 2.6 shows the results. The share of U.S. Dollar invoicing (dependent variable) increases among eurozone exports, as import duty increases. Again, this is consistent with results from the previous section, and we may loosely conclude that euro area countries switch from invoicing in the euro to the U.S. Dollar when duty rates are raised.

Table 2.6: U.S. Dollar Share in EU exports

Variable	EU	Eurozone	Prospective	Non-Members
Δ_τ Euro Exchange Rate	0.0237***	0.0493***	-0.157***	-0.00221
	(0.00543)	(0.00902)	(0.0381)	(0.00584)
Δ_τ Eurozone CPI	-0.103	0.0445	0.00518	-0.262***
	(0.0670)	(0.114)	(0.487)	(0.0696)
$\Delta_\tau ln(1 + Duty)$	0.00115*	0.00467***	0.00620	-0.000373
	(0.000672)	(0.00174)	(0.0117)	(0.000651)
Market Share	0.00119	-0.00172	0.0327	0.00157
	(0.00314)	(0.00633)	(0.0305)	(0.00302)
Time in EU	-0.0000768***	0.000250***	-0.000434**	0.00110***
	(0.0000174)	(0.0000266)	(0.000196)	(0.0000508)
Time in the Eurozone		-0.00234***		
		(0.000109)		
USD Peg Period	0.0106***	-0.0991***	-0.00487	0.0732***
	(0.00270)	(0.00716)	(0.0217)	(0.00276)
Constant	0.564***	0.775***	0.726***	-0.00295
	(0.0102)	(0.0228)	(0.0387)	(0.0251)
Observations	78208	34121	2390	41631
Within R^2	0.000758	0.0158	0.0112	0.0154
Overall R^2	0.00509	0.0264	0.0420	0.0120
Between R^2	0.00305	0.0349	0.0519	0.00429

Note: Robust standard errors are in parenthesis. Asterisk(s) denote(s) the significance level: *** for 1%, ** for 5%, and * for 10%.
Source: Authors' estimation.

On the other hand, since prospective and non-members are assumed not to switch invoicing currencies as tariffs change from the previous results, it is there-

fore natural that the coefficient on the import duty for both country groups are not statistically significant here. The difference between the effect of the dollar share, though being a vehicle currency to both eurozone members and non-members may range from existing agreements with trading firms and product types. The result for the EU as a whole is thus mainly stemming from the euro area countries. Being an older member of the EU and the eurozone reduces the share of U.S. Dollar invoiced products from the EU and the euro area respectively, although the magnitudes are small. This result however is consistent with Kamps (2006). A U.S. Dollar peg exchange rate regime increases the share of U.S. Dollar invoicing for the EU, but across exporters, this result shows up in estimates for non-members only. We can conclude that the third hypothesis is in a large part observed in these results.

2.5.2 The Euro as a Vehicle Currency in non-EU exports

Econometric specification

We may finally explore the internationalization of the euro by estimating its use in trade invoicing by non-EU countries in exporting to Malawi.

Using a logit estimation on the panel data, like that of Ligtharty and Werner (2012) and Devereux et al. (2017), we estimate the probability for the euro being used by other countries. The dependent variable is dichotomous variable which equals 1 if a product is invoiced in the euro by a non-EU country exporting to Malawi and 0 if invoiced in any other currency by such a country. The estimated non-linear model is as follows:

$$Pr(EUR_{jt}) = \frac{exp(v_{jt})}{[1 + exp(v_{jt})]}$$

v_{jt} takes two forms which are estimated. The first:

$$\begin{aligned} v_{jt} = \alpha + \beta_0 \Delta_{\tau e_{euro,t}} + \beta_1 ms_{jt} + \beta_2 D_{highincome} + \beta_3 D_{lowincome} \\ + \beta_4 EUsize + \beta_5 Eurozonesize + \theta \boldsymbol{Y_{it}} + \epsilon_{it} \end{aligned} \tag{2.14}$$

In another case the estimated equation is as follows:

$$v_{jt} = \alpha + \beta_0 \Delta_{\tau e_{euro,t}} + \beta_1 ms_{jt} + \beta_2 D_{europe} + \theta \boldsymbol{Y_{it}} + \epsilon_{it}$$

where:

$EUsize$	= the size of the EU by number of countries
$Eurozonesize$	= the size of the euro area by number of countries
D_{europe}	= dummy for European countries outside the EU Control variables: cum change in euro area
D_{income}	= Dummy for the income level of the exporting non-EU country from which a Malawian import originated.

Product j is defined simply as product g in the Data section without the tariff, i.e. from the set $L = (HS, exp, cur, u)$. Tariff data spans from 2007. As we do not use import duty in this part of the analysis, we are able to have the data go further back to 2004.

We then use predictive margins to forecast the increase in that probability if (1) all European countries joined the EU and (2) all European countries joined the euro area. Studies show that the emergence of another vehicle currency in international trade besides the U.S. Dollar will bring more stability in the global economy. With the backlash against globalization in some parts of the world, it is worth seeing if increased trade and monetary integration in Europe will further this cause.

Results

The results from equations in 2.14 are presented in Table 2.7. First, a depreciation against the euro (and against the exporters' currencies in alternative models), an increase in the average CPI of euro area countries, being a European country and the size of both the EU and the euro area, all increase the probability of the euro being used as a vehicle currency. On the other hand, being a high or low-income country does not make much difference in euro invoicing and an increase in an exporter market share reduces the choice of the euro, as we may expect a country to use its own currency in such a case.

Table 2.7: Euro as a Vehicle Currency (Logit Model)

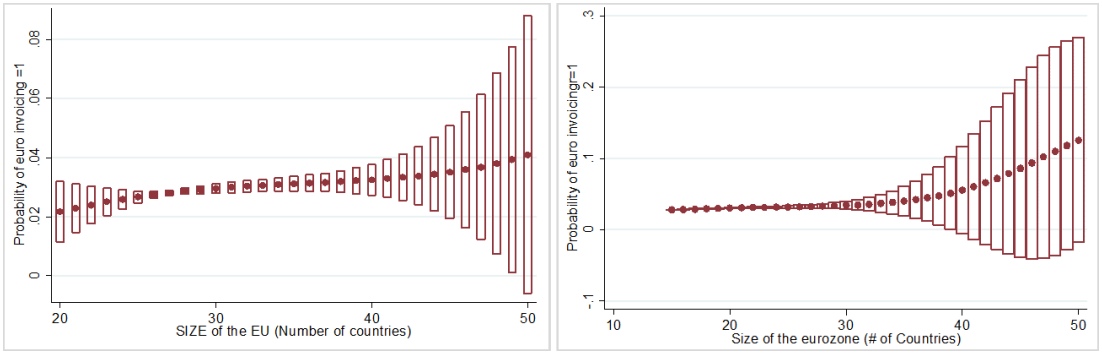
Variable	(I)	(II)	(III)
Δ_τ Euro Exchange Rate	0.735***	0.736***	0.578*
	(0.258)	(0.261)	(0.309)
Δ_τ Eurozone CPI	4.505*	4.517*	5.957*
	(2.591)	(2.646)	(3.164)
Market Share	-0.445***	-0.493***	-0.520***
	(0.137)	(0.144)	(0.162)
Size of the EU	0.225***	0.233***	0.111
	(0.0645)	(0.0640)	(0.0704)
Size of the eurozone	0.195*	0.191*	0.105
	(0.118)	(0.115)	(0.108)
Low Income		-7.758***	
		(0.309)	
High Income		-1.103***	
		(0.144)	
R.O Europe			15.56***
			(0.746)
USD Peg Period	0.513***	0.486***	0.199
	(0.182)	(0.183)	(0.223)
Observations	702049	702049	702049

Note: The dependent variable, EUR_{jit} =1 if a good is priced in the euro and = o otherwise. Sample from 2004-2016. Robust standard errors are in parenthesis. Asterisk(s) denote(s) the significance level: *** for 1%, ** for 5%, and * for 10%. Source: Authors' estimation.

In an extended panel model, we include tariffs, the share of the euro as a dependent variable as in equation 2.13, and additional time lags on the variables. The results (Table B.7 in Appendix B) are consistent with the following diversions: the sign on the change in the MWK/euro exchange rate from the last two times a product was imported, is negative; being a European country doesn't affect the share of euro invoicing, and the size of the EU has a negative sign. Being a high-income country increases the euro invoicing share as does, interestingly tariffs. This suggests that non-EU exporters switch to using the euro following a tariff increase, as opposed to euro area countries. The sign on the size of the euro area is positive however, suggesting as the monetary union grows, so will euro invoicing by third party countries.

Predictive margins in Figure 2.5 show the change in the probability of euro invoicing if all EU countries joined the euro area and if all European countries joined the EU. This probability would increase from 3.0 to 3.3 percent and from 2.8 to 4.1 percent respectively. Although these predictions are not drastic, they do indicate the potential of the euro increasing its role in global trade, assuming the same exercise is carried out for the EU's other trading partners.

Figure 2.5: Import Prices, Exchange Rates and Import Duty 2004-2016



Note: LHS if all European countries joined the EU. RHS if all European countries joined the eurozone.
Source: Authors' estimation.

2.6 Concluding Remarks

Using highly disaggregated customs level data, this chapter provides, from my knowledge, the first empirical evidence on the role of invoicing currencies in both exchange rate and tariff pass-through to import prices; and second, the determinants of euro usage in trade invoicing when EU exporters trade with a developing country in Africa. The main takeaways are: the U.S. Dollar is the dominant invoice currency across all products, although exporters in the euro area use the euro more relative to prospective and non-members. Exchange rate pass-through is highest in the pound sterling and lowest in euro invoiced products. Second, an increase in import duty lowers the tariff-exclusive import price, with the least (if any) response in euro invoiced products. Across exporters and sectors, exporters with the highest (lowest) exchange rate pass-through in a currency of invoicing, have the lowest (highest) tariff pass-through for the same product.

Third, in the use of the euro in producer currency pricing, an increase in the import duty and a depreciation of the Malawi Kwacha against the euro result in a decline in the share of euro invoicing, while an increase in market share and being in the euro area longer leads to an increase. Euro area exporters opt for to switch invoice currencies while prospective and non-members prefer or seem to not have much a choice but to maintain euro invoicing when there is a change in tariffs. Fourth, as a vehicle currency in non-EU exports to Malawi, the size of both the EU and the euro area matter in increasing the probability of euro invoicing and non-EU European countries are more likely to invoice in the euro than all other exporters from the rest of the world. The results are robust across various specifications and extensions.

The empirical findings have implications of exchange rate shock and trade policy transmission on prices of imports from the EU in the context of a developing country importer. A higher share of the euro seems beneficial to importers com-

pared to other major invoicing currencies in the event of exchange rate shocks, even when tariffs are fully borne by the importer. Considering that exchange rates change far more frequently than tariffs, a more internationalized euro may be preferred by importers. The euro will continue to increase in its role in trade invoicing as both the EU and the eurozone also grow. There is, however, room for increased usage of the euro considering that the EU is one of Malawi's main trading partners and the exporter has more bargaining power when it comes to settling the invoice currency.

Chapter 3

Invoice Currency Choice in Malawi's Imports from Asia Any Evidence of Renminbi Internationalization?

3.1 Introduction

In recent years, Africa has become one of China's strategic economic partners. Trade is a major focus of this relationship as the total share of Sub-Saharan Africa (SSA) imports from China increased from just 2.0 percent in 1995 to as high as 17.5 percent 2016.[1] As the China-Africa trade has been growing over the last few decades, China's trade policies have moved towards a more accommodative stance with Africa. In 2005, China agreed to exempt from tariffs of 190 commodities from 25 least developed African countries (Olu, 2006). The first "China Africa Policy" was released in 2006, followed by the second one in 2015. China's exports to Sub-Saharan Africa

[1]WITS (World Integrated Trade Solution) database

as a share of world exports, doubled between 2000 and 2016 whilst its exports to Malawi increased from 6.9 million U.S dollars to 228.2 million U.S dollars in the same time period. This increase is seen from both ends of the trade transaction. On the imports side, China's share among imports in SSA increased from 7.6 percent to 16.3 percent between 2005 and 2015, with Malawian imports from China increasing from 2.9 percent to 13.1 percent in the same time period. Clearly, these changes have been even more pronounced in Malawi, compared to the regional averages of SSA.

Such an increase in African trade with China calls for a discussion about the possibility of a growing use of Chinese renminbi (henceforth, RMB) as a trade invoicing currency. There have been a large number of studies on RMB internationalization (e.g., Eichengreen and Kawai (2014); L. Zhang and Kunyu (2014); Xu and Fan (2015) and Henry (2007)). These studies show that RMB-invoiced trade increased in the 2010s, whereas it has declined considerably since 2015 likely due to China's large devaluation in August 2015.[2] The destination (source) country breakdown data as well as commodity breakdown data on RMB-invoiced trade has not been presented in previous studies. A few exceptions are T. Ito, Koibuchi, Sato, and Shimizu (2018) that conducted large-scale questionnaire survey with Japanese overseas subsidiaries and presented information on to what extent Japanese subsidiaries operating in China and other Asian countries used the RMB for trade invoicing. It was revealed that the RMB is used only in trade of Japanese subsidiaries operating in China; otherwise, the RMB is rarely used by Japanese subsidiaries.

Although RMB internationalization has not progressed evidently in recent years, further use of the RMB may be possible in China's trade with developing countries. China started an initiative for the RMB internationalization in 2008 with the purpose of facilitating the use of RMB in China's trade transactions. In addition to the pilot scheme that permitted the RMB-denominated trade settlements

[2]See Box Figure 9 in Yoichi and Hongbo Wang (2018).

with Hong Kong, Macao, mainland cities, and ASEAN countries, China initiated a RMB-denominated bilateral currency swap agreement with various countries mainly including Asia and other emerging countries, which helps to provide RMB abroad to be used for trade settlement.[3]

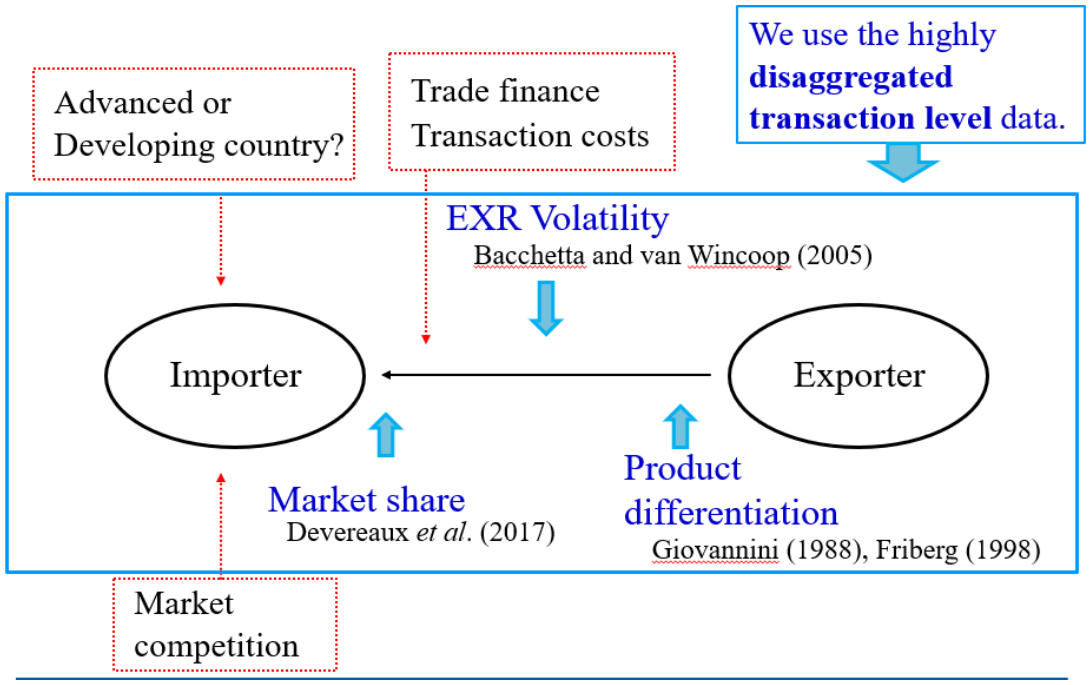
The main purpose of this chapter is to empirically investigate the choice of invoicing currency in Malawi's imports from 17 Asian countries, with a particular emphasis on imports from China and Japan. As discussed earlier, African countries are strategically important economic partners for China and Malawi is one of the smallest African countries whose trade relations with China has been strengthening. We collected the transaction-level data of Malawi imports from 2004 to 2016 at Harmonized System (HS) 8-digit level. We focus on Malawi's imports from Asia and reveal which currencies are used in its imports by source country and by industry. To our knowledge, such detailed information on invoicing currency choice have never been published nor disclosed in the literature.

By showing the data on invoicing currency choice, we reveal the extent to which the RMB is internationalized through China's exports to Malawi (i.e., Malawi's imports from China), whether the progress of the RMB internationalization is comparable to that of the Japanese yen and whether other Asian countries use the RMB in exporting to Malawi.[4] We also estimate a panel logit model to empirically analyze possible determinants of invoicing currency in imports from China, Japan, and the other Asian countries in the sample. From the literature, this relationship surrounds such factors as depicted in Figure 3.1 below: development of importing country, trade finance and transaction costs, market competition and product characteristics. We explore these possible determinants of invoice currency choice in the paper and the results are discussed below.

[3]See, for instance, Eichengreen and Kawai (2014) and H. Ito and Kawai (2016) for a brief history of the RMB internationalization.

[4]There have been a large number of studies on the yen internationalization. See, for instance, Fukuda and Ji (1994), Kawai (1996), and T. Ito and Sato (2007).

Figure 3.1: Determinants of Invoice Currency Choice



Source: Various literature.

From the processing of transaction-level data, we first reveal that the RMB is rarely used in Malawi's imports from China. In contrast, the share of yen-invoiced transactions in the imports from Japan is more than 20 percent in terms of import amounts and more than 30 percent in terms of import shipments. The evidence for the other Asian countries in the sample is mixed, where countries such as Singapore and Hong Kong have larger shares of exporter's currency used in their merchandise trade in some years, but not dominantly across the sample period, and certainly not as much as Japanese exporters. This evidence suggests that the internationalization of the RMB lags far behind the yen internationalization process. We further reveal that the U.S. dollar is dominantly used in terms of import amounts in Malawi's imports from China and other Asian countries. However, if calculated in terms of shipments, the share of the South African Rand becomes quite large, 24 percent in imports from China and 18 percent in imports from other Asian countries. The South African

Rand plays the second largest role of vehicle currency invoicing in Malawi's imports from Asia.

We reveal from logit estimations that the degree of product differentiation and the market share of imported products have positive influences on exporter's currency (yen) invoicing in the imports from Japan. The former however, negatively affects local currency pricing (LCP). The degree of bilateral nominal exchange rate volatility however, has a negative effect on exporter's currency invoicing in imports from China, Japan, and other Asian countries. On the other hand, vehicle currency invoicing is generally chosen in imports from China and other Asian countries. Our panel logit estimation shows that the larger the exchange rate volatility, the more likely vehicle currencies are to be chosen. Thus, the exchange rate stability plays an important role in facilitating exporter's currency invoicing. Finally, when choosing a vehicle currency, we find that the transaction value of the product plays a key role.

The rest of this chapter is organized as follows: Section 3.2 describes the data and shows detailed information on invoicing currency choice in imports from the sample Asian countries. Section 3.3 presents the empirical method and explanatory variables, and Section 3.4 discusses the empirical results. Section 3.5 concludes.

3.2 Data and Descriptive Analysis

3.2.1 Data overview and Source

This chapter uses the monthly series of customs-level transaction data for Malawi's imports from January 2004 to December 2016 obtained from the Malawi National Statistical (NSO). The NSO data contains information on the total value and the number of volume (net kilograms) of each import transaction at the 8-digit HS product classification. Information on exporting (source) country is available, but exporting

firms are not identified. More importantly, we can obtain the information on the choice of invoicing currency for each import transaction.

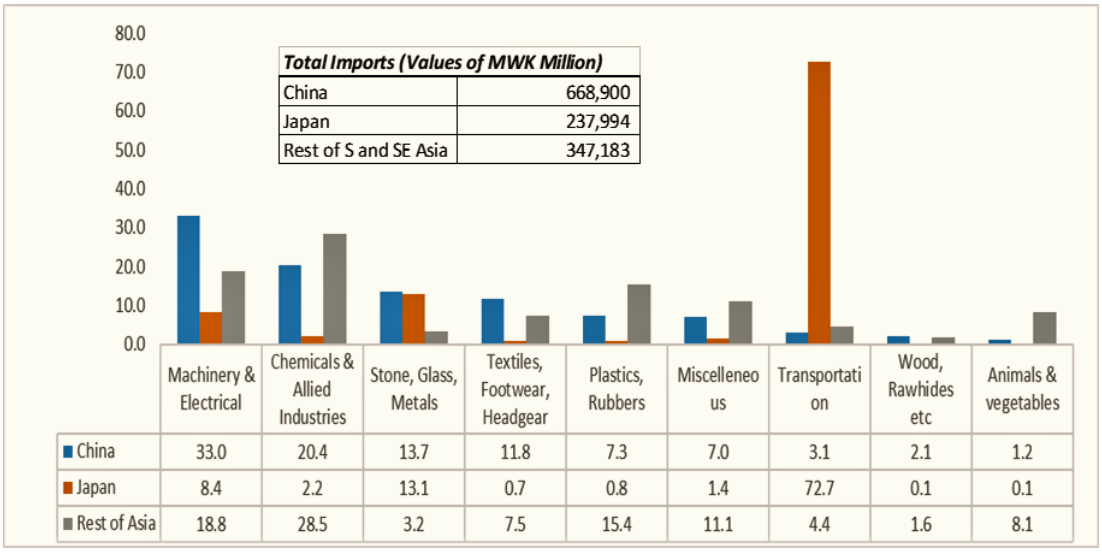
The raw data includes a total of 2.2 million import transactions for the whole sample period from January 2004 to December 2016. After assembling all import transactions and collecting the data on imports from the 17 Asian countries we will have in the sample, the number of observations is reduced to 193,225. The sample countries and their number of observations are reported in Table 3.1 and discussed in further details below.

3.2.2 Product Share by Source Country

By dividing the 17 Asian countries into three, namely, China, Japan, and the rest of Asia (ROA), Figure 3.2 presents Malawi's import amounts in MWK by these three groups and by HS-2 industry classification. First, in terms of the total amount of imports, China is the largest import partner for Malawi, followed by the ROA. Second, in imports from China, Machinery and Electrical products account for 33 percent, followed by Chemicals and Allied Industries (20.4 percent). Similarly, in imports from ROA, Chemicals and Allied Industries account for 28.5 percent, followed by Machinery and Electrical products (18.8 percent).

For Japan, 72.7 percent of import values are accounted for by Transportation products. This is no surprise as Japan is among the largest sources of automobile imports in Malawi, making up over 50 percent of passenger vehicles and nearly 64 percent of public vehicle imports between May 2012 and December 2016. One reason for this is that most of these are used vehicles thus quite affordable for consumers in a low-income country and Japan drives on the left just like Malawi, making it a more "go-to" source of imports compared to say, Germany. Thus China has the highest value share (in-sample).

Figure 3.2: Industry Share in Malawi's Imports from Asia (%) 2004-2016



Source: Authors' calculation from the Malawi National Statistical Office (NSO) data).

3.2.3 Share of Invoicing Currency

Table 3.1 shows the full list of the exporting countries in the sample, the number of observations for each country and the share in shipment counts for the observations of transactions invoiced based on vehicle currency pricing (VCP), producer currency pricing (PCP) or LCP. It should be noted that these are not the total shipments from these countries, but the number of observations after assembling the data (more on this is Section 3.3). In agreement with Figure 3.2, we observe that China still has a larger share even in terms of count of imports, with over 120 thousand observations. This is followed by Japan as a far second with about 25 thousand observations, contrary to Figure 3.2 where ROA has the second largest share in value. This suggests Japan although has higher transactions/observations, may have lower value transactions relative to the 15 Asians countries in the ROA group.

We observe that Japan has the largest share of producer currency pricing, nearly 45 percent of all products (by count) during the U.S. dollar peg period in Malawi. This can be expected since among the sample, Japan is an advanced country

and is more likely to export more differentiated products. This share drops dramatically by over half, in the period when the Kwacha was allowed to float, in which case imports from Japan were mostly invoiced in a vehicle currency. This decline is also observed for Hongkong, Singapore and Thailand, the only other countries with considerably higher amounts of PCP than the rest of the countries in the sample.

Table 3.1: List of Asian Countries and % of Invoicing by Shipments

	VCP	PCP	LCP	VCP	PCP	LCP	
Exporter	Fixed (Jan '04- April '12)			Floating (May'12- Dec '16)			Obs
Bangladesh	100.0	0.0	0.0	100.0	0.0	0.0	209
Brunei	100.0	0.0	0.0	100.0	0.0	0.0	84
China	96.8	1.6	1.6	98.9	1.0	0.1	128,612
Hong Kong	85.2	11.2	3.6	95.2	4.8	0.0	11,627
Indonesia	95.7	0.0	4.3	100.0	0.0	0.0	2,442
Japan	53.9	44.9	1.2	81.8	17.3	0.9	25,171
Cambodia	100.0	0.0	0.0	100.0	0.0	0.0	75
Korea, (South)	99.7	0.2	0.1	99.8	0.2	0.0	6,261
Myanmar	0.0	0.0	100.0	100.0	0.0	0.0	29
Macau	100.0	0.0	0.0	100.0	0.0	0.0	10
Malaysia	99.2	0.3	0.5	99.7	0.2	0.1	3,420
Philippines	98.9	0.0	1.1	100.0	0.0	0.0	494
Singapore	94.6	5.2	0.2	98.2	1.7	0.1	2,050
Thailand	85.1	10.3	4.5	96.5	3.5	0.0	5,763
Taiwan	98.8	1.1	0.2	99.6	0.3	0.1	6,329
Vietnam	100.0	0.0	0.0	100.0	0.0	0.0	648

Source: Authors' calculation from the Malawi National Statistical Office (NSO) data).

Table 3.1 further reveals that the share in the currencies used in invoicing products from China in terms of shipments did not change much, with the exception of local currency pricing. Malawi Kwacha invoiced products in the period prior to May 2012 accounted for 1.6 percent (992 observations) and this reduced to a mere 0.1 percent (89 observations) after adopting a floating exchange rate regime in Malawi. This is likely due to the perception by market players that the exchange rate is far less likely to change in the fixed exchange rate regime. This certainty vanishes once

the exchange rate is market determined in the floating regime. The PCP and VCP shares were 1.6 percent and 96.8 percent for the fixed regime and 1.0 percent and 98.9 percent for floating regime respectively.

Interestingly, although the value shares are negligible as further discussed below, the use of local currency pricing is higher than producer currency pricing in the fixed exchange rate regime for imports from Indonesia, Myanmar, Malaysia and the Philippines. These shares all drop in the floating exchange rate regime period. This may make sense since during the fixed exchange rate regime, the artificial rate gives exporters more certainty of the amounts they will receive, since they have a known rate at which the Kwacha will trade for, unlike in the floating regime where market forces decide.

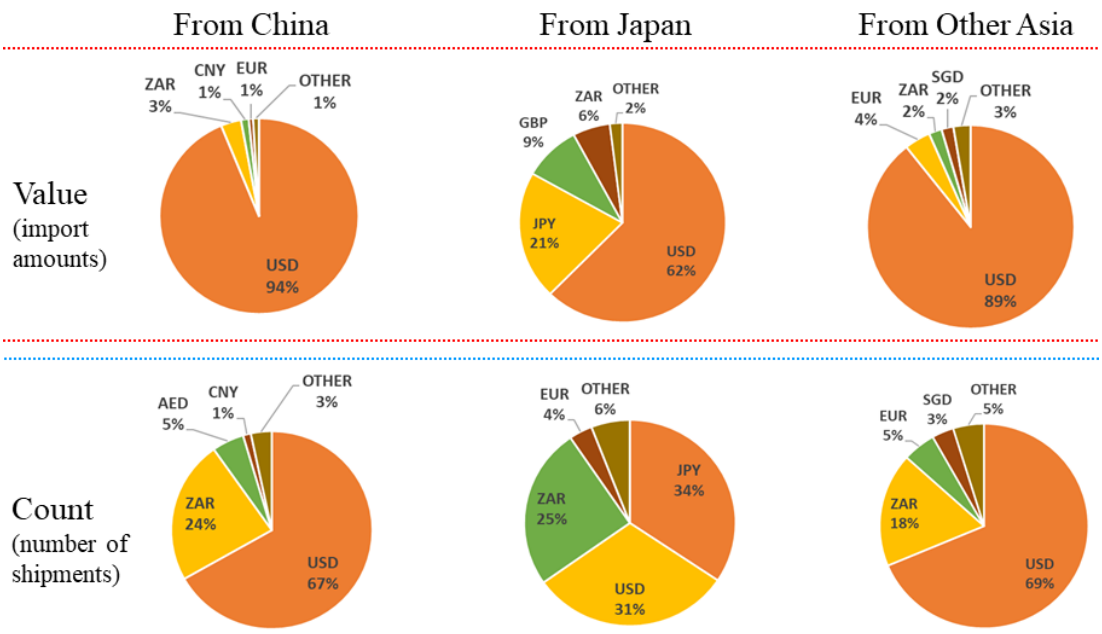
Figure 3.3 shows the share of invoicing by individual currency, in Malawi's imports from China, Japan, and ROA. The share is calculated based on all HS8-digit import data during the period from 2004 to 2016, where 34 currencies were used amongst all the countries in the sample.

First, in imports from China, the U.S. Dollar accounts for 94 percent in terms of import amounts, while the share of the U.S. dollar declines to 67 percent when shipments are considered, followed by the South African Rand (24 percent). This implies that the number of Rand-invoiced transactions is surprisingly large, whereas such transactions are in practice relatively smaller in terms of import amounts. As seen in Table 3.1, in the imports from China, VCP is dominantly used even in terms of shipments, and Figure 3.3 shows this VCP is mainly the U.S. dollar and the rand.

Second, in Malawi's imports from Japan, 34 percent are invoiced in the yen in terms of shipments, while the share of the yen declines to 21 percent in terms of import value amounts. Thus, PCP accounts for a relatively larger share in Malawi's imports from Japan, especially for higher value transactions. It is interesting to note that VCP, not only the U.S. dollar but also the South African Rand, accounts for

the largest share in the imports from Japan. In particular, the Rand accounts for 25 percent of the import shipments whilst the dollar share is 62 percent in values but almost half that in shipments. Once again it seems exporters price lower value but high number of transactions in the South African Rand hence the large share in quantity relative to value. The same can be said about the euro, albeit at a lower magnitude.

Figure 3.3: Share of Invoicing Currency (by Value)



Source: Authors' calculation from the Malawi National Statistical Office (NSO) data).

Third, in Malawi's imports from other Asian countries (ROA), the U.S. dollar accounts for the largest share in terms of both import amounts and number of shipments. Again, the share of the South African Rand is non-negligible, accounting for 18 percent in terms of shipments. In the case of these products, the euro share is almost consistent across both values and shipments (4 percent and 5 percent respectively), suggesting transaction value may not be a factor id euro invoicing decision.

Overall, PCP is mainly used in Malawi's imports from Japan, and LCP (i.e., MWK invoiced trade) is less likely in Malawi's total imports. VCP is generally observed including the U.S. dollar as somewhat expected but also the South African Rand is typically used as an invoicing currency especially when we use the quantity data in terms of shipments.

In Table 3.2, we show the full data set divided by PCP, LCP and VCP and the shares by number of observations (not value). We observe that China's use of its own currency is less than the other 15 countries in the sample: 1.3 percent vis-à-vis 3.7 percent respectively, despite the large share of Chinese products in the Malawian market. Further, it shows that on average, in the sample period, China has the largest share of vehicle currency pricing, even when looking at the number of products. Interestingly, there is still some amount of local currency pricing, albeit hovering around just 1 percent of the observations across Asian exporters to Malawi. We observe from Table 3.1 that this is mainly from the fixed exchange rate regime. These will be explored further, mainly making use of the observation data more than the value data of invoicing.

Table 3.2: Share of PCP, LCP and VCP Across the Full Dataset

Country	PCP	LCP	VCP	Total Obs
China	1,617	1,081	125,914	128,612
Japan	8,657	273	16,241	25,171
ROA	1,454	414	37,571	39,442
China	1.26%	0.84%	97.90%	100.00%
Japan	34.39%	1.08%	64.52%	100.00%
ROA	3.69%	1.05%	95.26%	100.00%

Source: Authors' calculation from the Malawi NSO data).

A look at the trend data on exporters currency pricing share over time can be seen in Table 3.3. Japan's PCP share ranges from 21 percent to 35 percent in most years, with no particular spikes. China's share of exporter pricing was below 1

percent throughout the sample except for the years 2012 and 2016. Some of the other Asian countries do not show a high share of PCP, but the low levels are still higher than the share of China. For instance, for 2006 Singapore and Hong Kong invoiced nearly 50 percent and 11 percent of their exports to Malawi in their own currencies, respectively. Likewise, South Korea in 2007, 12.2 percent. These are value shares, so may indicate that there may have been a high value purchase of relatively high differentiated products in those years.

Table 3.3: Share of Exporter's Currency Invoicing (by Value)

Exporter	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Japan	24.3	31.8	34.6	29.4	24.3	25.7	32.0	35.3	23.5	23.5	16.1
Singapore	47.9	2.8	7.7	1.2	0.4	0.1	0.0	2.2	0.0	0.2	30.0
Hong Kong	10.6	4.0	5.8	5.3	0.9	5.8	1.7	2.7	1.2	2.6	1.1
S. Korea	0.0	12.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Taiwan	1.5	1.7	2.9	8.4	0.0	0.0	0.7	0.0	0.0	4.3	3.7
Thailand	8.4	0.9	0.5	0.3	0.3	0.7	1.7	0.5	0.2	0.2	0.0
China	0.6	0.1	0.2	0.9	0.3	0.6	2.2	0.3	0.1	0.2	3.6
Malaysia	0.0	0.8	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.3	0.0

Note: Countries in the sample that are excluded in this table are those that had values of 0 percent
Source: Authors' calculation from the Malawi NSO data).

Finally, looking at the industry-breakdown data for all the countries pooled together (Table C.1 in Appendix C), the U.S. dollar has the largest value share in each of the HS-2 categories in our sample, regardless of the share of that industry in Malawian imports. The RMB is rarely used in Malawi's imports from Asia except for imports of Animals and Vegetables from China, which averaged 18 percent of the share. The Japanese yen also makes up a 20 percent share of the transportation imports from the sample countries whilst, notably, foodstuffs were mainly invoiced in Malawi Kwacha (21 percent). Again, these shares are reflective more of the source countries more, but the industry breakdown also reveals key insights. For instance, the foodstuffs Kwacha invoicing is mainly from the 2005-2006. During this time, there

was a drought in Malawi. Thus, may have been food aid for affected areas invoiced in the Kwacha to reduce exchange rate costs for the Malawi government in time of a food crisis.

All of this descriptive analysis, reveals that both exporter and importer country characteristics are key in the invoicing decision.

3.3 Empirical Strategy

3.3.1 Empirical Method

In this section, we use a panel logit model to investigate determinants of invoicing currency choice in Malawi's imports from China, Japan and ROA.[5] For the local currency pricing (Malawian Kwacha, MWK) analysis is additionally made on a subset of observations whose HS-2 industry share of the local currency is at least 20 percent in value. This is due to the small number of observations with LCP, and to also conduct a robustness against sample bias. We also estimate the use of the Renminbi as a vehicle currency by other countries in the sample, and thus use dummy variable for the Renminbi (1 if $CUR = RMB, 0$ otherwise). Finally, we estimate VCP use of the U.S. Dollar (1 if $CUR = USD, 0$ otherwise) and for the South African Rand (1 if $CUR = ZAR, 0$ otherwise) and introduce a transaction value variable.

The dependent variables are binary variables similar to previous studies such as L. S. Goldberg and Tille (2016): producer currency pricing ($PCP = 1, LCP = VCP = 0$); local currency pricing ($LCP = 1, PCP = VCP = 0$); and vehicle currency pricing ($VCP = 1, PCP = LCP = 0$). The functional form for the logit model is the cumulative distribution function of the logistic distribution whereby the predicted probabilities are limited between 0 and 1 as follows:

[5]Panel logit model has been used in the previous studies of invoicing currency choice, such as Devereux et al. (2017) and Donnenfeld and Haug (2008).

$$pr(X) = \frac{exp(v_{st})}{1 + exp(v_{st})} \tag{3.1}$$

The right-hand- side is a non-linear function of the predictors:

$$v_{st} = \alpha + \boldsymbol{Z'}_{st}\boldsymbol{\beta} + \epsilon_{st}$$

X represents either PCP_{st}, PCP_{st}, or VCP_{st} as explained above. For instance, takes one if a product s is invoiced in the respective currency. $\boldsymbol{Z'}_{st}$ includes the following explanatory variables: the exchange rate volatility, the relative price as a proxy for product differentiation, the market share, and other control variables further discussed below.

Unless otherwise specified, all regressions are estimated separately for China, Japan and ROA. All reported results are average marginal effects (unless otherwise specified), computed as means of the individual marginal effects over all observations as follows:

$$\frac{\partial p}{\partial x_k} = \frac{\sum F'(x'\beta)}{n}\beta_k \tag{3.2}$$

where:

$k =$ the k^{th} independent variable/predictor

$n =$ the sample size.

As the importer is a developing country, it will be sufficient to apply the standard model of invoicing currency choice based on a partial equilibrium model, developed by Friberg (1998) and Bacchetta and Wincoop (2005), even though recent studies tend to consider invoicing currency decision in intra-firm trade along production chains.[6] The standard model shows that invoicing currency choice is conditional

[6]See T. Ito et al. (2018) for an empirical analysis of invoicing currency choice in intra-firm trade.

on the product differentiation (Giovannini, 1988; Friberg, 1998) or exporter's market share ((L. S. Goldberg & Tille, 2016; Devereux et al., 2017), and the exchange rate volatility (Bacchetta & Wincoop, 2005).

3.3.2 Explanatory Variables

Relative Price (RP) is a variable that we construct as a proxy for product differentiation. We assume that all firms in the producing/exporting country face the same production costs in producing an HS-8 product. This cost is reflected in the price and is the average cost of producing that HS-8 good in that country. This assumption is in line with monopolistic competition assumptions of (Krugman, Obstfeld, & Melitz, 2014) and reasonable in our case as a country has somewhat average production costs due to the same macroeconomic conditions, and belonging to the same sector of an industry for a good specified so narrowly as HS-8 digit code. This cost, ($\bar{P}$) then can be calculated by taking the average value of each 8-digit HS code product (pro) for each country (j) in each month t:

$$\bar{P}_{pro,jt} = \frac{\sum IM_{pro,j}}{N_{pro,j}} \tag{3.3}$$

where:

$IM_{pro,j}$ = total import value of all HS-8 products from country j

N = number of products

This assumption requires that we separate all transactions with the same HS-8 code by their countries of origin in the transaction data. We thus take all transactions within the same HS-8 code, and separate them based on the country of origin and the currency they are invoiced in and the unit of measurements. We then call this specifically defined good s and calculate the price for this good which is found within (pro). This price we call P_{st}. We further assume that the degree of

product differentiation is proportional to the difference between the export price (P_{st}) and the production costs $\bar{P}_{pro,jt}$. This difference can be regarded as a mark-up. The Relative Price (RP) is therefore:

$$RP_{st} = \frac{P_{st}}{\bar{P}_{pro,jt}} \tag{3.4}$$

We expect this variable to be positively related to PCP, negatively related to LCP and ambiguous for VCP.

Exchange Rate volatility is defined as the bilateral nominal exchange rate volatility between the exporter's currency and the MWK (*EXR Volatility*). The monthly series of the exchange rate volatility is calculated as the standard deviation of the moving average of the natural log of the bilateral nominal exchange rate during the last 12 months. We also use the exchange rate volatility between the Kwacha and the respective invoice currency , including the U.S. dollar and the South African Rand.

Overall Market Share is a variable we include to assess the relative bargaining power of both exporters and importers. The variable is calculated as the local currency share of imports from an exporting country in the corresponding month. Since we do not have firm identifiers, this country share variable shows the trade relations between source (exporting) countries and Malawi. This is therefore a macro- or country-level variable.

Industry Market Share is the share of an exporting country in imports of a particular HS 2-digit category in a given month. For estimations of RMB invoicing as a vehicle currency, we use China's industry market share instead of the exporters'.

Product Market Share is the share of an exporting country in imports of a specific HS 8-digit product in a month, which is likely to be the best measure, because we use the product or transaction level data. A large market share of a

specific product may indicate that an exporter has some monopoly power, which likely have a positive impact on PCP.

Transaction Value is simply the total value of all transactions within good s, thus for every product, the transaction value is $= \sum IM_l$. This is still at the HS 8-digit level, and we expect that higher valued transactions are more likely to be invoiced in the dollar than the rand and is used for vehicle currency analysis, based on the descriptive analysis of the data.

Other variables included are the share of the vehicle currency issuer in the Malawi market for South Africa and the USA and China in assessing invoicing choice for the rand, the dollar and the renminbi respectively. We also include control variables such as a dummy for the exchange rage regime when Malawi has a peg to the dollar (2004:01 to 2012:04).

The summary statistics of the main variables such as the mean and standard deviation, are presented in Table C.2 in Appendix C.

3.4 Empirical Results

This section presents the estimated results of the panel logit model of Malawi's imports from China, Japan and other Asian countries (ROA). We report the average marginal effects based on the maximum likelihood estimates, with the standard errors provided in parentheses. The reported magnitudes represent the expected difference in outcome probability associated with a one-unit increase (or the discreet change from the base level for dummy variables), unless raw estimates are specified. Some of the results for LCP and PCP are based on a population averaged regression, due to the small number of positive responses for the dichotomous dependent variables. However, when estimating PCP in imports from Japan as well as estimating VCP, we use a random effect model.

3.4.1 Producer Currency Pricing

Country level Results

Table 3.4 presents the results of panel logit estimation when the dependent variable is PCP. First, the exchange rate volatility variable has a significantly negative effect on PCP in imports from China, Japan and ROA. This negative effect is found in all the models estimated and across all the separate regressions using the three different market share variables respectively. Thus, the larger the exchange rate volatility, the less likely exporter's currency is to be chosen as an invoicing currency relative to a vehicle currency or the importer's currency.

Second, the relative price variable, which is used as a proxy for product differentiation, is positive and statistically significant in the imports from Japan sample across all specifications. This indicates that the higher the product price, the more likely the yen is to be used in imports from Japan. Our proxy variable for product differentiation works well in imports from Japan, and the results support the hypothesis that differentiated products tend to be invoiced in the exporter's currency in exports from an advanced country to a developing country.[7] This is also consistent with the descriptive statistics. In contrast, the relative price variable is not statistically significant in imports from other Asian countries (ROA). Moreover, the relative price variable takes negative and statistically significant coefficients in imports from China, although at only a 10 percent significance level in two out of the three cases. This may be explained by the fact that most products from China are of relatively lower prices and more homogeneous.

Third, the coefficient of the overall market share variable is positive and statistically significant in imports from all the exporters, which indicates that the

[7]This hypothesis comes from the well-known stylized facts. One is that trade between an advanced country and a developing country is typically invoiced in the advanced country's currency, as articulated in Grassman (1973), and Page (1977, 1981). Another stylized fact is that differentiated products tend to be invoiced in the exporter's currency (McKinnon, 1973).

Table 3.4: Determinants of PCP

	China	Japan		ROA
	PA	PA	RE	PA
(A) Product Market Share				
Relative Price	-0.0014**	0.0018**	0.191***	0.0026
	(0.0007)	(0.0003)	(0.008)	(.0020)
Product MS	-0.00002	0.0003***	0.0009***	0.000007
	(0.00001)	(0.0001)	(0.0001)	(0.000019)
EXR Volatility	-0.0082**	-0.0195***	-1.370***	-0.0809***
	(0.0026)	(0.0023)	(0.058)	(0.0068))
(B) Industry Market Share				
Relative Price	-0.0012*	0.0015***	0.191***	0.0026
	(0.0006)	(0.0003)	(0.008)	(0.0020)
Industry MS	0.00021***	-0.00039***	-0.0018***	0.000014
	(0.00002)	(0.00005)	(0.0001)	(0.000053)
EXR Volatility	-0.0127***	-0.0190***	-1.366***	-0.0806***
	(0.0027)	(0.0024)	(0.057)	(0.0069)
(C) Overall Market Share				
Relative Price	-0.0011*	0.0017***	0.193***	0.0032
	(0.006)	(0.003)	()0.008_	(0.0020)
Overall MS	0.00038***	0.00004***	0.0060***	0.00069***
	(0.00002)	(0.00001)	(0.0003)	(0.00011)
EXR Volatility	-0.0233***	-0.0189***	-1.057***	-0.0817***
	(0.0029)	(0.0023)	(0.059)	(0.0069)
Observations	128,612	25,171	25,171	39,442

Note: Average marginal effects of the panel logit model are reported. "PA" denotes population averaged estimation. "RE" denotes random effect estimation. Robust standard errors are in parenthesis. Asterisk(s) denote(s) the significance level: *** for 1%, ** for 5%, and * for 10%.
Source: Authors' calculation from the Malawi NSO data).

larger the exporter's country share in the importer's market, the more likely the exporter's currency is to be chosen. Although this result is convincing, when the other two market share variables are used, the estimated results are inconsistent. When using the industry market share variable, the estimated coefficient becomes negative in imports from Japan but is positive in imports from China. The negative coefficient in imports from Japan may be due to the fact that whilst transportation

products account for the largest share in Malawi's imports from Japan, automobiles and related products of Japan's exports are still largely invoiced in the U.S. dollar and not the yen, although they constitute the largest of yen invoicing.[8] However, when using the product market share variable, positive and significant coefficients are found only in imports from Japan. Nevertheless, we can conclude across exporters that market share increases the probability of conducting PCP.

Since we use the product level data of invoicing currency choice for the dependent variable, it will be more appropriate to measure the product market share effect at the product level. Significantly positive effect of market share is not found in Malawi's imports from China, while the relative price variable has negative effect on PCP in imports from China. These results may be due to the relatively small number of PCP in Malawi's imports from China despite a large share of products from in both value and shipment of the imports. In contrast, we find significantly positive effect of the relative price (product differentiation) and the product-level market share on PCP in imports from Japan, which is quite expected.

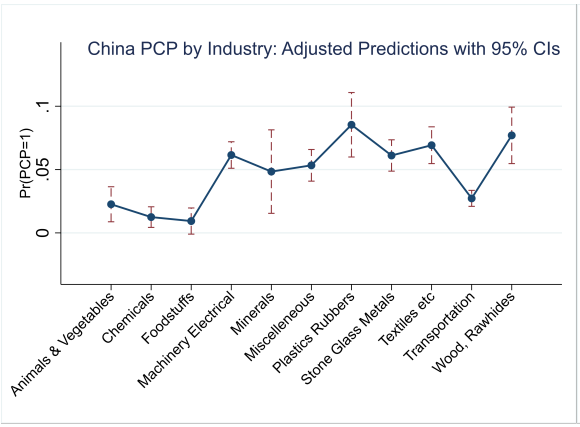
Industry level Results

Industry level estimations of PCP are graphically displayed in the figures in 3.4 for China (3.4a), Japan (3.4b) and ROA (3.4c). Holding all other variables at their means in the benchmark model, the probability of PCP for products from China in Figure 3.4a, varies. For instance, it is 8.5 percent for plastics and rubbers, 7.7 percent for wood and rawhides and as low as 0.9 percent for foodstuffs. Using animals and vegetables as a base, the probabilities are 6.4 percent, 4.8 percent and 4.0 percent higher for plastics, textiles and machinery, respectively.

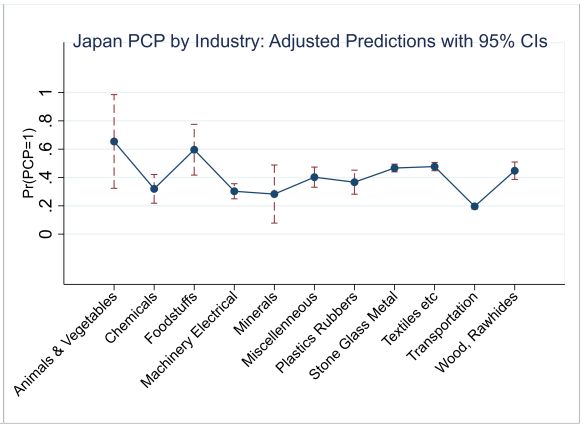
[8]Ito et al(2018) reveals that Japanese automobile exporters typically conduct the pricing-to-market (PTM) behavior by choosing LCP in exports to advanced countries and VCP (mainly U.S. dollar-invoicing) in exports to developing countries.

Figure 3.4: PCP By Industry: Adjusted Predictions with 95% CI's

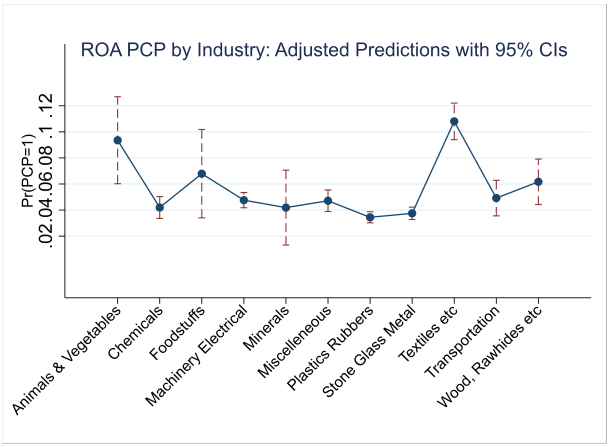
(a)



(b)



(c)



Source: Authors' estimations.

The magnitudes are much higher for Japan, presented in 3.4b, ranging from 65.4 percent (animals and vegetables) to 20 percent (transportation). Although the probability of choosing PCP for transportation products is lowest among Japan's exports, the magnitude is much higher compared the industries for products from China (2.7 percent) and ROA (4.9 percent). Again, the result on transportation may be due to the second-hand cars which are the built of the large share of transportation imports from Japan. In general, PCP also varied markedly across industries.

3.4.2 Local Currency Pricing

As shown in the previous section, the Malawi Kwacha appears to be rarely used in Malawi's imports. But, the industry breakdown indicates that MWK is used in imports of Foodstuffs: 65 percent of imports from Korea and 94 percent from the Philippines, for instance, are invoiced in the MWK. Although the observations with LCP are relatively few, we conduct population averaged estimation of the panel logit model to examine the determinants of LCP. The results are displayed in Table 3.5.

The coefficient of the relative price is consistently negative and statistically significant in all cases, which indicates that the higher the relative price (product differentiation), the less likely exporters are to choose LCP. This result is expected and consistent with the results of PCP in Table 3.4 and the stylized facts discussed in the previous sub-section. This somewhat diverges from the findings of L. S. Goldberg and Tille (2016) where the local currency pricing was used more on larger shipments for Canadian imports. This could be because Canadian importers may have a higher bargaining power than Malawian importers, although in our robustness checks it would appear Malawian importers may have higher bargaining power with Japanese and ROA exporters but not so much from China (See discussion in Appendix C). The coefficient of the exchange rate volatility is significantly negative in imports from China and other Asian countries (ROA) in all the models. This is also expected as a volatile local currency against the exporter's currency will likely lead to vehicle currency pricing.

As a robustness check and considering the low levels of LCP, we estimate LPC for a subset of products with industries with an LCP share of at least 20 percent in value over the sample period. The results are presented in Table C.3 in Appendix C and are consistent with (1) the assertion of Baron (1976) that exporters prefer to invoice in the currency whose relative price has the least volatility and (2) with our baseline results of Table 3.5. Thus our sample selection is quite reliable.

Table 3.5: Determinants of LCP (PA Model)

Dependent Variable: LCP=1 China			
Relative Price	-0.000885**	-0.000905**	-0.000778*
	(0.000423)	(0.000438)	(0.000421)
EXR Volatility	-0.0445***	-0.0439***	-0.0470***
	(0.00292)	(0.00302)	(0.00316)
Product MS	-0.0000763***		
	(0.0000136)		
Industry MS		-0.000117***	
		(0.0000171)	
Overall MS			0.0000474***
			(0.0000164)
Observations	128,612	128,612	128,612
Dependent Variable: LCP=1 Japan			
Relative Price	-0.0127***	-0.0113***	-0.0139***
	(0.00217)	(0.00201)	(0.00227)
EXR Volatility	0.00149	-0.00439	-0.0141
	(0.00990)	(0.00969)	(0.0107)
Product MS	0.000218***		
	(0.0000366)		
Industry MS		0.000406***	
		(0.0000722)	
Overall MS			-0.000361***
			(0.0000705)
Observations	25,171	25,171	25,171
Dependent Variable: LCP=1 ROA			
Relative Price	-0.00648***	-0.00624***	-0.00667***
	(0.00179)	(0.00176)	(0.00177)
EXR Volatility	-0.0536***	-0.0537***	-0.0543***
	(0.00608)	(0.00605)	(0.00606)
Product MS	0.0000213**		
	(0.0000106)		
Industry MS		0.000161***	
		(0.0000245)	
Overall MS			0.000330***
			(0.0000601)
Observations	39,442	39,442	39,442

Note: Average marginal effects are reported. Standard errors are in parenthesis. Asterisk(s) denote(s) the significance level: *** for 1%, ** for 5%, and * for 10%.
Source: Authors' estimations.

3.4.3 Vehicle Currency Pricing

Table 3.6 presents the results of random effect estimation for VCP determinants. First, the relative price variable is not statistically significant in imports from China, Japan, and other Asian countries (ROA), which suggests that the degree of product differentiation does not affect the choice of VCP significantly, unlike PCP and LCP. Second, the coefficient of the exchange rate volatility is significantly positive in all the sample countries.

The effect of a one standard deviation increase is more pronounced in products from Japan (34.6 percent) and ROA (26.8 percent), however, than for China (1.9 percent). This implies that the larger the exchange rate volatility, the more likely exporting countries are to choose VCP and not PCP, consistent with PCP and LCP findings. the effect of unstable exchange rates however seem to affect China the least. Third, the industry market share variable takes a positive coefficient only in imports from Japan, which is consistent with the result of Table 3.4 where the coefficient of the industry market share variable for Japan is significantly negative. We can conclude that exchange rate volatility is the key variable in choosing VCP.

Table 3.6: Determinants of VCP

	China	Japan	ROA
Relative Price	-0.0000192	0.00164	0.00287
	(0.000886)	(0.0179)	(0.0104)
Ex. Rate Vol	0.0187**	0.346***	0.268***
	(0.00953)	(0.102)	(0.0471)
Industry MS	-0.0000178	0.00181***	-0.000202
	(0.0000187)	(0.0000897)	(0.000172)
Obs.	128612	25171	39442

Note: Average marginal effects of the panel logit random effects model are reported. Standard errors are in parenthesis. Asterisk(s) denote(s) the significance level: *** for 1%, ** for 5%, and * for 10%.
Source: Authors' calculation from the Malawi NSO data).

USD and ZAR as Vehicle Currencies

As we observed, the Rand share amount transactions is quite high across exporters, but not so much its value share (see Section 3.2). This suggests that low valued transactions are invoiced in the South African Rand whilst high value transactions are invoiced in the U.S dollar, when it comes to a choice among vehicle currencies. As such, we add a variable, transaction value as an explanatory variable. We expect the higher valued transactions to be more likely to be invoiced in the dollar and vice versa for the rand. This analysis is pooled for all the countries in the sample, as the quantity and value shares of U.S. dollar and rand invoicing were consistent across all countries: the latter larger when quantity is considered, the former larger when value was considered. The results are displayed in Table 3.7.

We find that indeed the higher the transaction value, the less likely that good is to be invoiced in the South African Rand, and the more likely it is to be invoiced in the U.S. dollar. The results in Table 3.7 are raw results and not marginal effects, thus we can only interpret the signs. The table does show that the results are consistent with observations in the descriptive analysis. These findings then clearly and empirically explain the major differences between value and shipment shares of VCP between the U.S dollar and the South African Rand in imports from Asia. Interestingly, we observe that the market share of the issuer of the currencies (USA and South Africa) does not affect the invoicing decision.

We further observe that the proxy for product differentiation also does not affect neither rand nor U.S. dollar invoicing, consistent with overall results of determinants of VCP in Table 3.6. On the other hand, a higher product market share in an HS-8 good positively affects dollar invoicing and negatively affects rand invoicing. This may indicate some monopolistic behavior when a firm has a large product market share, hence higher value transactions and dollar pricing.

Table 3.7: USD and ZAR as Vehicle Currencies

All 17 Asian Countries				
USD in VCP	Dep Var: USD=1			
Ex Vol (MWK/USD)	-0.000711	-0.000772	-0.00389	-0.00375
	(0.000440)	(0.000484)	(0.00754)	(0.00768)
Rel. Price	-5.53e-10	-2.63e-09	1.41e-08	1.43e-08
	(1.26e-08)	(1.63e-08)	(0.0000001)	(0.0000001)
Product MS	0.0000053**	0.0000061**		
	(0.0000022)	(0.000003)		
Trans. Value			0.00292***	0.00298***
			(0.000358)	(0.00036)
Share of USA		0.0000750		-0.0103
		(0.000865)		(0.0187)
D.USD Peg	0.000244**	0.000291**	-0.000141	-0.000304
	(0.00011)	(0.00013)	(0.00110)	(0.00114)
ZAR in VCP	Dep Var: ZAR=1			
Ex Vol (MWK/ZAR)	-0.000054**	0.000034**	0.0000043	0.000018
	(0.000023)	(0.0000174)	(0.000065)	(0.0000758)
Rel. Price	-4.81e-10	-4.93e-11	-1.81e-09	-2.30e-09
	(6.45e-08)	(0.000000150)	(1.67e-08)	(4.12e-09)
Product MS	-0.00000035***	-0.00000013***		
	(0.0000001)	(4.52e-08)		
Trans. Value			-0.000021***	-0.000024***
			(0.0000051)	(0.000007)
Share of RSA		-0.0000275*		-0.000206**
		(0.0000146)		(0.000083)
D.USD Peg	0.0000098***	0.000005***	0.000059***	0.00005***
	(0.000003)	(0.000002)	(0.00002)	(0.00002)
Obs	193225	193225	193225	193225

Note: Raw results from panel logit random effects model are reported. Relative price is Unit based. Standard errors are in parenthesis. Asterisk(s) denote(s) the significance level: *** for 1%, ** for 5%, and * for 10%.
Source: Authors' calculation from the Malawi NSO data).

RMB as a Vehicle Currency

Finally, Table 3.8 presents results of RMB usage as a vehicle currency, where the dependent variable is the RMB dummy and the sample is all the Asian countries except China. First, as is expected for vehicle currency pricing in general, the exporters 'mar-

ket share reduces the probability of choosing the RMB as a vehicle currency, whilst the exchange rate volatility of the exporter and the importer increases it. When we use China's market share instead of the exporting countries' market share as a predictor variable, it is the only significant variable and positively affects probability of Renminbi invoicing by the other 16 countries in the sample.[9] Specifically, a 10 percent increase in China's market share increases the likelihood of Renminbi usage as a vehicle currency by 0.1 percent. This signifies that China's place in the import market can play a crucial role in the internationalization of the renminbi, and is in sharp contrast with USD and ZAR invoicing as VCP as the market share of the issuing countries had no positive effect on the currencies being used in the import market (Table 3.7.)

Table 3.8: RMB as a Vehicle Currency

Dep Var.: RMB = 1		
Relative Price	0.00185	0.00149
	(0.00411)	(0.00494)
Ex. Rate Vol	0.0226*	0.0203
	(0.0118)	(0.0149)
Industry MS	-0.000269**	
	(0.000108)	
Industry MS China		0.000112**
		(0.0000469)
Observations	64557	64557

Note: Raw results from panel logit random effects model are reported. Standard errors are in parenthesis. Asterisk(s) denote(s) the significance level: *** for 1%, ** for 5%, and * for 10%.
Source: Author's calculation from the Malawi NSO data).

[9]We use industry market share based on the PCP results of Table 3.4 where only the industry market share was significant and the correct sign for China)

3.5 Concluding Remarks

By processing unpublished customs level data of Malawi's imports at HS 8-digit level, we show detailed information on invoicing currency choice in Malawi's imports from China, Japan, and other Asian countries. While there are a large number of studies on the RMB internationalization, this is the first study that reveals to what extent the RMB is used in Malawi's imports from China at a detailed product level, and in trading with a developing country.

We have found that the RMB is rarely used in Malawi's imports from China. In contrast, the share of yen-invoiced transactions in the imports from Japan is much larger. This suggests that the internationalization of the RMB lags far behind the yen internationalization process. The U.S. dollar is dominantly used in terms of import amounts in Malawi's imports from China and other Asian countries. However, when calculated in terms of shipments, the share of the South African Rand becomes quite large especially among products from China and other Asian countries. Thus, the South African Rand plays the second largest role of vehicle currency in Malawi's imports from Asia.

By estimating a panel logit model, we have also analyzed possible determinants of invoicing currency. We have revealed that the degree of product differentiation and the market share of imported products have positive influences on PCP (yen invoicing) in Malawi's imports from Japan. The former negatively affects local currency pricing. The degree of bilateral nominal exchange rate volatility has negative effect on PCP (exporter's currency invoicing) in imports across all exporters: China, Japan, and other Asian countries. When analyzing the determinants of VCP, it is found that the larger the exchange rate volatility, the more likely vehicle currencies are to be chosen. Further, lower value transactions are more likely to be invoiced in the Rand than the dollar. We may thus conclude that exporter's currency invoicing

will be more probable compared to vehicle currency invoicing as the bilateral exchange rate becomes more stable.

It will be informative to analyze why one of African currencies can be used as a vehicle currency. Possibly the large of South African products in Malawian imports, means importers are more likely to have access to the Rand and thus it is the chosen vehicle currency in lieu of the dollar. We found that the share of South Africa in the Malawian market does not affect rand invoicing by Asian countries. These issues can to be taken into consideration in our future research.

We conclude that China's role as a trading partner has increased at a much faster pace than the role of its currency in that trade. There is room for the RMB internationalization to further expand, especially as it is now a reserve currency among the International Monetary Fund's SDR basket of currencies.

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Appendix A

Supplementary material for Chapter 1

A.1 Additional tables

Table A.1: List of sectors and HS codes

Category	Starting HS Code
Animal and vegetables	
Animal & Animal Products	HS 01 - 05
Vegetable Products	HS 02 - 15
Foodstuffs	HS 16 - 24
Mineral Products	HS 25 - 27
Chemicals & Allied Industries	HS 28 - 38
Plastics and Rubbers	HS 39 - 40
Wood, Rawhides etc.	
Raw Hides, Skins, Leather, & Furs	HS 41 - 43
Wood & Wood Products	HS 44 - 49
Textiles, Footwear, Headgear	
Textiles	HS 50 - 63
Footwear / Headgear	HS 64-67
Stone/Glass, Metals	
Stone/Glass	HS 68 - 71
Metals	HS 72 - 83
Machinery / Electrical	HS 84 - 85
Transportation	HS 86 - 89
Miscellaneous	HS 90 - 97

Source: UN Trade Statistics (2017).

A.2 Robustness Checks

In this exercises of robustness checks and investigating a U-shaped relationship between market share and ERPT as in (Devereux et al., 2017), we use product market share (that is $k = p$ in MS_{kt}) to estimate the effect of market share on ERPT at the industry level and overall market share (that is $k = o$ in MS_{kt}) for the country level estimations. We add the market share squared term and interact it with the exchange rate, such that our equation is as below:

$$\Delta_\tau p_{st} = \delta_0 + \beta_0 \Delta_\tau s_{st} + \delta_1[\Delta_\tau s_{st} MS_{kt}] + \delta_2[\Delta_\tau s_{st} MS_{kt}^2] + \boldsymbol{Z_{st}}\gamma + \epsilon_{st} \tag{A.1}$$

The results from equation A.1 for the industry-level analysis are in Table A.2. They show that the coefficient on the non-linear interaction term is consistently negative, suggesting a Kuznets curve type of relationship.

Table A.2: Market Share and ERPT across Industries: Floating Regime

	Market Share		$\Delta_\tau s_{st} MS_{pt}$		$\Delta_\tau s_{st} MS_{pt}^2$	
Industry	Coef.	SE	Coef.	SE	Coef.	SE
Chemicals	0.292***	(0.036)	-0.111	(0.277)		
	0.288***	(0.0364)	3.628**	(1.288)	-3.727**	(1.261)
Machinery/Electrical	0.667***	(0.025)	0.289	(0.211)		
	0.666***	(0.0253)	8.886***	(0.808)	-8.769***	(0.812)
Animals & Vegetable	0.181**	(0.0695)	0.335	(0.480)		
	0.180**	(0.0695)	3.206	(2.540)	-2.689	(2.330)
Stone, Glass, Metal	0.406***	(0.0304)	0.273	(0.250)		
	0.401***	(0.0304)	5.785***	(1.027)	-5.539***	(0.999)
Transportation	0.436***	(0.0454)	0.137	(0.351)		
	0.434***	(0.0455)	4.671***	(1.366)	-4.619***	(1.355)
Plastics & Rubbers	0.530***	(0.0548)	-0.684	(0.418)		
	0.526***	(0.0547)	4.607**	(1.667)	-5.521**	(1.714)
Wood, Rawhides	0.312***	(0.0509)	0.634	(0.401)		
	0.308***	(0.0509)	6.569***	(1.810)	-6.078***	(1.795)
Textiles	0.431***	(0.0458)	-0.109	(0.320)		
	0.431***	(0.046)	2.851	(1.517)	-2.898*	(1.460)
Mineral Products	0.0471	(0.0865)	0.661	(0.749)		
	0.0451	(0.0868)	4.783	(3.696)	-4.016	(3.475)
Foodstuffs	0.125*	(0.0592)	-0.612	(0.411)		
	0.125*	(0.059)	-0.487	(1.998)	-0.125	(1.951)

Asterisk(s) denote(s) the significance level: *** for 1%, ** for 5%, and * for 10%.
Source: Authors' estimation.

Table A.3 displays the results by exporter. We use the overall market share variable since our interest is on country level differences, i.e. low-, middle- and high-income economies and this market share variable measures the share of products for a country in Malawian imports.

The non-linear interaction for the middle-income countries, which is also the group of countries that constitute the highest number of countries from which imports originate, agree further that the relationship is not a U-shaped one as in Devereux et al. (2017) for Canada. The other coefficients for the low and high-income countries on this variable are not statistically significant. Thus, our general conclusions hold.

Table A.3: Market Share and Pass-Through Across Exporters: Alternative Model

	Fixed			Floating		
	Low	Middle	High	Low	Middle	High
$\Delta_\tau s_{st}$	0.391	0.621***	0.522***	0.510***	0.724***	1.062***
	(0.495)	(0.157)	(0.160)	(0.176)	(0.0569)	(0.0543)
$\Delta_\tau ExporterCPI_{st}$	1.177***	1.815***	2.785***	1.441***	1.668***	0.947*
	(0.255)	(0.133)	(0.482)	(0.273)	(0.126)	(0.490)
MS_{ot}	5.530	0.0919	0.103	3.246	0.421**	1.235*
	(5.538)	(0.159)	(0.319)	(14.29)	(0.178)	(0.745)
$\Delta_\tau s_{st} MS_{ot}$	-0.804	-1.420**	5.610*	4.344	0.690*	-1.866
	(23.90)	(0.616)	(3.316)	(10.10)	(0.357)	(1.554)
$\Delta_\tau s_{st} MS_{ot}^2$	-39.24	-0.0143	1.581	269.1	-1.362**	-2.383
	(55.68)	(0.413)	(1.005)	(547.2)	(0.661)	(6.143)
Constant	-0.00106	0.154***	0.275***	-0.0498	-0.221***	-0.175***
	(0.188)	(0.0497)	(0.0972)	(0.139)	(0.0369)	(0.0620)
Obs.	18960	207941	70097	19588	218328	73156
R^2	0.00978	0.00253	0.00394	0.0320	0.0121	0.0263

Asterisk(s) denote(s) the significance level: *** for 1%, ** for 5%, and * for 10%.
Source: Authors' estimation.

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Appendix B

Supplementary material for Chapter 2

B.1 List of Additional Tables

Table B.1 details invoicing shares of all imports from the EU by HS-2 Industry. These are average shares for each industry per currency used in value, between 2004 and 2016.

Table B.1: Invoice Currency Share by Industry

Industry	USD	Euro	GBP	ZAR	MWK	JPY	Other
Animal and vegetables	79.1	17.8	0.2	0.2	2.7	0.0	0.0
Chemicals & Allied Industries	90.6	7.3	1.7	0.3	0.1	0.0	0.0
Foodstuffs	32.8	19.8	1.8	2.9	42.7	0.0	0.1
Machinery & Electrical	34.9	53.3	8.0	3.4	0.1	0.1	0.2
Mineral Products	11.9	40.6	9.6	0.5	37.3	0.0	0.1
Miscellaneous	39.9	29.6	26.9	1.7	1.6	0.0	0.3
Plastics & Rubbers	79.0	13.2	4.1	3.6	0.0	0.0	0.1
Stone/Glass, Metals	46.3	29.1	20.1	3.7	0.4	0.0	0.3
Textiles, Footwear, Headgear	92.8	2.7	3.7	0.1	0.5	0.0	0.1
Transportation	21.6	28.3	44.2	3.0	0.3	2.4	0.3
Wood, Rawhides etc.	61.7	14.4	20.3	3.5	0.0	0.0	0.0
Currency % Share	62.7	22.7	11.2	2.0	1.1	0.2	0.0

Source: Authors' calculation from Malawi National Statistical Office (NSO).

Table B.2 has a list of all the EU countries in the sample. The asterisks indicate which group the country was considered in based on euro area membership, for the analysis.

Table B.2: EU Countries in the sample

Name	EU Member	Eurozone	Prospective Members	Non-Members
Austria	*	*		
Belgium	*	*		
Bulgaria	*		*	
Croatia	*		*	
Cyprus	*			
Czech Republic	*		*	
Denmark	*			*
Estonia	*	*		
Finland	*	*		
France	*	*		
Germany	*	*		
Greece	*	*		
Hungary	*		*	
Ireland	*	*		
Italy	*	*		
Latvia	*			
Lithuania	*		*	
Luxembourg	*	*		
Malta	*			
Netherlands	*	*		
Poland	*		*	
Portugal	*	*		
Romania	*		*	
Slovakia	*	*		
Slovenia	*	*		
Spain	*	*		
Sweden	*		*	
United Kingdom	*			*
Total	28	17	9	2

Source: The European Union (2019)

B.2 ERPT and Invoicing Currency Choice: Supplementary Results

Table B.3 shows baseline pass-through estimates without the tariff from the equation 2.11 in the main text. The results displayed are from the following estimation and provide average pass-through estimates of exchange rates, regardless of what currency the product is invoiced in.

$$\Delta_\tau p_{gt} = \alpha + \beta \Delta_\tau e_{it} + \theta \Delta_\tau \boldsymbol{Z}_{it} + \epsilon_t \tag{B.1}$$

Table B.3: Exchange Rate Pass-Through

Variable	EU	Eurozone	Prospective	Non-Members
$\Delta_\tau ExchangeRate$	0.909***	0.948***	0.971***	0.871***
	(0.052)	(0.0765)	(0.250)	(0.0840)
$\Delta_\tau ExporterCPI$	2.277***	2.290**	2.079	2.213***
	(0.460)	(0.934)	(1.649)	(0.595)
USD Peg Period	-0.491**	-0.771	0.278	-0.200
	(0.233)	(0.508)	(0.708)	(0.256)
USD Peg * $\Delta_\tau ER$	-0.283*	-0.432*	0.272	-0.215
	(0.168)	(0.235)	(0.936)	(0.254)
Constant	0.070	0.301	0.702	-0.233
	(0.122)	(0.183)	(0.711)	(0.162)
Observations	89264	37665	2513	48992
Within R^2	0.0119	0.0175	0.0780	0.0143
Overall R^2	0.0173	0.0250	0.0908	0.0176
Between R^2	0.0502	0.0547	0.158	0.0494

Note: ER= Exchange Rate. Robust standard errors are in parenthesis.
Asterisk(s) denote(s) the significance level: *** for 1%, ** for 5%, and * for 10%.
Source: Authors' estimation.

In Table B.4, we have estimates of equation B.1 in sub-samples of products by invoice currency. Euro invoiced goods across exporters have lower ERPT een before tariffs are considered.

Table B.4: ERPT and Invoicing Currency Choice

Currency	Eurozone	Prospective	Non-Members
USD	1.197***	0.997***	0.897***
	(0.110)	(0.361)	(0.126)
Euro	0.898***	0.146	0.627***
	(0.0916)	(0.459)	(0.176)
GBP	1.109***	0.227	1.018***
	(0.337)	(0.992)	(0.100)
Constant	0.283	0.697	-0.226
	(0.183)	(0.712)	(0.163)
Observations	37,665	2,513	48,992
Within R^2	0.0176	0.0821	0.0146
Overall R^2	0.0256	0.0929	0.0180
Between R^2	0.0585	0.149	0.0530

Note: Robust standard errors are in parenthesis.
Asterisk(s) denote(s) the significance level: *** for 1%, ** for 5%, and * for 10%.
Source: Authors' estimation.

B.3 Robustness Checks and Extensions

B.3.1 Robustness Checks

Several robustness to model specification were conducted. A test for the inclusion of time fixed effects for both fixed and random effects models. In all cases the null hypothesis that the coefficients for all months are jointly equal to zero was rejected and therefore time fixed effects were included in all estimations.

In addition, we use a quantity measure of the weight in equation 2.4 and then recalculate price in equation 2.5. This is due to value weight concerns using MWK amounts that already contain the exchange rate in the dependent variable. The weight is as follows:

$$\alpha_{lg} = \frac{Q_{lg}}{\sum_{x \in L_r} M_x} \tag{B.2}$$

where:

$Q =$ the number of units in a transaction l instead of the value in MWK of the transaction.

In all cases our results hold and conclusions remain the same.

B.3.2 Extensions

Below are the extensions of results mentioned in the text to further the argument and the main results.

Table B.5 displays pass-through results when products are simply split by euro invoiced and non-euro invoiced. Still we see that the coefficient on exchange rate for euro invoiced products is lower in consistently, compared to "non-euro" currencies. However, analysis cannot be made on currency switching and the tariff pass-through rates when the comparison is simply all other currencies apart from the euro. Thus, separating by major currencies is necessary especially for testing of hypothesis 2 on the effect of invoice currency on tariff pass-0through and on hypothesis 3 on the effect of tariffs on invoice currency choice.

Table B.5: ERPT and Invoicing Currency Choice

	EU		Eurozone		Non-Eurozone	
	EUR	NON-EUR	EUR	NON-EUR	EUR	NON-EUR
$\Delta_\tau ln(1+Duty)$	-0.0429*	-0.114***	-0.0494*	-0.0204	0.0111	-0.125***
	(0.024)	(0.013)	(0.026)	(0.034)	(0.0579)	(0.0136)
$\Delta_\tau ER$	0.828***	0.921***	0.911***	1.029***	0.337	0.872***
	(0.108)	(0.068)	(0.122)	(0.117)	(0.241)	(0.0885)
$\Delta_\tau Exp.CPI$	2.033*	2.444***	1.713	2.654*	3.630	2.479***
	(1.222)	(0.591)	(1.456)	(1.507)	(2.336)	(0.679)
D. USD.Peg	-0.112	0.319	-0.0982	-0.379	-0.317	0.471*
	(0.498)	(0.215)	(0.525)	(0.501)	(0.875)	(0.242)
USD Peg*$\Delta_\tau ER$	-0.559	-0.485**	-0.840**	-0.904***	1.717	-0.210
	(0.414)	(0.225)	(0.392)	(0.281)	(1.279)	(0.314)
Constant	0.252	-0.0164	0.312	0.254	-0.743	-0.138
	(0.279)	(0.137)	(0.296)	(0.235)	(0.600)	(0.167)
Observations	16312	56206	14575	14380	1737	41826
Within R^2	0.0226	0.0172	0.0236	0.0257	0.108	0.0191
Overall R^2	0.0261	0.0223	0.0268	0.0362	0.102	0.0231
Between R^2	0.0373	0.0683	0.037	0.0902	0.0919	0.0677

Note: Robust standard errors are in parenthesis. Asterisk(s) denote(s) the significance level: *** for 1%, ** for 5%, and * for 10%.
Source: Authors' estimation.

Table B.6 shows results of euro invoicing by countries in the euro area (producer currency pricing). We have an all-round consistency for all the variables in terms of signs and significance levels, except for time in the EU. It would seem countries' membership of the eurozone is more important for PCP that membership of the Eu. Thus euro usage is likely to increase with increased monetary integration in the EU. Interestingly, depreciation of both the euro and the U.S. Dollar exchange rates have a negative impact on euro invoicing among eurozone countries. This is notable seeing as the dollar is a vehicle currency to these countries whilst the euro is their own currency. This speaks to the co-movement of the currencies and suggests exporters invoice currency choice has more to do with the importing country's currency strength against major currencies. Thus depreciation iof the Kwacha is likely to be against both currencies and thus effect on import prices may not be too different from the importers' view.

Table B.6: Euro in Producer Currency Pricing

Variable	Coef.	S. E	Coef.	S.E
$\Delta_\tau ER_{EUR}$	-0.0389***	(0.0115)		
$\Delta_\tau Exp.CPI$	0.148	(0.131)	0.130	(0.129)
Market Share	0.0373***	(0.00687)	0.0373***	(0.00687)
Time in EU	-0.000589***	(0.0000302)	-0.000590***	(0.0000302)
Time in the Eurozone	0.00235***	(0.000641)	0.00243***	(0.000658)
USD Peg Period	0.191*	(0.113)	0.200*	(0.115)
$\Delta_\tau ER_{USD}$			-0.0353***	(0.0107)
Constant	0.573***	(0.137)	0.558***	(0.141)
Observations	19,895		19,895	
Within R^2	0.214		0.214	
Overall R^2	0.225		0.225	
Between R^2	0.219		0.219	

Note: Dependent Variable: Share of the euro in value among products from the EU. Robust standard errors are in parenthesis. Asterisk(s) denote(s) the significance level: *** for 1%, ** for 5%, and * for 10%.
Source: Authors' estimation.

In investigating euro usage as a vehicle currency, we use the share of the euro in products from non-EU countries as a dependent variable and include additional time lags, while maintaining the definition of the lag being the previous time a good was imported. The equation is as follows similar to equation 2.13 but for VCP analysis. This linear model we expect to agree with the results from equation 2.14:

$$\begin{aligned}\delta_{gt}^{k} = \alpha + \beta\Delta_\tau e_{euro,t-2} + \upsilon\Delta_\tau \ln(1+T_{gt}) + \nu_1 EUsize + \nu 2 Eurozone_size \\ + \nu 3 D_{highincome} + \nu 4 D_{lowincome} + \nu 4 D_{Europe} + \Omega_0 ms_{git} + \theta\Delta_\tau \boldsymbol{Y}_{it} + \epsilon_t\end{aligned} \tag{B.3}$$

The results are in Table B.7. In this case import duties increase the share of the euro, suggesting non-Eu exporters switch from other currencies to the euro when tariffs increase. This agrees with our finings of the euro and dollar share regressions from non-eurozone countries where we concluded that switching of currencies is something that is observed with products from the eurozone only. These results also further the conclusions from Table B.6 that the eurozone region is more influential on euro invoicing than the Eu as a region.

Table B.7: Share of Euro Invoiced Products from Non-EU Countries

	1	2	3	4
$\Delta_{\tau-2}EuroER$	-0.00391***	-0.00391***	-0.00439***	-0.00392***
	(0.00113)	(0.00113)	(0.00113)	(0.00113)
$\Delta_{\tau-2}EuroCPI$	0.0607***	0.0606***	0.0528***	0.0603***
	(0.0168)	(0.0168)	(0.0167)	(0.0168)
Market Share	-0.000732***	-0.000758***	-0.000184	-0.000746***
	(0.000221)	(0.000221)	(0.000221)	(0.000221)
$\Delta_{t-1}SizeoftheEU$	-0.0306***	-0.0306***	-0.0309***	-0.0306***
	(0.00109)	(0.00109)	(0.00110)	(0.00109)
$\Delta_{\tau-1}Sizeoftheeurozone$	0.00111**	0.00112**	0.00126**	0.00112**
	(0.000548)	(0.000548)	(0.000550)	(0.000547)
$\Delta_{\tau}ln(1+Duty)$	0.000208***			
	(0.0000786)			
Low Income			-0.00665***	
			(0.000524)	
High Income			0.0160***	
			(0.000738)	
R.O Europe				0.00870
				(0.00769)
USD Peg Period	-0.0279***	-0.0279***	-0.0275***	-0.0279***
	(0.00182)	(0.00182)	(0.00183)	(0.00182)
Constant	0.845***	0.844***	0.847***	0.844***
	(0.0247)	(0.0247)	(0.0248)	(0.0247)
Observations	256956	256956	256956	256956
Within R^2	0.0922	0.0922	0.0922	0.0922
Overall R^2	0.0845	0.0845	0.108	0.0846
Between R^2	0.0519	0.0519	0.0867	0.0521

Note: Robust standard errors are in parenthesis. Asterisk(s) denote(s) the significance level: *** for 1%, ** for 5%, and * for 10%.
Source: Authors' estimation.

Appendix C

Supplementary material for Chapter 3

C.1 List of additional tables and results

Table C.1 displays industry level invoicing shares (in values), with the top three currencies for each industry.

Most industries were almost entirely invoiced in one currency, mostly the U.S. Dollar. Several notable exceptions exist however at the country-industry level. For instance, Brunei exporters are the least users of the U.S. Dollar and most of the products were invoiced in the Singaporean Dollar as follows: wood and raw hides, 99 percent; transportation, 100 percent; stone, glass and metals, 94.8 percent; and machinery (80 percent). This is due to the country currency interchangeability with the Singapore Dollar.

Table C.1: Invoicing Currency by Industry (2004-2016)

Animal & vegetables	% Share
USD	81%
CNY	18%
GBP	0%
Chemicals & Allied Industries	**% Share**
USD	99%
EUR	1%
ZAR	0%
Foodstuffs	**% Share**
USD	75%
MWK	21%
ZAR	2%
Machinery and Electrical	**% Share**
USD	88%
ZAR	7%
JPY	2%
Mineral Products	**% Share**
USD	93%
ZAR	5%
AED	2%
Plastics and Rubbers	**% Share**
USD	97%
ZAR	2%
JPY	0.3%
Stone, Glass, Metals	**% Share**
USD	81%
GBP	15%
ZAR	2%
Textiles, Footwear, Headgear	**% Share**
USD	97%
ZAR	1%
AED	0%
Transportation	**% Share**
USD	74%
JPY	20%
ZAR	4%

Source: Authors' calculation from the Malawi NSO data.

Table C.2 gives the summary statistics of the key variables. The "Ex.Vol Exp.Cur" is the exchange rate volatility between the MWK and the exporters currency; Inv. Cur refers to the invoicing currency of the the product.

Table C.2: Descriptive Statistics of Variables

Variable	#obs	Mean	Median (50 P)	Std.Dev	Min	Max
Ex.Vol Exp.Cur	193225	0.075	0.05920	0.06930	0.00026	2.368
EX Vol Inv. Cur	193169	0.072	0.05970	0.0669849	0.00000	0.993
Ex Vol USD	193225	0.069	0.04892	7.2E-02	0.00000	0.284
Product MS	193,225	79.898	100	34.026	0.00003	100.0
Industry MS	193,225	51.909	64.883	34.538	0.00001	100.0
Overall MS	193,225	38.240	46.401	22.458	0.00010	91.0
Relative Price	193225	0.8741147	1	0.3884754	1.28E-06	4.976
# of s products	193,225	12829.95	12664	6870.188	1	24300

Source: Authors' calculation from the Malawi NSO data.

Table C.3 is the alternative specification with the smaller sample size base on LCP shares in the data. We see that the coefficient on the relative price variable is still consistently negative. In the baseline model, only the China Results have the expected negative and statistically significant signs on the coefficients of the exchange rate volatility and the industry market share.

When we include the dummy for the fixed exchange rate regime, the results still confirm our underlying conclusion from the results. However, for Japan and ROA in both models, a higher market share has a positive impact on local currency pricing, suggesting importers may have some bargaining power with these exporters. This somewhat agrees with finings of L. S. Goldberg and Tille (2016).

Table C.3: Average Marginal Effects for LCP

Baseline Model	China	Japan	ROA
Relative Price	0.000631	-0.00916*	-0.00237*
	(0.00283)	(0.00488)	(0.00136)
Exchange Rate Volatility	-0.0891***	-0.0215	-0.0176
	(0.0323)	(0.0314)	(0.0112)
Industry MS	-0.000155***	0.000187***	0.000104**
	(0.0000557)	(0.0000698)	(0.0000442)
Observations	60708	17674	18996
Alternative Specification	China	Japan	ROA
Relative Price	-0.000888	-0.0243**	-0.00747**
	(0.00349)	(0.0108)	(0.00337)
Ex. Rate Vol	0.291***	-0.11	0.0190**
	(0.0516)	(0.0854)	(0.00927)
Industry MS	-0.000107	0.00200***	0.000295***
	(0.0000659)	(0.000334)	(0.0000789)
Fixed Regime	0.0879***	0.00115	0.0350***
	(0.00774)	(0.0102)	(0.00258)
Observations	60708	17674	18996

Note: Average marginal effects of the panel logit population averaged model are reported. Standard errors are in parenthesis. Asterisk(s) denote(s) the significance level: *** for 1%, ** for 5%, and * for 10%.
Source: Authors' calculation from the Malawi NSO data).

List of Publications and Research Work during PhD

Chapter 1

A version of this chapter co-authored with Prof. K. Sato, Prof. N. Shrestha and Prof. C. Parsons has been:

- Presented at the University of Oxford's CSAE Annual Conference (March 2019). Available at https://custom.cvent.com/4E741122FD8B4A1B97E483EC8BB51CC4/files/9db85b26f4d943828becf299c56590af.pdf
- Presented at the Africa Meeting of Econometric Society (July 2019)
- Is under review with *Review of World Economics (ROWE)*

Chapter 2

A version of this chapter (Job Market Paper) has been:

- Presented at at RIEF Doctoral Meetings in Munich, June 2018
- Presented at ETSG in Warsaw, September 2018. Available at http://www.etsg.org/ETSG2018/papers/233.pdf
- Under review with the *International Journal of Finance and Economics (IJFE)*

Chapter 3

A version of this chapter co-authored with Prof. Kiyotaka Sato has been:

- Presented at JSPS EU-Japan Joint Workshop on Post GFC Integration in East Asia and Europe in France, September 2018 (By Prof Sato)
- Presented at East Asia Economic Association (EAEA) Conference in Taiwan, October 2018
- Published a as a RIETI Discussion Paper No. 19e060, August 2019 available at https://www.rieti.go.jp/jp/publications/dp/19e060.pdf