Unveiling the Ripple Effect: US Monetary Policy and Firm Markups in Emerging Markets

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Abstract

This paper studies the spillovers of US monetary policy on firm markups in emerging market economies (EMEs). Using firm-level data from 22 EMEs spanning 2000 to 2018 and applying the local projections method, I find that contractionary US monetary policy shocks exert a significant and persistent negative impact on firm markups in EMEs. Firms in economies with higher export exposure to the US experience more pronounced and persistent reductions in markups. Additionally, the markup reduction of firms with higher degree of backward global value chain participation is attenuated, while these firms transmit the spillovers to originating value-added firms, highlighting the role of the demand channel. Exporters with higher dollar invoicing ratios experience sharper reductions in markups as local currency depreciation against the US dollar following US monetary tightening reduces trade volumes, underscoring the effect of the exchange rate channel. However, the financial channel, measured by corporate debt held by US investors, has a muted effect on firm markups in EMEs. Notably, exports play a significant role at both the extensive and intensive margins of the demand channel, but only at the extensive margin of the exchange rate channel.

JEL classification: E52, F10, F41, L11

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1 Introduction

The study of firm market power has become an increasingly prominent topic in the literature due to its critical impact on productivity and competitive dynamics. On the one hand, elevated firm market power can distort pricing mechanisms, leading to inefficiencies in resource allocation. This concentration of power can also reduce competitive pressures and productivity growth, as dominant firms have fewer incentives to innovate or improve efficiency. On the other hand, maintaining markups can bolster firms' resilience to external shocks, and in sectors characterized by substantial upfront costs, such as infrastructure and green energy, high markups are essential to secure the returns needed for long-term investments. At the same time, central bank monetary policy plays a crucial role in shaping corporate sector behavior. While a substantial body of research has focused on the financial aspects of firm behavior, such as credit access and investment decisions, the effects of monetary policy on real economic outcomes, particularly on the supply side, remain underexplored.

This paper studies the spillover effect of US monetary policy shocks on firm market power in emerging market economies (EMEs). Using firm-level data of publicly listed firms in 22 EMEs from 2000 to 2018, I estimate firm-level markups and employ the local projections method to evaluate the effect of US monetary policy tightening shocks. The findings indicate that the contractionary US monetary policy shock has a negative and persistent effect on firm markups in EMEs. To understand the underlying mechanisms driving this result, I analyze the potential channels of policy spillovers and assess the compositional effect of each characteristic. Additionally, I explore the regional heterogeneity in markup responses, investigating how these effects vary across different geographical regions.

I start by estimating firm-level markups using the balance sheet data of 22 EMEs over 19 years from Worldscope using a production function approach, as proposed by De Loecker and Warzynski (2012). Considering a translog production function of capital stock and variable inputs, I employ the GMM method to estimate a non-parametric function and derive firm-specific, time-varying output elasticities of variable inputs. I then use firm balance sheet data to calculate the markups. Over the sample period, I observe that aggregate firm markups in EMEs remain relatively stable, with some degree of dispersion. Next, I apply a high-frequency event-study approach following Gürkaynak et al. (2005) and Gorodnichenko and Weber (2016) to identify US monetary policy shocks and employ the local projections method following Jordà (2005) to conduct my empirical analysis.

Applying the panel local projections estimation method, I find that the contractionary US

monetary policy shock exerts a negative and persistent effect on firm markups in EMEs. Building on this finding, I investigate the potential mechanisms of policy spillovers. First, I construct the indicator of export exposure to the US by calculating the ratio of value added origin of final demand by the US relative to the global final demand. The result reveals that firms in economies with higher export exposure to the US exhibit more pronounced and persistent markup reductions in response to US monetary tightening, highlighting the role of the *demand channel* of US monetary policy spillovers. Within high-export exposure economies, non-exporting firms experience larger reductions in markups than exporting firms, suggesting that exporters, in response to demand shocks, redirect their focus to domestic markets, intensifying competition and disproportionately affecting non-exporters. Another indicator of the demand channel is the backward global value chain (GVC) participation and it captures the exposure of final-goods producing firms that rely on foreign value added. Empirical results show that firms, particularly exporters, in economies with higher backward GVC participation reduce their own markups in a smaller magnitude as a result of reduced marginal costs of foreign inputs in production. At the same time, they transmit US monetary policy spillovers to the originating value-added firms within the supply chain. When narrowing the analysis to exporters, I find that exports significantly influence firm responses at both the extensive and intensive margins. Specifically, firms with higher export intensity exhibit greater sensitivity to US monetary tightening shocks in economies with higher export exposure to the US and greater backward GVC participation.

Second, I find that exporting firms with higher ratios of US dollar invoicing in exports experience significant markup reductions following US monetary policy tightening, while those with lower dollar invoicing ratios see little change. This effect arises as local currency depreciation against the US dollar after US monetary tightening raises the price of dollar-denominated exports, prompting exporters to lower prices and thus markups in response. This heterogeneity underscores the importance of the *exchange rate channel* in transmitting policy effects. In addition, firm's export intensity does not further influence markup responses in economies with higher dollar invoicing ratio of exports, suggesting that the exchange rate channel affects exporters based on invoicing practices rather than export scale. Notably, I find no evidence of heterogeneity in markup responses based on firms' debt linkage with the US, suggesting a muted role for the *financial channel* in this context.

Next, I assess the compositional effects of these characteristics using the Kitagawa-Blinder-Oaxaca (KBO) decomposition (Kitagawa (1955), Blinder (1973), and Oaxaca (1973)) method in the local projections specification introduced by Cloyne et al. (2023). Among the characteristics analyzed, the export exposure to the US plays a dominant role in firm markup responses to US

monetary tightening. This finding suggests that the international transmission of contractionary US monetary policy shocks to firm markups in EMEs primarily occurs through the demand channel. Quantitatively, in the fourth quarter after a 25bps US monetary tightening shock, a 1pp increase in US export exposure from the mean leads to an average reduction of 0.023pp in firm markups. As for the exchange rate channel, while the dollar invoicing ratio of exports drives significant heterogeneity in firm markup responses, the magnitude is much smaller compared with the demand channel, with a 1pp increase in the dollar invoicing ratio reducing firm markups by only 0.001pp in the fourth quarter after a 25bps US monetary tightening shock.

I further explore the regional heterogeneity in firm markup responses to contractionary US monetary policy shocks by grouping the sample into three regions: Asia, the Americas, and EMEA[1]. The dynamic results reveal that firms in emerging Asia and the Americas significantly reduce their markups following US monetary tightening, with the effect being more persistent for firms in emerging Asia in later quarters. In contrast, firms in emerging EMEA exhibit no significant changes in markups. Both the demand channel, captured by the export exposure to the US and backward GVC participation, and the exchange rate channel, reflected in the dollar invoicing ratio of exports, contribute to explaining the regional heterogeneity in markup responses. However, a distinct regional effect emerges between Asia and the Americas, partially explaining the divergence in markup responses in the later quarters following the policy tightening. This remaining heterogeneity between Asia and the Americas is largely attributable to the differences in exchange rate regimes across these economies.

Related Literature. This paper contributes to several strands of literature. First, this paper is related to the limited body of work that examines the relationship between monetary policy and firm markups. Baqaee et al. (2021) focus on the supply-side effects of monetary policy, arguing that contractionary monetary shocks lead to a deleterious reallocation of inputs across firms using US firm-level data. Duval et al. (2021) show that firm market power dampens the output response to monetary policy shocks, using firm-level data of the United States and a large cross-country firm-level dataset of advanced economies. Similarly, Ferrando et al. (2021) find that firms with more market power are less responsive to monetary policy shocks using firm-level data from the euro area. Another two papers by Meier and Reinelt (2022) and Chiavari et al. (2022) investigate the US firm markup responses to US monetary policy. Morlacco and Zeke (2021) investigate the interaction between interest rates, customer capital, and market power using evidence for the US economy. Compare with these papers, and to the

[1]EMEA includes emerging market economies in Europe, the Middle East and Africa.

best of my knowledge, this paper is the first paper that brings novel empirical evidence on the US monetary policy spillovers to firm-level markups in EMEs and examines the transmission mechanisms.

Second, this paper contributes to the literature of firm markup estimations. De Loecker and Warzynski (2012) propose a method to estimate firm-level markups using a production function approach, assuming Hicks-neutral productivity that evolves following a Markov process. Basu (2019) and Raval (2023b) review various markup estimation methods and argue that the estimation using De Loecker and Warzynski (2012) might be biased because due to its assumption that output elasticity remains constant over time[2]. More recently[3], Traina (2018) adjusts the measure of non-capital inputs to estimate markups. Demirer (2022) proposes a non-parametric control function approach incorporating labor-augmenting productivity to estimate firm-level markups. This paper contributes by applying a translog production function approach to the estimation method proposed by De Loecker and Warzynski (2012), allowing for the estimation of time-varying firm-level output elasticities, thereby introducing greater flexibility in the analysis.

Third, there is a growing body of literature studying the implications of firm market power. De Loecker and Eeckhout (2018) argue that technological innovation and changes in market structure have driven the rise in firm market power. Diez et al. (2018) and Díez et al. (2021) estimate the global evolution of firm markups and explore how this trend relates to firm investment, innovation, and other characteristics. De Loecker et al. (2020) find the rise of firm market power in the US and investigate its macroeconomic implications. Additionally, De Ridder (2024) argues that the rise of firm market power can be explained by the rise of intangible inputs. This paper adds to the literature by examining an international context, focusing on how external policy shocks, such as US monetary tightening, influence firm market power.

This paper is also related to the literature on monetary policy transmission. Starting from the domestic transmission of monetary policy, Ferrando et al. (2019) and Morais et al. (2019) focus on the bank lending channel of monetary policy on firms. Jeenas (2018) and Jungherr et al. (2022) examines the effect of US monetary policy on US firms' investment behavior. Akinci and Queralto (2018) and Kalemli-Özcan (2019), on the other hand, investigate the international transmission of US monetary policy. This paper contributes to the literature by focusing on the supply-side effects (Baqaee et al. (2021)) of US monetary policy spillovers on

[2]De Ridder et al. (2022) argue that markup estimates based on revenue data can be biased compared with estimates using production data, though the latter requires detailed information on product prices.

[3]Doraszelski and Jaumandreu (2019) propose a dynamic panel estimator for markups, but this method requires data on the quantity produced.

publicly listed firms in EMEs.

The paper proceeds as follows. Section 2 presents the motivation that guides the research design for the analysis. Section 3 describes the data and provides summary statistics. Section 4 presents the empirical methodologies. Section 5 explores the baseline results. Section 6 investigates the transmission channels and Section 7 explores the heterogeneity across regions. Section 8 concludes.

2 Theoretical Motivation

In this section, I build on the existing literature and establish the framework for the empirical analysis. Drawing on the channels of US monetary policy spillovers, I make testable hypotheses regarding the potential heterogeneous responses of EME firm markups to the changes in US monetary policy.

A substantial body of literature has focused on the mechanisms through which US monetary policy affects the rest of the world. Standard open-economy models assume that US monetary policy affects foreign economies through three channels (Ammer et al. (2016)). The first channel operates through *aggregate demand*. When US monetary policy tightens, the resulting contraction in US aggregate demand reduces imports of foreign goods, thereby dampening economic activity abroad. Exporting firms in emerging markets are directly affected by this decline in US demand. Additionally, firms integrated into global value chains are indirectly exposed to these demand effects. For example, a final-goods producer engaged in backward global value chains not only faces reduced demand for its exports to the US but may also pass on this decreased demand to intermediate-goods suppliers, further amplifying the demand contraction along the supply chain.

The second channel is the *exchange rate channel*. An unexpected increase in US interest rates relative to foreign rates often leads to an appreciation of the US dollar. In the presence of price rigidities, nominal exchange rate fluctuations alter relative prices, consequently influencing real economic variables in the rest of the world. Under the dominant currency pricing paradigm (Gopinath et al. (2020)), where the US dollar is widely used for invoicing, bilateral trade between non-US countries becomes more vulnerable to the dollar exchange rate movements. Following US monetary tightening, the US dollar appreciates, US import prices fall, and global trade, as well as trade among other economies, declines[4].

[4]Gopinath et al. (2020) develop an open-economy model that incorporates three key features to support this finding: pricing in a dominant currency, strategic complementarities in pricing, and imported input use in production.

The third channel is the *financial channel*. Following a contractionary US monetary policy shock, longer-term US yields rise, attracting international investors to rebalance their portfolios away from foreign assets towards US assets. This capital outflow tightens foreign financial conditions (Rey (2015), Iacoviello and Navarro (2019), and Kalemli-Özcan (2019)), as credit availability diminishes and borrowing costs rise. This phenomenon is particularly pronounced in EMEs, where firms often rely heavily on foreign capital for financing investment and operations. As foreign investors withdraw capital, domestic interest rates in EMEs tend to rise, leading to tighter credit conditions and reduced access to external financing for firms.

Recent literature has increasingly focused on studying firm market power[5]. One area of research focuses on firm markups as a measure of market power, exploring their correlated characteristics and the determinants of markups[6]. De Loecker and Warzynski (2012) explore the relationship between markups and exporting behavior using data from Slovenian manufacturing firms and find that exporters tend to charge higher markups on average. Berman et al. (2012) analyze how French exporting firms respond to exchange rate fluctuations and find that high-performance firms react to currency depreciation by increasing their markups.

Given the outstanding role of the exporting behavior in shaping firm market power, a key question arises: Does US monetary policy affect EME firm market power and is the spillover effect heterogeneous with exporting status? To begin addressing this question and activate my analysis, I first examine firm profitability as a broad measure of market power, analyzing its evolution in response to US monetary policy. I then narrow the focus to firm markups, which serve as a direct measure of market power and provide insights into competitive dynamics. This analysis forms the basis for discussing potential mechanisms and developing testable hypotheses on firm markup responses to US monetary policy.

Firm profitability is measured using the gross profit margin, calculated as the ratio of gross income to firm sales using firm income statement data. Figure 1 presents the aggregate firm profitability for 22 emerging market economies[7] from 2000 to 2022. Over the past two decades, the aggregate firm profitability in EMEs has declined significantly, from 0.7 in 2000 to 0.2 in 2022, as shown in panel (a). During three distinct episodes of US monetary policy tightening

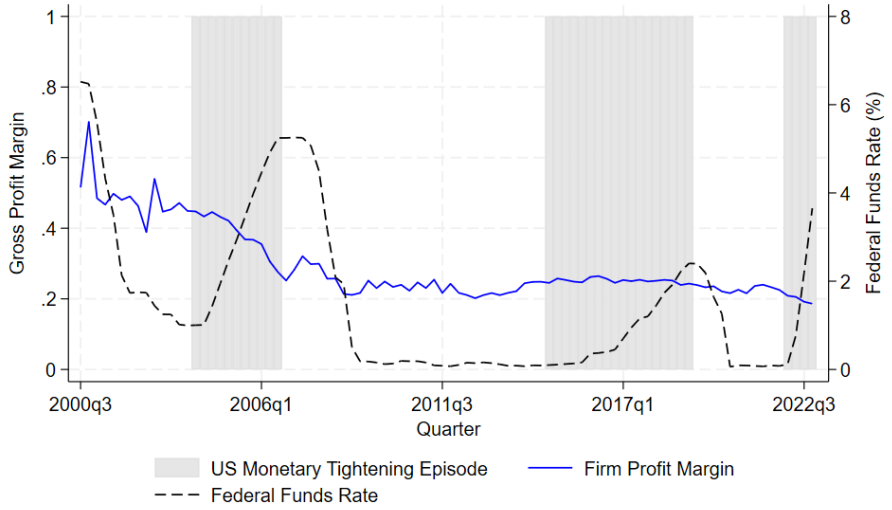
[5]Recent research use firm-level markup as a measure of firm market power. De Loecker and Warzynski (2012), Traina (2018), Basu (2019), and Demirer (2022) focus on the estimation method of firm markup, De Loecker and Eeckhout (2018) explore the global market power and De Loecker et al. (2020) study the rise of US firm market power and implications.

[6]De Ridder (2024) constructs a endogenous growth model with creative destruction and intangible inputs and find the positive effect of R&D expenditures on firm markups. In Appendix B, I show that the markup response of EME firms to US monetary policy is not heterogeneous with R&D expenditure.

[7]Emerging market economies include Argentina, Bangladesh, Brazil, Chile, China, Colombia, Hungary, India, Indonesia, Malaysia, Mexico, Morocco, Pakistan, Peru, Philippines, Poland, Romania, Russia, South Africa, Thailand, Turkey, and Ukraine.

(indicated by gray shaded areas), the aggregate firm profitability declined markedly in 2004–2006 and 2022. However, it remained relatively stable between 2015 and 2019, hovering around 0.23.

(a) Aggregate Firm Profitability



(b) Exporters vs. Non-Exporters

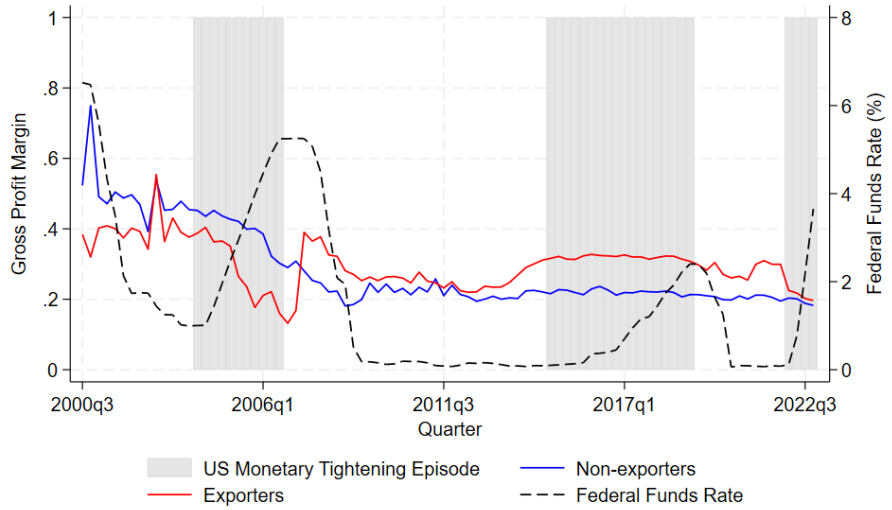


Figure 1: Aggregate Firm Profitability in Emerging Market Economies

Note: This figure shows the aggregate firm profitability of 22 emerging market economies weighted by firm sales. The gray shaded area represents the period of US monetary tightening episodes. The black dashed line represents the US federal funds rate, which is obtained from FRED.

Further disaggregation of firm profitability by exporting status is reported in panel (b) of Figure 1. Comparing the aggregate profitability of exporting firms with non-exporting firms reveals notable patterns. Exporters' profitability declined less than that of non-exporters on average. Interestingly, in 2007, EME exporters' profitability surged and surpassed that of non-exporters, maintaining this lead thereafter. However, during the US monetary tightening episodes of 2004–2006 and 2022, exporters' profitability experienced a larger decline compared to non-exporters. These findings underscore the critical role of exports in firm market power,

particularly during the periods of external monetary shocks.

When US monetary policy tightens, the demand for imports from the rest of the world decreases, prompting exporters to adjust their pricing strategies, which in turn affects their markups. Exporting firms may also shift their focus toward domestic markets, and as competition intensifies, non-exporters may be pressured to reduce their markups. Firms involved in global value chains can also see their markups impacted by the decline in global demand. In terms of the exchange rate channel, the spillover effects extend beyond US trading partners to non-US trading partner countries where the US dollar represents a significant share of export invoicing currencies. In these economies, exporting firms are particularly vulnerable to US monetary policy, which can have a pronounced effect on their markups. The financial channel may affect EME firm markups by altering firms' investment decisions and pricing strategies. Firms facing a credit supply shock may raise prices in order to raise cash holding and hoard internal liquidity, thereby boosting short-term profits at the expense of future market share (Renkin and Züllig (2021)). In response to US monetary tightening, firms might initially increase markups to preserve liquidity but later reduce them due to the long-term loss of market share.

To summarize the mechanisms discussed earlier, I make four testable hypotheses and examine them in the following sections:

H1. *Following US monetary tightening, firms with higher export exposure to the US will reduce markups in a larger magnitude compared to firms with lower export exposure.*

H2. *Firms with higher degree of global value chain participation will experience greater reductions in markups in response to US monetary tightening.*

H3. *In response to US monetary tightening, exporting firms with a higher US dollar invoicing ratio of exports will reduce markups compared with exporting firms having a lower dollar invoicing ratio.*

H4. *Following US monetary tightening, firm markup responses will be heterogeneous with the ratio of dollar-denominated debt.*

3 Data

In this section, I describe the dataset used for the empirical analysis and present descriptive statistics for the main variables of interest.

3.1 Firm-Level Data

I use quarterly firm-level data of publicly listed firms in 22 EMEs[8] obtained from Worldscope. While Worldscope provides firm balance sheet and income statement data starting from 1980, publicly listed firms in EMEs have only emerged since 2000. To align with the US monetary policy shocks data (as detailed in the next section), the year coverage of the final dataset is from 2000 Q1 to 2018 Q4. After excluding firms in the sector of finance, insurance, and real estate[9], the final sample consists of 11,467 non-financial firms across 22 EMEs. To validate the empirical studies, I focus on the firms that are currently active. For comparability across economies, the dataset is deflated, adjusted for purchasing power parity (PPP), and expressed in real US dollars. Further details on sample selection and data construction can be found in the Appendix A.

Turning to firm characteristics, I include variables such as firm age, number of employees, leverage, sales, total assets, and cash holding ratio in the empirical analysis. Firm leverage is measured as the ratio of total debt relative to total assets, and cash holding ratio is defined as the ratio of cash holdings and equivalents relative to total assets. Additionally, I incorporate variables such as liquidity (cash holdings and equivalents divided by total liabilities) and sales growth. To measure firm capital stock, I follow De Loecker et al. (2020) and Demirer (2022), using the gross value of property, plants, and equipment (PPEGT)[10]. Table 1 reports the summary statistics for the main variables used in the empirical analysis.

Table 1: Summary Statistics of Firm-Level Variables

Variable	Mean	Std. dev	Median	Observations
Sales	606.63	3,978.82	78.58	410,436
COGS	440.34	3,013.06	54.69	408,815
SGA	74.89	483.96	11.19	312,894
Total assets	3,090.77	15,815.71	490.60	410,345
Capital stock	1,974.92	16,946.12	177.18	410,436
Total debt	953.08	4,837.04	777.99	410,310
Leverage	0.27	7.95	0.20	410,284
Age	22.09	9.29	22	410,436
Nb. employees	5,648.91	19,966.37	1,472	350,202

Note: COGS stands for the cost of goods sold and SGA stands for selling, general, and administrative expenses. Firm sales, COGS, SGA, total assets, capital stock, and total debt are measured in millions of real 2010 US dollars. Firm leverage is a ratio and firm age is in years.

[8]Emerging market economies include Argentina, Bangladesh, Brazil, Chile, China, Colombia, Hungary, India, Indonesia, Malaysia, Mexico, Morocco, Pakistan, Peru, Philippines, Poland, Romania, Russia, South Africa, Thailand, Turkey, and Ukraine.

[9]Financial firms often operate as intermediaries instead of direct participants on production or trade markets. Therefore, these firms are excluded from the sample.

[10]Other studies, including Traina (2018), Meier and Reinelt (2022), and Hubmer and Restrepo (2023), use the perpetual inventory method to measure capital stock.

Since Worldscope data only covers publicly listed firms, it is important to assess how representative the sample is relative to the entire corporate sector and the aggregate economy. Table A.2 reports the sample coverage of each economy at annual level. The sample coverage is calculated as the percentage of firms' aggregate output (measured by sales) relative to each economy's annual GDP[11].

3.2 Macro-Level Data

There are multiple country- and sector-level datasets used in this paper. Exchange rate, GDP, and GDP deflator data are obtained from the IMF International Financial Statistics (IFS) Database. The monetary policy rates data of EMEs is obtained from central banks and BIS database, and purchasing power parity (PPP) data is obtained from the World Bank database. US GDP growth data is obtained from FRED. Additionally, I employ the Trade in Value-Added (TiVA) Database developed by the OECD. The composition of goods and services purchased globally are composed of inputs from numerous countries. However, traditional measures of international trade often fail to capture the intricate flows within global production chains. TiVA Database addresses this issue by accounting for the value added by each country in the production of goods and services consumed internationally. Among the indicators in TiVA Database, I use the backward GVC participation and the value added origin of final demand measures in the empirical analysis[12]. Detailed explanation of these variables is discussed in Section 4. Export volume data is sourced from UN Comtrade, trade invoicing currency composition data is downloaded from Boz et al. (2022), and the data of corporate debt holding of US investors is obtained from Coppola et al. (2021). Table 2 provides a full list of variables and data sources.

4 Empirical Framework

In this section, I present the construction of firm-level markups and examine the evolution of aggregate markups, along with markup distribution across countries and sectors. Then I describe the construction of key indicators, the identification of US monetary policy shocks and econometric specifications for the empirical analysis.

[11] Among the 22 EMEs, the sample coverage is particularly high in Chile, China, India, Malaysia, the Philippines, Russia, South Africa, and Thailand.

[12] Forward global value chain (GVC) participation is not included in the main analysis as it is a similar indicator capturing the export exposure. Empirical results using forward GVC participation index are presented in Appendix B.

Table 2: Data Sources of Macro-Level Indicators

Variable	Data Source
Exchange rate	IFS
GDP	IFS
GDP deflator	IFS
Monetary policy rates of EMEs	BIS, central banks
Purchasing power parity	World Bank
GVC participation	OECD TiVA
Debt holding of US investors	Coppola et al. (2021)
Trade invoicing currency composition	Boz et al. (2022)
Gross exports	UN Comtrade
Value added origin of final demand	OECD TiVA
EME inflation rate	World Bank

4.1 Markup Estimation

To measure firm-level markups, I follow the approach outlined by De Loecker and Warzynski (2012) and De Loecker et al. (2020). The markup estimator is derived using a production function approach by solving firm's cost minimization problem.

Consider a firm i at time t produces output using the following production technology

$$Q_{it} = Q_{it}(X_{it}^1, \ldots, X_{it}^V, K_{it}, \omega_{it}), \tag{1}$$

where $X_{it}^1, \ldots, X_{it}^V$ are variable inputs of production such as labor and intermediate inputs. K_{it} denotes capital stock and ω_{it} is firm i's productivity at time t.

Assume producers are cost minimizing, then the output elasticity of variable input X_{it}^v can be expressed as follows

$$\frac{\partial Q_{it}(\cdot)}{\partial X_{it}^v}\frac{X_{it}^v}{Q_{it}} = \frac{1}{\lambda_{it}}\frac{P_{it}^{X^v} X_{it}^v}{Q_{it}}, \tag{2}$$

where λ_{it} denotes the Lagrangian multiplier of the cost minimization problem and represents the marginal cost of production.

Given that firm i's markup is defined as the ratio of price over marginal cost $\mu_{it} \triangleq \frac{P_{it}}{\lambda_{it}}$, equation (2) can be rewritten as

$$\begin{aligned} \theta_{it}^X &= \mu_{it}\frac{P_{it}^X X_{it}}{P_{it}Q_{it}} \\ &= \mu_{it}\alpha_{it}^X, \end{aligned} \tag{3}$$

where θ_{it}^X is the output elasticity on input X and α_{it}^X is the share of input X's expenditure in total sales. Therefore, in order to estimate firm markup, one needs data on expenditure share and output elasticity of the variable input. The expenditure share α_{it}^X can be estimated by the ratio of cost of goods sold and sales at the firm and time level.

In order to estimate the output elasticity θ_{it}^X, De Loecker and Warzynski (2012) consider the production function with a scalar Hicks-neutral productivity term and with common technology parameters across the set of producers in an industry and obtain the output elasticity of input X at industry level $\hat{\theta}_{st}^X$. Then the markup μ_{it} is computed as

$$\mu_{it} = \frac{\hat{\theta}_{st}^X}{\alpha_{it}^X}. \tag{4}$$

Two key assumptions are made by De Loecker and Warzynski (2012), that is, Hicks neutrality[13] and common technology parameters[14] across producers within a sector. Hicks-neutral productivity implies that technological advancements increase the marginal productivity of labor and capital proportionally. Recent literature has been discussing this assumption and the potential bias it may introduce. Raval (2023b) using manufacturing firm datasets from multiple countries, finds that the substantial firm-level heterogeneity in input ratios is inconsistent with a Hicks-neutral production function. To account for non-neutral productivity, Demirer (2022) proposes a non-parametric production function estimation approach that includes factor-augmenting productivity and Hicks-neutral productivity to estimate firm-level markups. Demirer (2022) also empirically shows that neglecting factor-augmenting productivity leads to mismeasurement of output elasticities and markups.

The second assumption is that firms within the same sector share the same technology level and, consequently, have identical output elasticities. This approach is potentially misleading as output elasticities may vary across firms and over time. Foster et al. (2022) and Raval (2023b) argue that accounting for greater heterogeneity in technology within the same sector is needed when estimating markups using the production function approach. Basu (2019) further argues that the output elasticities should be calculated at the firm level. Foster et al. (2022) use the method proposed by De Loecker and Warzynski (2012) but estimate output elasticities with varying degrees of flexibility across sectors and over time.

To address the potential estimation bias and account for the heterogeneity in production technology across firms within a sector, I assume that the output elasticites of variable inputs are heterogeneous across firms and time-varying. While firms within the same sector in each economy share a common technology level, they differ in productivity and optimally chosen inputs in any given year. Specifically, I consider a translog production function of capital stock

[13] A change is considered Hicks neutral if it does not affect the balance between capital and labor in the production function.

[14] De Loecker and Eeckhout (2018) argue that firms and therefore countries vary in their TFP and the chosen inputs, but not in the technology, which is common across firms within a sector in a given year.

and variable inputs

$$y_{it} = \beta_k k_{it} + \beta_v v_{it} + \beta_{kk} k_{it}^2 + \beta_{vv} v_{it}^2 + \beta_{kv} k_{it} v_{it} + \omega_{it} + \epsilon_{it}, \tag{5}$$

where k_{it} is logged capital stock, v_{it} is logged variable inputs composed of labor and materials. ω_{it} represents firm's productivity. Following Diez et al. (2018), I assume the variable inputs depend on capital stock and productivity, that is, $v_{it} = \phi(\omega_{it}, k_{it})$. Therefore, equation (5) can be written as

$$\begin{aligned} y_{it} &= \beta_k k_{it} + \beta_v v_{it} + \beta_{kk} k_{it}^2 + \beta_{vv} v_{it}^2 + \beta_{kv} k_{it} v_{it} + \phi^{-1}(v_{it}, k_{it}) + \epsilon_{it} \\ &= \psi_t(v_{it}, k_{it}) + \epsilon_{it}. \end{aligned} \tag{6}$$

The estimation procedure consists of two steps. In the first step, I run a non-parametric estimation

$$y_{it} = \psi_t(v_{it}, k_{it}) + \epsilon_{it} \tag{7}$$

and obtain the expected output $\hat{\psi}_{it}$. In the second step, assume that the law of motion for productivity takes the following form

$$\omega_{it} = g(\omega_{it-1}) + \xi_{it}, \tag{8}$$

where $g(\cdot)$ is an unknown function and the equation allows for the potential of additional decision variables to affect current productivity outcomes, in addition to the standard inclusion of previous productivity. Given the estimated output obtained from the first step

$$\omega_{it}(\beta) = \hat{\psi}_{it} - \beta_k k_{it} - \beta_v v_{it} - \beta_{kk} k_{it}^2 - \beta_{vv} v_{it}^2 - \beta_{kv} k_{it} v_{it}, \tag{9}$$

I estimate equation (8) using third-degree polynomial approximations and obtain the estimated productivity $\hat{\omega}_{it}$ and the innovation to productivity $\xi_{it}(\beta)$.

Then I construct moments to obtain the estimates of the production function

$$E \begin{bmatrix} \xi_{it}(\beta) k_{it} \\ \xi_{it}(\beta) v_{it-1} \\ \xi_{it}(\beta) k_{it}^2 \\ \xi_{it}(\beta) v_{it-1}^2 \\ \xi_{it}(\beta) k_{it} v_{it-1} \end{bmatrix} = 0. \tag{10}$$

In the moment conditions, I rely on the lagged variable inputs to identify the coefficients, as current variable inputs are expected to react to productivity shocks, and therefore, $E(\xi_{it}(\beta)v_{it})$ is expected to be nonzero.

Given the small sample size of each sector within each market, I assume that the production function of EME firms in a given sector remains constant over time, and I estimate the production function parameters, β's at the sector level. However, since the production function takes a translog form, the output elasticity of variable input V $\theta_{it}^{V} = \beta_v + 2\beta_{vv}v_{it} + \beta_{kv}k_{it}$ remains heterogeneous and time-varying at the firm level. This allows the model to capture variations in productivity across firms and over time.

Building on the estimates of output elasticities, I follow Traina (2018) to construct the revenue share of variable inputs, accounting for both Cost of Goods Sold (COGS) and Selling, General, and Administrative Expenses (SGA)[15]. Therefore, the firm markup can be written as

$$\mu_{it} = \hat{\theta}_{it}^{V} \times \frac{Sales_{it}}{COGS_{it} + SGA_{it}}. \tag{11}$$

Figure 2 reports the evolution of firm markups in EMEs. The red solid line represents the average markup weighted by firm sales and the lightblue boxes present the boxplots of markup distributions over the sample period. Overall, markups exhibit modest fluctuations, with the weighted average around 1.25 and the median around 1.1 throughout the sample period. The distribution of firm markups in EMEs between 2001 and 2004 is relatively more dispersed compared to other years. However, there has been a contraction in markup dispersion since 2012, with aggregate markups remaining relatively stable from 2012 through the end of the sample period. In contrast to the rising firm markups in the United States, as documented by De Loecker et al. (2020) (ranges from 1.47 in 2000 to 1.61 in 2016), aggregate firm markups in EMEs are lower and do not exhibit an upward trend over time. This result aligns with the findings of Diez et al. (2018), which suggest that the increase in markups has primarily occurred in advanced economies, with less evidence of rising markups in EMEs.

Figures A.3 and A.4 break down the evolution of markups by economy, presenting both the sales-weighted average markups (represented by the red solid line) and the corresponding boxplots. There is noticeable heterogeneity in the evolution of markups across countries. In economies such as Morocco, Romania, Russia, Ukraine, and Brazil, aggregate markups show an

[15]Traina (2018) argues that there is a missing feature of the markup calculation in De Loecker and Warzynski (2012) that is the part of operating costs attributable to getting the product to the consumer. Traina (2018) further proposes that Selling, General and Administrative Expenses (SGA) should be included when calculating the expenditure share of variable inputs in total sales.

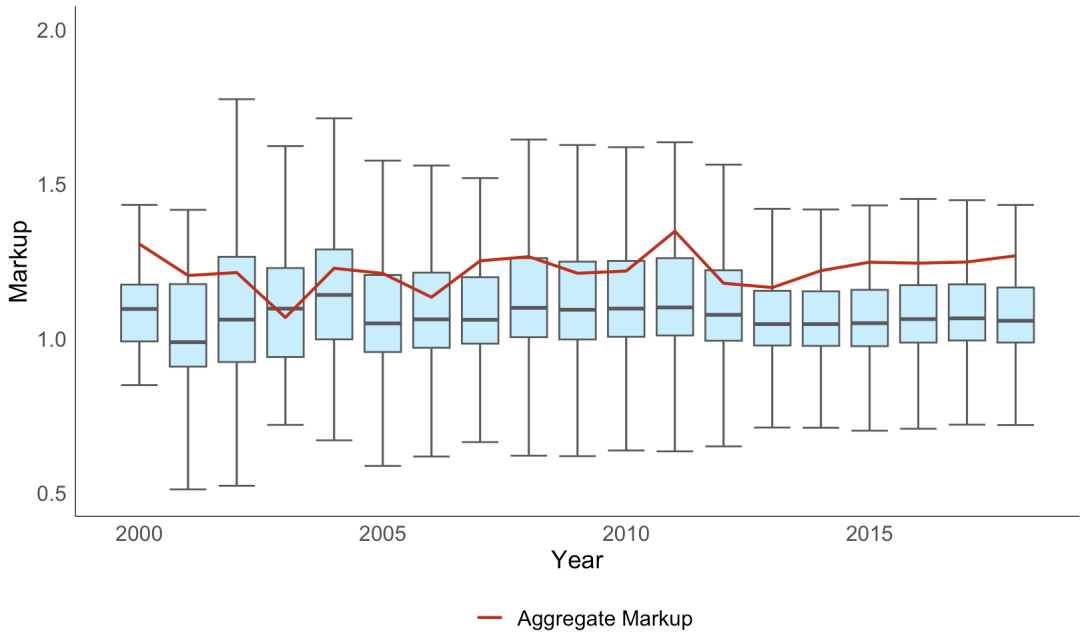


Figure 2: Evolution of Firm Markups in EMEs

Note: The red solid line represents the average markup weighted by firm sales across 22 EMEs. The lightblue boxes are the boxplots of markup distributions over the sample period, with the median markup represented by the central line within each box. Within each quarter and each market, firm markups are winsorized at the 1% and 99% cutoff to avoid any outliers.

upward trend over the sample period, While in other EMEs such as Thailand, Chile, and South Africa, aggregate markups remain relatively stable over time. Moreover, the distribution of markups, as represented by the boxplots, reveals that some economies, such as Brazil, China, and Colombia, experienced more dispersed markups in the early years of the sample, while this dispersion contracted over time, indicating a convergence in firm behavior within these economies.

The evolution of markups by sector in EMEs is presented in Figure A.5. Among the eight sectors classified by firms' SIC codes, the aggregate markup in mining is notably higher than in other sectors, with an upward trend from 0.62 in 2001 to 2.35 in 2018. In contrast, markups in the manufacturing sector remain stable over time, with an average of 1.16 throughout the sample period. Other sectors, such as construction, retail trade, and services, also display stable markups, with no significant upward or downward trends.

As reported in Figure A.1, exporters have consistently maintained higher markups than non-exporters since 2013, with the gap widening over time. This trend suggests that exporters, particularly those involved in global trade, possess stronger pricing power relative to non-exporters[16]. However, during the Great Trade Collapse and US monetary tightening periods, the markups of exporters exhibited more pronounced declines compared to non-exporters. This

[16]This result is also in line with the finding in De Loecker and Warzynski (2012).

positive correlation between export activity and markups highlights the importance of external demand in shaping firm pricing behavior in EMEs.

4.2 Monetary Policy Shocks

I identify monetary policy shocks using the high-frequency event-study approach pioneered by Cook and Hahn (1989). This method employs high-frequency movements in financial markets around Federal Open Market Committee (FOMC) meetings and makes inference about the unexpected components of monetary policy announcements. The high-frequency approach make fewer assumptions when identifying shocks than other approaches. Following Gürkaynak et al. (2005) and Gorodnichenko and Weber (2016), the US monetary policy shock is constructed as

$$e_t^{MP} = \frac{D}{D-t}(ffr_{t+\Delta^+} - ffr_{t-\Delta^-}), \tag{12}$$

where $ffr_{t+\Delta^+}$ denotes the Federal Funds futures rate shortly after the FOMC announcement time t and $ffr_{t-\Delta^-}$ denotes the Federal Funds futures rate shortly before the announcement. I restrict the time window to fifteen minutes before the announcement and forty-five minutes after the announcement. D is the number of days in the month and $\frac{D}{D-t}$ adjusts for the fact that the Federal Funds futures settle on the average effective overnight Federal Funds rate. Using the monetary shocks data from Gürkaynak et al. (2021) and given the limited number of publicly listed firms in EMEs before 2000, I restrict my sample period to 2000 Q1–2018 Q4.

To synchronize with the quarterly firm-level data from Worldscope, I aggregate the high-frequency monetary policy shocks to a quarterly frequency. Specifically, I sum up the monetary policy shocks within each quarter to yield a quarterly measure of shocks, denoted as ε_t^{MP}, and then merge with the firm-level data.

4.3 Construction of Indicators

4.3.1 Export Exposure to the US

To measure the export exposure to the US, I construct two indicators. The first indicator is derived from the gross exports data from UN Comtrade and takes the form

$$\text{EXtoUS}_{c,y} = \frac{\text{Gross Exports to US}_{c,y}}{\text{Total Gross Exports}_{c,y}}. \tag{13}$$

Here, I calculate the ratio of exports from country c to the US relative to the total exports of country c in year y. This measure directly reflects the extent of a country's export exposure to the US in terms of gross exports.

Given the fact that there is a large amount of intermediate goods traded and these imported inputs are often used in final goods production and re-exported to third markets, gross exports exposure $\text{EXtoUS}_{c,y}$ does not fully capture country c's exposure to the US in terms of exports. To address this limitation, I introduce a second indicator that incorporates the global supply chain by considering the origin of value added in final demand. This measure provides estimates of the value added in final demand for country p, broken down by the value added generated by the source country c for final goods and services. Figure 3 provides an illustrative diagram of the value added origin of final demand.

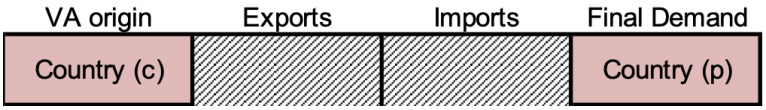


Figure 3: Illustrative Diagram of the Value Added Origin of Final Demand
Source: Guide to OECD Trade in Value Added (TiVA) Indicators, 2023 edition.

This indicator provides a more comprehensive measure of country c's export exposure to the US within the context of the global value chain. To construct this indicator, I use data from OECD Trade in Value Added (TiVA) Database. I calculate the ratio of the value added in final demand originating from country c that is destined for the US, relative to the total value added destined for global final demand, using the following expression

$$\text{FDVAbyUS}_{c,y} = \frac{\text{FDVA by US}_{c,y}}{\text{FDVA by World}_{c,y}}, \tag{14}$$

where $\text{FDVAbyUS}_{c,y}$ captures country c's exposure to the US in terms of original value added. Compared with the first indicator, this measure accounts for the export component that is included in global supply chain, providing a more comprehensive assessment of a country's export exposure. The time series and description of the original value added ratio of final demand in the US at the aggregate level are reported in Appendix A.4.

4.3.2 Global Value Chain Participation

The indicator of value added origin of final demand measures the export exposure to the US by focusing on the country of origin for value added. However, it does not capture a country's exposure to the US as an importer of intermediate goods that are used to produce final goods

for export to the US. To examine the role of the global value chain (GVC) participation, I use the data from The Trade in Value-Added (TiVA) Database developed by OECD, which provides a broad range of indicators on the value-added components of gross exports and levels of GVC participation by economy and year. In this paper, I focus on the backward GVC participation to capture the foreign import component in exports. Backward GVC participation is measured by the share of foreign value added in a country c's gross exports to the world and is often referred to as the import content of exports[17]. Specifically, the backward GVC participation index is expressed as follows

$$\text{GVCbackward}_{c,y} = \frac{\text{Foreign value added}_{c,y}}{\text{Gross exports}_{c,y}}. \tag{15}$$

The time series of backward GVC participation is reported in Figure A.7, with median value of backward GVC participation increasing slightly over the sample period from 0.15 in 2000 to 0.19 in 2018.

4.3.3 Dollar Invoicing of Exports

Another key channel of US monetary policy spillovers operates through the exchange rate, particularly via trade—the *exchange rate channel*. US dollars are widely used as the invoicing currency in international trade, even in cases where the United States is not directly involved as a trading partner. This phenomenon is named as the "dominant currency pricing" paradigm (DCP)[18]. Gopinath (2015) and Boz et al. (2022) find that more than 40% of global trade is invoiced in US dollars, while the United States accounts for less than 10% of global trade as a direct trading partner. Due to the absence of granular invoicing currency data at the trade level, I use the dataset from Boz et al. (2022) to measure an economy's dollar invoicing ratio and investigate its role in driving heterogeneous markup responses. This dataset includes annual invoicing ratios for various currencies—such as the US dollar, euro, home currency, and others—in both exports and imports. It covers 115 countries from 1990 to 2019. The time series of dollar invoicing ratio of exports and imports at the aggregate level over the sample period is reported in Figure A.9.

[17]See https://web-archive.oecd.org/2023-11-24/644737-TiVA_2023_Indicators_Guide.pdf for detailed description.

[18]The dominant currency paradigm is documented in Goldberg and Tille (2008), Gopinath (2015), and Gopinath et al. (2020).

4.3.4 Debt Linkage with the US

Recent literature on global capital allocation highlights that bilateral portfolio investments from advanced economies to firms in emerging market economies are significantly larger than previously understood[19]. Using global traded securities data from Morningstar, Coppola et al. (2021) construct bilateral investment positions data by the residence of the debt issuer and the restatement to investments by the nationality of the issuer. Drawing on this dataset, which reflects the actual level of security holdings by foreign investors, I construct two indices to measure the debt linkage of EME firms with US investors[20].

The first measure is the ratio of debt holdings by US investors by nationality scaled by issuing country's GDP. One limitation is that in some economies, publicly listed firms represent only a small fraction of the corporate sector, meaning it may not fully capture the debt linkage. To address this, I build the second measure as the ratio of debt holdings of US investors by nationality scaled by aggregate output of publicly listed firms in the issuing country. Unlike traditional data reported in official statistics, these indicators capture the actual value of foreign security holdings owned by US investors and issued by firms parenting in country c. These two measures take the following forms

$$\text{USdebtGDP}_{c,y} = \frac{\text{Position Nationality}_{c,US,y}}{\text{GDP}_{c,y}}, \tag{16}$$

$$\text{USdebtOutput}_{c,y} = \frac{\text{Position Nationality}_{c,US,y}}{\text{Aggregate Output}_{c,y}}, \tag{17}$$

where $\text{Position Nationality}_{c,US,y}$ denotes the value of the holdings of US investors in securities issued by firms in country c in year y on a nationality basis. Figures A.10 and A.11 report the time series of the ratio of US investors' security holdings relative to GDP and output, respectively.

4.4 Firm-Level Responses

To estimate the dynamic responses of EME firm markup to US monetary policy shocks, I apply the state-dependent local projections method proposed by Jordà (2005). Let $Y_{i,t}$ be firm i's markup at time t. The main dependent variable is defined as $\Delta^h \log Y_{i,t} = \log Y_{i,t+h} - \log Y_{i,t-1}$

[19] Coppola et al. (2021) attribute this phenomenon to the fact that global firms often finance themselves through offshore subsidiaries, often shell companies located in tax havens, which obscures their true economic locations in official statistics.

[20] I exclude sovereign, agency, and local government bonds and aggregate common equities, corporate bonds, and asset-backed securities at country-pair and year level.

and it captures the h-year forward difference in firm i's markup, that is, the cumulative markup change. To begin with, I examine the average effect of US monetary policy shocks using the following specification

$$\Delta^h \log Y_{i,t} = \alpha_i^h + \beta^h \varepsilon_t^{MP} + \Gamma^h \boldsymbol{Z_{i,t-1}} + \Theta^h \boldsymbol{W_{c,t-1}} + u_{i,t}^h, \tag{18}$$

where i indexes firms and $h \in \{0, \ldots, 16\}$ denotes the forecast horizon, ranging from 0 to 16 quarters. α_i^h denotes firm fixed effects, capturing permanent differences across firms. ε_t^{MP} represents the US monetary policy shock in quarter t and $\boldsymbol{Z_{i,t-1}}$ is a set of control variables, including time-varying firm characteristics such as four lags of firm age, number of employees, leverage, total assets, cash holding ratio, sales, and sales growth. I also include four lags of the dependent variable ($\log(markup)$) following Montiel Olea and Plagborg-Møller (2021)[21]. $\boldsymbol{W_{c,t-1}}$ represents the set of country-level characteristics including four lags of EME inflation rate, EME monetary policy rates, and EME GDP growth as controls. Standard error $u_{i,t}^h$ is clustered at firm and quarter level to deal with possible serial correlation and correlation across firms in the forecast errors following Driscoll and Kraay (1998). In the baseline regression, I remove country-time and sector-time fixed effects in order to estimate the average effect of US monetary policy shocks.

To explore whether and how EME firms respond differently to a US monetary policy shock depending on their characteristics at the time of the shock and afterward, I consider the following specification

$$\Delta^h \log Y_{i,t} = \alpha_i^h + \sum_{g \in \mathcal{G}} \beta_g^h Dg_{i,t-1} \varepsilon_t^{MP} + \sum_{g \in \mathcal{G}} \delta_g^h Dg_{i,t-1} + \Gamma^h \boldsymbol{Z_{i,t-1}} + \Theta^h \boldsymbol{W_{c,t-1}} + u_{i,t}^h, \tag{19}$$

where $Dg_{i,t-1}$ is a dummy variable taking the value of 1 if firm i belongs to group g at time $t-1$, and 0 otherwise. In the main analysis, firms are grouped by their own or the belonging economy' characteristics, including export exposure to the US (measured by $\text{FDVAbyUS}_{c,y}$), backward GVC participation, dollar invoicing ratio of exports, and corporate debt holding ratio by US investors (measured by $\text{USdebtGDP}_{c,y}$). Detailed classifications of firm groups are discussed in Section 5.2. When exploring heterogeneous responses, I include sector-time fixed effects to capture differences in how sectors across countries are exposed to aggregate shocks and thus to eliminate the role of sector-specific sensitivities to monetary policy. With the control for sector-time fixed effects, it allows to investigate heterogeneous markup responses to

[21] Montiel Olea and Plagborg-Møller (2021) show that lag-augmented local projections provide more robust inference and obviate the need to correct standard errors for serial correlation in the regression residuals.

US monetary policy shocks depending on country and firm characteristics.

To investigate the compositional effect of each transmission channel, I apply the Kitagawa-Blinder-Oaxaca decomposition (referred as the *KBO decomposition* for brevity) method (Kitagawa (1955), Blinder (1973), and Oaxaca (1973)) in the local projection specification. This decomposition-based approach for local projections is introduced by Cloyne et al. (2023). This method is specified as follows

$$\Delta^h \log Y_{i,t} = \alpha_i^h + \beta^h \varepsilon_t^{MP} + \Phi^h(\boldsymbol{X_{i,t-1}} - \bar{\boldsymbol{X}}_i)\varepsilon_t^{MP} + \Xi^h(\boldsymbol{X_{i,t-1}} - \bar{\boldsymbol{X}}_i) + \Gamma^h \boldsymbol{Z_{i,t-1}} + \Theta^h \boldsymbol{W_{c,t-1}} + u_{i,t}^h, \tag{20}$$

where the KBO decomposition term is $\Phi^h(\boldsymbol{X_{i,t-1}} - \bar{\boldsymbol{X}}_i)\varepsilon_t^{MP}$, with the *indirect effect (heterogeneous effect)* captured by Φ^h. The *direct effect*, representing the average effect of the policy intervention, is captured by β^h. $\boldsymbol{X_{i,t}}$ denotes the set of characteristics of interest, including the export exposure to the US, backward GVC participation, US dollar invoicing of exports, and the debt linkage with the US. I start by using country-level characteristics and then construct the following firm-level proxies for these characteristics to explore the composition of each transmission channel,

$$\begin{aligned}
\text{FDVAbyUS}_{iq} &= \text{FDVAbyUS}_{cy} \times \frac{\text{Exports}_{iq}}{\text{Sales}_{iq}} \\
\text{GVCbackward}_{iq} &= \text{GVCbackward}_{cy} \times \frac{\text{Exports}_{iq}}{\text{Sales}_{iq}} \\
\text{USDExport}_{iq} &= \text{USDExport}_{cy} \times \frac{\text{Exports}_{iq}}{\text{Sales}_{iq}} \\
\text{USdebtGDP}_{iq} &= \text{USdebtGDP}_{cy} \times \text{Leverage}_{iq},
\end{aligned} \tag{21}$$

where quarterly exports data is interpolated using annual data adjusted for seasonality[22]. Compared to country-level characteristics, firm-level characteristics provide a more granular measure. Specifically, trade-related indicators such as FDVAbyUS, GVCbackward, and USDExport are disaggregated by the export share of firm sales, and USdebtGDP is disaggregated using firm leverage. However, one drawback of the firm-level characteristics, particularly those related to trade, is that they only capture the exposure of exporting firms. Non-exporting firms, which could be indirectly affected by US monetary policy through changes in the market structure, are excluded when examining the transmission channels.

[22]Seasonality is estimated using exports data from Comtrade and approximated at country-industry-quarter level.

5 Exploring Spillover Channels: An Initial Analysis

5.1 Average Effect of US Monetary Policy Spillovers

Before analyzing the results for different firm groups, I estimate the average effect of US monetary policy shocks on EME firm-level markups. It provides a benchmark against which one can study the contribution of each group of firms. Figure 4 presents the impulse response function up to 16 quarters, following the specification in equation (18). As shown in the figure, the effect of a contractionary US monetary policy shock on firm markups in EMEs is negative, significant, and persistent. Following a 25bps US monetary tightening shock, firm markups decline continuously, with the effect becoming significant from the fourth quarter after the shock. The peak effect is -0.12pp in the 11th quarter[23], and then fluctuates around this level within four years after the shock.

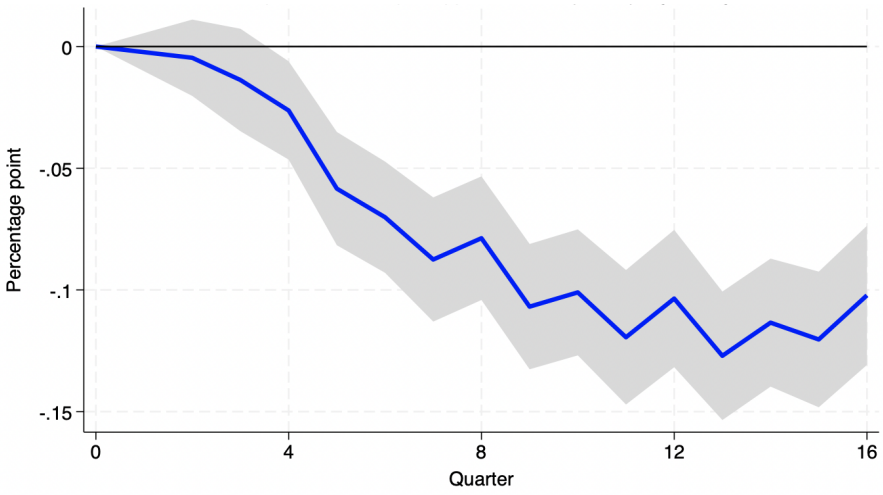


Figure 4: Average Markup Response to US Monetary Policy Tightening

Note: This figure shows the average EME firm markup response to a 25 basis points US monetary tightening shock. Cumulative impulse response functions are estimated using local projection method described in equation (18). The grey shaded area represents 95% confidence bands. Confidence intervals are constructed based on two-way clustered standard errors at firm and time level.

Following US monetary tightening, firms face two opposing forces. On the one hand, the decline of aggregate demand triggers firms to lower prices in an attempt to gain market share. On the other hand, as demand decreases, wages tend to fall in response to the reduced demand for labor. The nature of nominal rigidities determines the direction of firm markup responses to monetary policy shocks. When prices remain sticky and cannot be adjusted downward quickly, firms are unable to pass on cost savings or cut prices sufficiently in response to weakened demand. Similarly, when wages are sticky, labor costs do not fall proportionately to the reduction

[23]For example, on average, a firm with the initial markup of 1.2 would reduce its markup to 1.08 by the 11th quarter following a 25bps contractionary US monetary policy shock.

in demand. In regimes where wages are even stickier than prices, which is commonly the case in many EMEs, firms experience higher real labor costs relative to the prices they charge, further compressing their markups.

5.2 Channels of US Monetary Policy Spillovers

In this section, I disaggregate the average effect and explore the channels of firm markup responses in EMEs to contractionary US monetary policy shocks, focusing on the export exposure to the US, global value chain participation, dollar invoicing of exports, and debt linkage with the US. Each channel is examined individually to test the hypotheses outlined in Section 2. While these characteristics may be correlated, the aim here is to understand their individual effects before moving to a more comprehensive analysis of their joint correlations and compositional effects, which will be discussed in Section 6.

5.2.1 Export Exposure to the US

In Section 2, I discussed how exports play a crucial role in influencing firm markups. When the Federal Reserve implements contractionary monetary policies, US demand is suppressed, leading to a reduction in demand for imported goods and services. As a result, firms in EMEs that rely heavily on the US market for exports experience a decline in export volumes. This mechanism represents the *demand channel* of US monetary policy spillovers. In this section, I examine whether US monetary policy affects firm markups in EMEs through the demand channel.

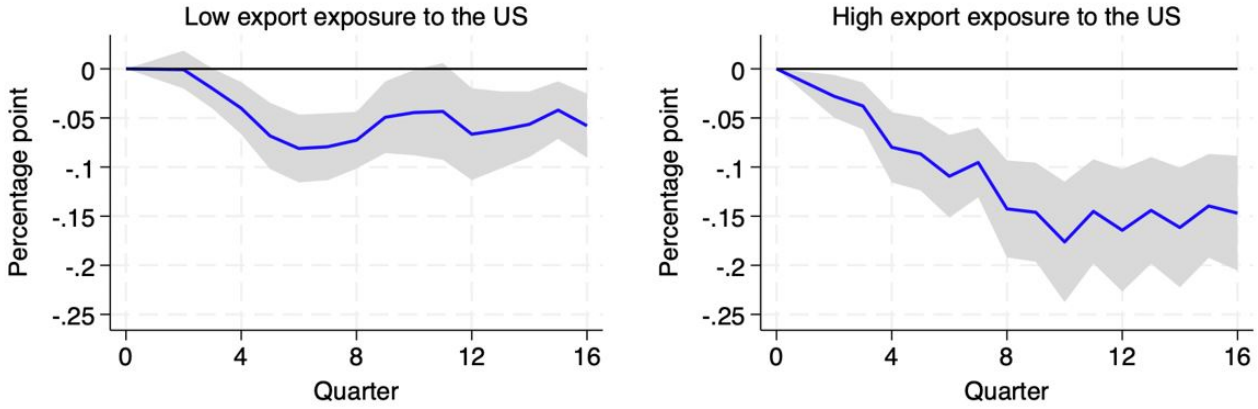
To examine the role of export exposure to the US on firm markup responses in EMEs to US monetary policy tightening, I split the full sample into two subgroups based on the median value of the US share of global final demand for original value added (FDVAbyUS, as constructed in equation (14) in Section 4.3)[24]. Firms in economies with export exposure below the median are classified as having lower export exposure, while those above the median are classified as having higher export exposure. The impulse response functions of markups for both subgroups are reported in Figure 5. Panel (a) reports the level effects for each firm group and panel (b) depicts the relative effect for firms in economies with higher export exposure to the US.

Firms in economies with higher export exposure to the US experience a significant reduction in markups, with the effect peaking at approximately -0.18pp in the 10th quarter after the policy shock and remaining below baseline levels over the observed horizon, as shown in the

[24]Figure B.1 in Appendix B reports the impulse response functions using indicator EXtoUS constructed in equation (13).

right panel of panel (a). In contrast, firms in economies with lower export exposure to the US demonstrate weaker and less persistent responses, with markups declining only marginally and stabilizing more quickly. The peak effect is −0.08pp in the sixth quarter after a 25bps US monetary tightening shock.

(a) Level Effect



(b) Relative Effect

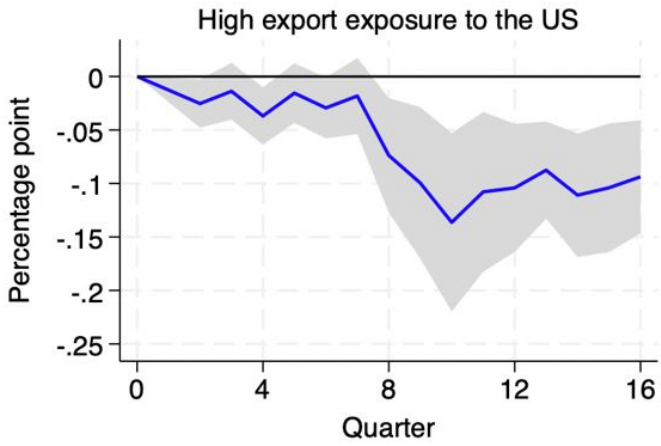


Figure 5: Impulse Response of Markups to US Monetary Policy Tightening by Export Exposure to the US (Measured by the Original Value Added Exposure to the US)
Note: This figure shows the EME firm markup response to a 25 basis points US monetary tightening shock. Panel (a) shows the result by group of original value added exposure to the US (measured by FDVAbyUS in equation (14)) and panel (b) reports the relative effect for the firms with higher export exposure to the US relative to that with lower export exposure to the US. The grey shaded area represents 95% confidence bands. Confidence intervals are constructed based on two-way clustered standard errors at country and time level.

Panel (b) in Figure 5 reports the impulse response of firm markups for firms in economies with higher export exposure to the US, relative to those with lower export exposure. While this approach loses track of the average effect of US monetary policy spillovers, it allows to formalize a test to determine whether the estimated impulse response function for each group at each horizon is statistically different from that of the base group. Consistent with the level effects in panel (a), firms in economies with higher export exposure to the US exhibit more

pronounced and persistent declines in markups following a 25bps contractionary US monetary shock compared to in the lower export exposure group.

5.2.2 Global Value Chain Participation

Using the backward GVC participation index constructed in equation (15) of Section 4.3, I establish the median threshold for backward GVC participation to investigate the potential heterogeneous impulse responses of firm markups to US monetary shocks, as another indicator that captures the demand channel via trade. Figure 6 presents the impulse response functions of markups to a 25bps US monetary tightening shock depending on the intensity of backward GVC participation[25]. As presented in panel (a), both groups of firms experience significant reductions in markups. Intuitively, firms in the economies with higher backward GVC participation are more deeply integrated into global production networks, making them more exposed and thus expected to experience more pronounced markup changes compared to firms in economies with lower backward GVC participation.

However, when comparing the statistical differences between the two groups, firms with higher levels of backward GVC participation do not exhibit significantly different markup responses from those with lower participation until the ninth quarter after the US monetary tightening, as shown in panel (b). This result suggests that the transmission of US monetary policy to EME firm markups may operate with a longer lag for firms with greater backward GVC participation, possibly due to delayed adjustments within global supply chains. In Section 6, I further investigate whether this pattern holds when accounting for other transmission channels.

5.2.3 Dollar Invoicing of Exports

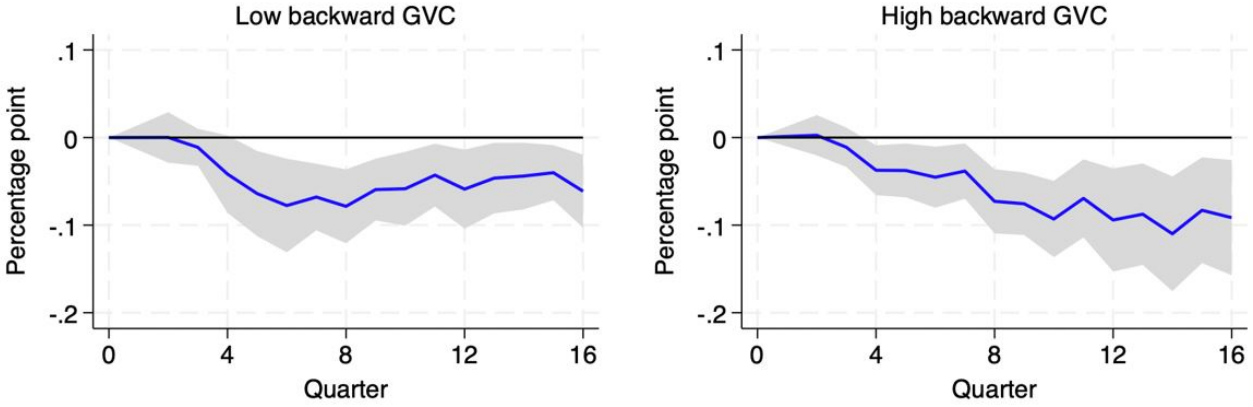
To capture the different responses of markups based on the ratio of dollar invoicing, I take the median dollar invoicing ratio in exports, as introduced in Section 4.3, as the threshold and estimate the impulse response functions for firms with lower and higher dollar invoicing ratios. Figure 7 reports the cumulative responses to a 25bps US monetary tightening shock[26].

Panel (a) reports the level effect for firms with low and high dollar invoicing ratios. Firms in economies with higher dollar invoicing ratios experience a more pronounced reduction in markups, with the effect reaching approximately -0.05pp in the eighth quarter following the

[25]Figure B.2 in Appendix B reports the impulse response functions depending on forward GVC participation.

[26]The impulse response functions depending on the US dollar invoicing ratio of imports is are reported in Figure B.3 of Appendix B.

(a) Level Effect



(b) Relative Effect

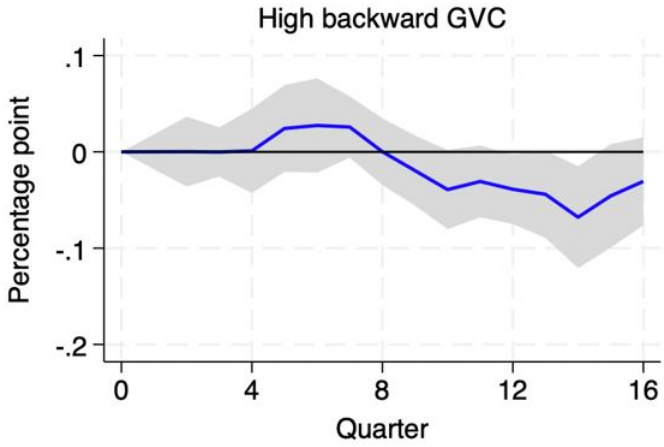


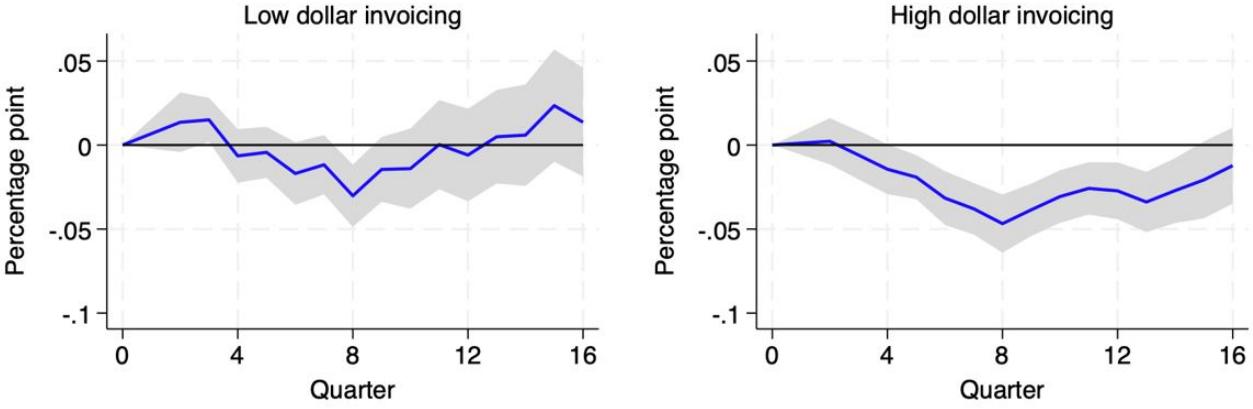
Figure 6: Impulse Response of Markups to US Monetary Policy Tightening by Backward Global Value Chain (GVC) Participation

Note: This figure shows the EME firm markup response to a 25 basis points US monetary tightening shock. Panel (a) show the result by group of backward global value chain (GVC) participation and panel (b) reports the relative effect for firms in the group of higher backward GVC participation relative to that of lower backward GVC participation. The grey shaded area represents 95% confidence bands. Confidence intervals are constructed based on two-way clustered standard errors at country and time level.

tightening shock. After this peak, markups gradually recover and converge toward their original levels by the 16th quarter. This pattern highlights the role of the *exchange rate channel*, where firms more reliant on US dollar invoicing are more vulnerable to exchange rate fluctuations resulting from US monetary policy shocks. In contrast, firms with lower dollar invoicing ratios exhibit minimal changes in markups, with no significant response to the monetary tightening.

Panel (b) in Figure 7 formally compares the relative effect between the two groups, showing that firms with higher dollar invoicing ratios exhibit a statistically significant and negative response in comparison to firms with lower dollar invoicing ratios. This finding reinforces the importance of the exchange rate channel in amplifying the impact of US monetary policy on firms with higher dollar exposure in their trade transactions.

(a) Level Effect



(b) Relative Effect

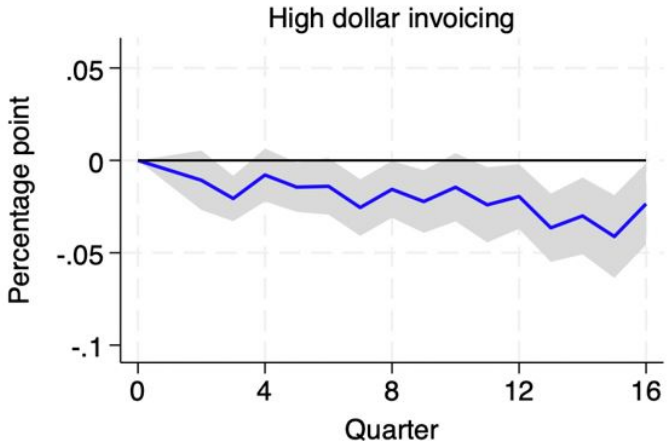


Figure 7: Impulse Response of Markups to US Monetary Policy Tightening by Dollar Invoicing of Exports

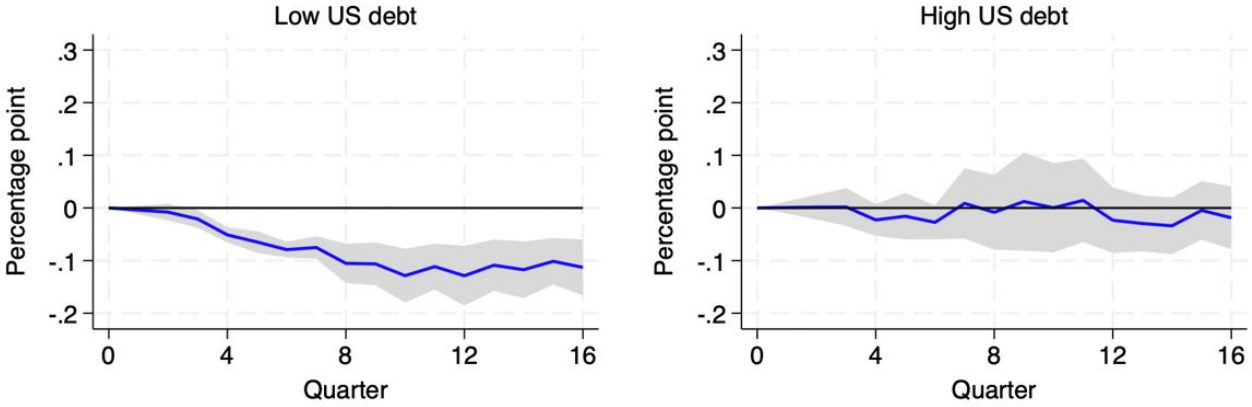
Note: This figure shows the EME firm markup response to a 25 basis points US monetary tightening shock. Panel (a) reports the result by group of US dollar invoicing of exports and panel (b) shows the relative effect for the firms with higher US dollar invoicing ratio relative to that with lower US dollar invoicing ratio. The grey shaded area represents 95% confidence bands. Confidence intervals are constructed based on two-way clustered standard errors at country and time level.

5.2.4 Debt Linkage with the US

In this section, I examine whether firm markup responses in EMEs to US monetary shocks are heterogeneous with the debt linkage with US investors, as measured by the security holdings of US investors in debt issued by firms in EMEs. Using the indicator constructed in Section 4.3, I divide the sample into two subgroups based on the median level of USdebtGDP as the threshold[27].

[27]Since my primary dataset is at the firm-quarter level, while the security holdings data is only available at the country-year level, it is not possible to identify the specific firms that issue more debt through offshore shell companies. The constructed indices serve only as an approximation, indicating which country and year these firms are likely operating in. Consequently, the reported result in Figure 8 is the average effect on markups given time-varying country characteristics.

(a) Level Effect



(b) Relative Effect

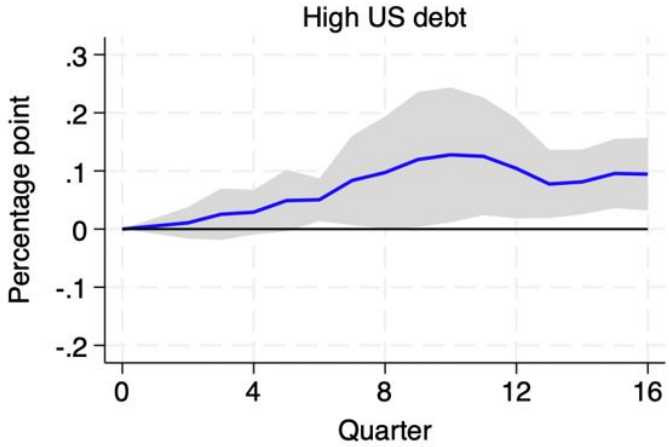


Figure 8: Impulse Response of Markups to US Monetary Policy Tightening by Debt Holdings of US Investors (Measured by the Ratio of Securities Held by US Investors on the Nationality Basis)

Note: This figure shows the EME firm markup response to a 25 basis points US monetary tightening shock. Panel (a) show the result by group of security holdings owned by US investors on the nationality basis (measured by USdebtGDP in equation (16)) and panel (b) reports the relative effect for firms with higher ratio of corporate debt held by US investors relative to that with lower ratio of debt held by US investors. The grey shaded area represents 95% confidence bands. Confidence intervals are constructed based on two-way clustered standard errors at country and time level.

Panel (a) in Figure 8 reports the local projection results of low and high dollar debt ratio groups. Firms in the group of lower ratio of corporate debt held by US investors, as indicated in the top left panel, reduce markups significantly in response to US monetary tightening. Following a 25bps US monetary tightening shock, firms in economies with lower US debt linkage reduce markups significantly, with the peak effect being -0.12pp in the 12th quarter. This effect is persistent, as markups continue to fluctuate around -0.10pp without converging to their initial levels. In contrast, markups of firms in economies with a higher ratio of corporate debt held by US investors appear unaffected by US monetary tightening shocks. Panel (b) formally assesses the statistical difference between the two groups. Consistent with the level effects, the markup response of firms with lower US debt linkages shows a significantly larger reduction compared to firms with higher US debt linkages, with the difference being statistically significant at most horizons. The results remain robust when using the measure USdebtOutput, as shown in Figure B.4 of Appendix B.

Another characteristic used to capture the financial channel of US monetary policy spillovers is firm liquidity. Measured by the ratio of cash and cash equivalents to total liabilities, firms with higher liquidity are less likely to be credit constrained, and even if the access to external finance tightens due to the credit supply shock, these firms can still continue operations using their cash reserves. Impulse response functions of firm markups depending on liquidity are reported in Figure B.5, suggesting that the markup response of EME firms to US monetary tightening is not heterogeneous with firm liquidity.

Breaking down the firms into exporters and non-exporters, and focusing on the financial channel, exporters often invoice their exports in US dollars according to the dominant currency paradigm. Evidence in the literature also indicates that exporters are more likely to borrow in US dollars. Casas et al. (2023) demonstrate that when firms not only price their exports in the dominant currency, but also finance their operations in that same currency, that is, the dominant currency financing. Consequently, when dollar appreciates following a US monetary tightening, exporters see an increase in their dollar-denominated revenue but also face a rise in their dollar-denominated debt. This dollar borrowing provides exporters with a natural hedge against local currency depreciation, protecting them from exchange rate volatility. In contrast, non-exporters, who lack dollar revenue, experience declining local currency revenue while their dollar-denominated debt burden rises, increasing their financial strain. To test this mechanism, I estimate the impulse response functions for exporters and non-exporters, further segmented by high and low levels of US debt. The results reported in Figure B.6 in Appendix B suggest that US monetary tightening does not affect EME firm markups through this mechanism.

In Section 6, I further examine whether the financial channel is relevant using the measure USdebtGDP when considering the presence of other transmission channels.

6 Evaluating Spillover Mechanisms: A Multivariate Approach

In Section 5, I discuss the potential mechanisms of US monetary policy spillovers to firm markups in EMEs, exploring heterogeneous responses based on country characteristics such as export exposure to the US, GVC participation, dollar invoicing of exports, and debt linkage with the US. In this section, I present the estimation results that account for all these characteristics simultaneously to study the compositional effect of each channel[28].

6.1 Correlation Among Characteristics

Before analyzing the composition of each channel and estimating the marginal effects, I calculate the pairwise correlations between the relevant country-level characteristics to evaluate potential collinearity. The characteristics under consideration—US export exposure, backward GVC participation, US dollar invoicing, and US debt linkage—play significant roles in transmitting US monetary policy spillovers to firm markups in EMEs, particularly for the exporting firms in economies with higher US dollar invoicing ratios.

But is there any potential correlation among these characteristics that may drive collinearity? Table 3 reports the correlation matrix. All of the characteristics have positive correlation with one another, except for the negative correlation observed between the dollar invoicing ratio and backward GVC participation (-0.435). Additionally, the correlation between the US dollar invoicing ratio of exports and export exposure to the US is 0.416, indicating that economies with higher dollar invoicing ratio of exports tend to be more exposed to the US in terms of export activity.

Furthermore, the correlation between US debt linkage and US dollar invoicing is relatively strong (0.419), suggesting that economies with higher debt linkages to US investors tend to have a higher share of exports invoiced in US dollars. However, none of the correlation coefficients exceed 0.6, which is generally considered the threshold for multicollinearity concerns (Allison

[28]Since the dollar invoicing data is missing for China and Mexico, I assume the dollar invoicing ratio of exports for China is close to the average dollar invoicing ratio of exports for Asia and dollar invoicing ratio of exports for Mexico is close to the average dollar invoicing ratio of exports for Latin America over the years. Then I use this proxy to expand the sample size in my estimations.

Table 3: Correlation Matrix of Characteristics

	US Export Exposure	Backward GVC	Dollar Invoicing	US Debt
US Export Exposure	1.000			
Backward GVC	0.324	1.000		
	(0.000)			
Dollar Invoicing	0.416	−0.435	1.000	
	(0.000)	(0.000)		
US Debt	0.298	0.074	0.419	1.000
	(0.000)	(0.203)	(0.000)	

Note: *p*-values in parentheses. *US Export Exposure* denotes the export exposure to the US and is named as FDVAbyUS in the econometric specification, *Dollar Invoicing* denotes the US dollar invoicing ratio of exports and is named as USDExport in the econometric specification, *US Debt* denotes debt linkage with the US and is named as USdebtGDP, and *Backward GVC* denotes the backward GVC participation and is named as GVCbackward in the econometric specification.

(1999)). This suggests that the characteristics can be studied as distinct transmission channels without collinearity posing a significant problem.

6.2 Results

6.2.1 Baseline Results

Before conducting the decomposition of the channels of US monetary policy spillovers, I first estimate a multivariate model using country-level characteristics that encompass both exporters and non-exporters to examine heterogeneity across all characteristics. The results, presented in Table 4, reveal that firms in economies with higher export exposure to the US experience more pronounced reductions in markups. This finding aligns with the relative effects of country-level export exposure to the US, as depicted in Figure 5b. However, the dollar invoicing ratio of exports does not introduce heterogeneity in firm markup responses. In contrast to previous findings in Section 5, backward GVC participation, exhibits a positive, though slightly significant, effect on US monetary policy tightening spillovers when controlling for other characteristics. Meanwhile, the financial channel, measured by the security holdings of US investors, does not appear to influence the heterogeneity of markup responses. This result indicates that the financial channel has a muted effect on the transmission of US monetary tightening to firm markups in EMEs.

6.2.2 Exporters vs. Non-Exporters

One limitation of using country-level characteristics to examine transmission channels is that they only capture the average exposure of all firms within an economy group but does not

Table 4: EME Firm Markup Responses to US Monetary Policy Tightening Using Country-Level Characteristics

$\Delta^h \ln(markup)_{i,t}$	(1) h=0	(2) h=4	(3) h=8	(4) h=12	(5) h=16
US Export Exposure	-0.0109	-0.0192	-0.0341**	-0.0436***	-0.0475***
	(0.0074)	(0.0127)	(0.0158)	(0.0133)	(0.0122)
Backward GVC	0.0027	0.0017	-0.0052	-0.0084	-0.0101
	(0.0031)	(0.0066)	(0.0081)	(0.0064)	(0.0059)
Dollar Invoicing	0.0034	0.0084*	0.0106*	0.0121**	0.0111**
	(0.0020)	(0.0041)	(0.0056)	(0.0054)	(0.0048)
US Debt	0.0054	0.0136*	0.0122	-0.0011	-0.0159**
	(0.0040)	(0.0070)	(0.0090)	(0.0095)	(0.0073)
USmp×US Export Exposure	-0.0217	-0.0319	-0.0782***	-0.0982***	-0.0644***
	(0.0168)	(0.0222)	(0.0197)	(0.0200)	(0.0211)
USmp×Backward GVC	0.0010	0.0046	0.0128*	0.0154**	0.0097
	(0.0036)	(0.0047)	(0.0063)	(0.0059)	(0.0060)
USmp×Dollar Invoicing	-0.0001	-0.0011	0.0003	0.0006	0.0005
	(0.0008)	(0.0014)	(0.0010)	(0.0012)	(0.0016)
USmp×US Debt	0.0009	0.0103	0.0141	0.0140	0.0148
	(0.0069)	(0.0137)	(0.0150)	(0.0095)	(0.0105)
Fixed Effects					
Time FE	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
R^2	0.4546	0.4211	0.4252	0.4585	0.4905
Obs.	150,641	148,878	147,351	145,654	143,712

Note: This table reports the estimation results using country-level characteristics of export exposure to the US, backward GVC participation, dollar invoicing for exports, and debt linkage with the US measured by securities held by US investors. It controls for the firm fixed effects. Confidence intervals are constructed based on two-way clustered standard errors.

distinguish between exporters and non-exporters. For instance, the interaction term of US monetary policy shock with an economy's export exposure to the US highlights the aggregate spillover effects. But how do exporters respond to US monetary tightening shock compared to non-exporters depending on these characteristics? To address this question, I extend the analysis by interacting the policy variable and country-level characteristics with an exporter dummy variable. This approach enables a comparison of how exporting firms respond relative to non-exporting firms under various scenarios. Tables 5 and 6 report the estimation results[29].

All of the three characteristics—US export exposure, dollar invoicing, and backward GVC participation—exhibit significant effects on the transmission of US monetary tightening shock after bringing in the exporter dummy, except the financial channel measured by the ratio of debt held by US investors[30]. Specifically, in economies with higher export exposure to the

[29]These results remain robust when controlling for country-time and sector-time fixed effects, as reported in Table B.5 in Appendix B.

[30]The statistical significance of the result is enhanced when controlling for country-time and firm fixed effects, particularly for the triple interaction term of US monetary policy shock, export exposure to the US, and the exporter dummy variable. This result highlights that the model in Table 6 with country-time fixed effects better captures the time-varying and country-time-varying characteristics that are not captured by the model in Table

Table 5: EME Firm Markup Responses to US Monetary Policy Tightening Using Country-Level Characteristics and the Exporter Dummy Variable (Controlling for Time Fixed Effects)

$\Delta^h \ln(markup)_{i,t}$	(1) h=0	(2) h=4	(3) h=8	(4) h=12	(5) h=16
US Export Exposure	-0.0104	-0.0127	-0.0279**	-0.0390***	-0.0448***
	(0.0078)	(0.0112)	(0.0111)	(0.0114)	(0.0114)
Backward GVC	0.0009	-0.0027	-0.0111***	-0.0138***	-0.0143***
	(0.0024)	(0.0034)	(0.0036)	(0.0037)	(0.0036)
Dollar Invoicing	0.0025*	0.0063***	0.0068**	0.0085**	0.0069
	(0.0014)	(0.0022)	(0.0029)	(0.0034)	(0.0045)
US Debt	0.0063	0.0188**	0.0179**	0.0045	-0.0110
	(0.0053)	(0.0076)	(0.0079)	(0.0074)	(0.0067)
US Export Exposure×Exporter	-0.0032	-0.0268***	-0.0266***	-0.0199*	-0.0121
	(0.0050)	(0.0085)	(0.0099)	(0.0110)	(0.0113)
Backward GVC×Exporter	0.0058***	0.0143***	0.0197***	0.0178***	0.0136***
	(0.0020)	(0.0028)	(0.0030)	(0.0034)	(0.0034)
Dollar Invoicing×Exporter	0.0018	0.0051	0.0091*	0.0088	0.0114*
	(0.0015)	(0.0032)	(0.0046)	(0.0054)	(0.0064)
US Debt×Exporter	-0.0027	-0.0114***	-0.0159***	-0.0144***	-0.0106***
	(0.0032)	(0.0042)	(0.0040)	(0.0033)	(0.0036)
USmp×US Export Exposure	-0.0338*	-0.0349	-0.0817***	-0.1033***	-0.0665***
	(0.0197)	(0.0227)	(0.0162)	(0.0120)	(0.0181)
USmp×Backward GVC	0.0028	0.0056	0.0114**	0.0154***	0.0093**
	(0.0036)	(0.0047)	(0.0048)	(0.0030)	(0.0046)
USmp×Dollar Invoicing	0.0007	-0.0006	0.0010	0.0010	0.0004
	(0.0009)	(0.0010)	(0.0010)	(0.0011)	(0.0017)
USmp×US Debt	0.0015	0.0195	0.0254	0.0166	0.0164
	(0.0090)	(0.0166)	(0.0184)	(0.0127)	(0.0120)
USmp×Exporter	0.0082	0.0148	0.0635	0.0805**	0.0504
	(0.0383)	(0.0441)	(0.0545)	(0.0352)	(0.0379)
USmp×US Export Exposure×Exporter	0.0372***	0.0124	0.0049	0.0106	0.0078
	(0.0103)	(0.0128)	(0.0179)	(0.0164)	(0.0267)
USmp×Backward GVC×Exporter	-0.0063**	-0.0055**	0.0027	-0.0012	-0.0008
	(0.0025)	(0.0024)	(0.0052)	(0.0042)	(0.0051)
USmp×Dollar Invoicing×Exporter	-0.0028***	-0.0026***	-0.0025**	-0.0017	-0.0005
	(0.0007)	(0.0009)	(0.0011)	(0.0013)	(0.0020)
USmp×US Debt×Exporter	-0.0057	-0.0033	0.0008	0.0073	-0.0044
	(0.0075)	(0.0100)	(0.0124)	(0.0086)	(0.0097)
Fixed Effects					
Time FE	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
R^2	0.4550	0.4236	0.4290	0.4618	0.4932
Obs.	150,641	148,878	147,351	145,654	143,712

Note: This table reports the estimation results using exporter dummy together with country-level characteristics of export exposure to the US, dollar invoicing for exports, debt linkage with the US measured by securities held by US investors, and backward GVC participation. It controls for time fixed effects and firm fixed effects. Confidence intervals are constructed based on two-way clustered standard errors.

Table 6: EME Firm Markup Responses to US Monetary Policy Tightening Using Country-Level Characteristics with the Exporter Dummy Variable (Controlling for Country-Time Fixed Effects)

$\Delta^h \ln(markup)_{i,t}$	(1) h=0	(2) h=4	(3) h=8	(4) h=12	(5) h=16
USmp×Exporter	0.0149	0.0073	0.0449	0.0555**	0.0089
	(0.0244)	(0.0119)	(0.0278)	(0.0238)	(0.0364)
US Export Exposure×Exporter	-0.0034	-0.0204***	-0.0203**	-0.0159	-0.0094
	(0.0042)	(0.0070)	(0.0089)	(0.0103)	(0.0105)
Backward GVC×Exporter	0.0021*	0.0064***	0.0106***	0.0113***	0.0091***
	(0.0012)	(0.0019)	(0.0025)	(0.0030)	(0.0031)
Dollar Invoicing×Exporter	0.0013	0.0035	0.0071	0.0081	0.0094
	(0.0012)	(0.0031)	(0.0045)	(0.0056)	(0.0067)
US Debt×Exporter	-0.0027	-0.0065**	-0.0069**	-0.0041	-0.0037
	(0.0017)	(0.0025)	(0.0026)	(0.0027)	(0.0029)
USmp×US Export Exposure×Exporter	0.0440***	0.0221**	0.0269**	0.0310**	0.0189
	(0.0090)	(0.0103)	(0.0106)	(0.0129)	(0.0241)
USmp×Backward GVC×Exporter	-0.0072***	-0.0065***	-0.0024	-0.0049***	-0.0026
	(0.0015)	(0.0014)	(0.0029)	(0.0015)	(0.0024)
USmp×Dollar Invoicing×Exporter	-0.0031***	-0.0032***	-0.0031**	-0.0011	-0.0005
	(0.0008)	(0.0010)	(0.0014)	(0.0020)	(0.0031)
USmp×US Debt×Exporter	-0.0020	0.0026	0.0088	0.0086	-0.0098
	(0.0053)	(0.0039)	(0.0084)	(0.0060)	(0.0087)
Fixed Effects					
Country-Time FE	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
R^2	0.4762	0.4527	0.4560	0.4837	0.5103
Obs.	150,621	148,854	147,329	145,630	143,690

Note: This table reports the estimation results using exporter dummy together with country-level characteristics of export exposure to the US, dollar invoicing for exports, debt linkage with the US measured by securities held by US investors, and backward GVC participation. It controls for country-time fixed effects and firm fixed effects. Confidence intervals are constructed based on two-way clustered standard errors.

US, exporters experience less markup reductions than non-exporters. While in economies with higher degree of backward GVC participation and higher dollar invoicing ratio of exports, exporters reduce markups more significantly than non-exporters. These results highlight the critical role of exporting firms in driving markup responses. Building on these findings, I next examine whether the intensity of export activity further differentiates firm markup responses among the exporting firms to US monetary policy tightening shocks. A firm's export intensity is measured as the share of exports in total sales, with quarterly export data interpolated using annual data adjusted for seasonality[31]. Table 7 reports the estimation results[32].

When narrowing the analysis to exporters and focusing on the extensive margin of exports,

5.

[31]Seasonality is estimated using exports data from Comtrade and approximated at country-industry-quarter level.

[32]In Table 7, I control for both time and firm fixed effects to account for other time-varying factors that potentially affect EME firm markup responses such as the global financial cycle. The estimation results controlling for firm fixed effects is reported in Table B.1.

Table 7: EME Exporters' Markup Responses to US Monetary Policy Tightening Using Country-Level Characteristics with the Export Intensity

$\Delta^h \ln(markup)_{i,t}$	(1) h=0	(2) h=4	(3) h=8	(4) h=12	(5) h=16
US Export Exposure	-0.0069	-0.0237***	-0.0333***	-0.0428***	-0.0487***
	(0.0065)	(0.0087)	(0.0094)	(0.0098)	(0.0101)
Backward GVC	0.0027	0.0013	-0.0038	-0.0084**	-0.0106***
	(0.0025)	(0.0032)	(0.0032)	(0.0034)	(0.0034)
Dollar Invoicing	0.0027**	0.0076**	0.0111***	0.0132**	0.0142**
	(0.0013)	(0.0029)	(0.0041)	(0.0051)	(0.0057)
US Debt	0.0037	0.0068	0.0057	-0.0021	-0.0068
	(0.0037)	(0.0053)	(0.0055)	(0.0062)	(0.0054)
Export Intensity	0.0450	0.0044	0.0630	0.1574	0.2976
	(0.0796)	(0.1468)	(0.1356)	(0.1902)	(0.2230)
US Export Exposure×Export Intensity	0.0036	-0.0199	-0.0173	0.0034	0.0242
	(0.0122)	(0.0136)	(0.0197)	(0.0220)	(0.0314)
Backward GVC×Export Intensity	-0.0006	0.0033	0.0021	-0.0014	-0.0060
	(0.0027)	(0.0033)	(0.0040)	(0.0052)	(0.0070)
Dollar Invoicing×Export Intensity	-0.0002	0.0005	0.0007	-0.0004	-0.0019
	(0.0008)	(0.0014)	(0.0013)	(0.0016)	(0.0019)
US Debt×Export Intensity	-0.0015	0.0041	-0.0069	-0.0092	0.0004
	(0.0051)	(0.0055)	(0.0074)	(0.0063)	(0.0073)
USmp×US Export Exposure	-0.0108	-0.0291	-0.0755***	-0.0839***	-0.0467***
	(0.0137)	(0.0176)	(0.0120)	(0.0123)	(0.0105)
USmp×Backward GVC	-0.0019	0.0002	0.0123***	0.0109***	0.0030
	(0.0034)	(0.0045)	(0.0025)	(0.0022)	(0.0036)
USmp×Dollar Invoicing	-0.0025**	-0.0031***	-0.0018	-0.0008	-0.0022
	(0.0010)	(0.0012)	(0.0013)	(0.0013)	(0.0017)
USmp×US Debt	0.0077	0.0131	0.0233**	0.0123	0.0182*
	(0.0058)	(0.0113)	(0.0089)	(0.0126)	(0.0105)
USmp×Export Intensity	0.4275	0.0885	0.2814	0.4622	-0.5407
	(0.4821)	(0.8024)	(0.4944)	(0.8038)	(0.7276)
USmp×US Export Exposure×Export Intensity	-0.0110	-0.0973**	-0.0406	-0.0925**	-0.1495***
	(0.0312)	(0.0474)	(0.0330)	(0.0373)	(0.0466)
USmp×Backward GVC×Export Intensity	0.0019	0.0229*	0.0159**	0.0281**	0.0423***
	(0.0052)	(0.0121)	(0.0076)	(0.0107)	(0.0115)
USmp×Dollar Invoicing×Export Intensity	-0.0042	-0.0023	-0.0032	-0.0065	0.0037
	(0.0051)	(0.0076)	(0.0049)	(0.0079)	(0.0073)
USmp×US Debt×Export Intensity	-0.0091	0.0038	-0.0218	-0.0097	0.0050
	(0.0139)	(0.0240)	(0.0236)	(0.0185)	(0.0226)
Fixed Effects					
Time FE	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
R^2	0.3567	0.3757	0.4209	0.4553	0.4854
Obs.	35,319	34,934	34,485	33,971	33,335

Note: This table reports the estimation results of exporting firms using firm export intensity together with country-level characteristics of export exposure to the US, dollar invoicing for exports, debt linkage with the US measured by securities held by US investors, and backward GVC participation. It controls for time fixed effects and firm fixed effects. Confidence intervals are constructed based on two-way clustered standard errors.

exporting firms in economies with higher export exposure to the US experience significantly larger reductions in markups compared to those in economies with lower export exposure. This effect becomes statistically significant starting from the eighth quarter after the policy shock. Backward GVC participation exerts a positive effect on the spillovers of US monetary tightening to exporters when controlling for other characteristics. Additionally, the interaction between US monetary tightening shock and the dollar invoicing ratio of exports becomes significant in the restricted sample of exporters, consistent with the results in Table 6. This finding underscores that the exchange rate channel primarily operates on exporting firms. Notably, the financial channel, captured by the ratio of debt held by US investors, continues to exhibit no significant effect on exporter markups, reaffirming its muted role in this context.

Having established the responses of exporting firms based on country-level characteristics, I now turn to the intensive margin to investigate whether a firm's export intensity further differentiates its markup responses to US monetary tightening shocks. Within the demand channel, as reported in Table 7, firms with higher export intensity experience larger markup reductions in economies with higher export exposure to the US. By contrast, in economies with higher backward GVC participation, firms with higher export intensity demonstrate smaller markup reductions relative to their lower-intensity counterparts, suggesting a buffering effect of backward GVC participation. This finding suggests that, in the presence of the other three characteristics (including the interaction terms), firms with higher backward GVC participation experience a positive change in markups relative to those with lower backward GVC participation. Exporting firms that rely more on the imported inputs are better positioned to sustain their markups under US monetary tightening. Their reliance on imported inputs potentially buffers the impact of reduced external demand, allowing them to maintain or even improve their pricing power during the periods of US monetary tightening.

Tables B.2 and B.3 in Appendix B report the estimation results using firm-level characteristics as constructed in equation (21), controlling for both country-time and sector-time fixed effects, and confirm that these findings are robust to the inclusion of additional controls, as shown in Table 7. I also replace the variable US debt with firm liquidity, as discussed in Section 5.2, and find that the estimation results remain robust when using liquidity as the measure of the financial channel. The results are reported in Table B.4.

Regarding the exchange rate channel, in economies with higher US dollar invoicing ratios of exports, exporting firms' markup responses show no variation with export intensity. These findings highlight a key distinction: the demand channel introduces heterogeneity at both the extensive and intensive margins, whereas the exchange rate channel operates uniformly across

exporting firms regardless of their export intensity. In the following section, I discuss each channel in detail.

6.3 Decomposing Spillover Channels: Which Characteristic Dominates?

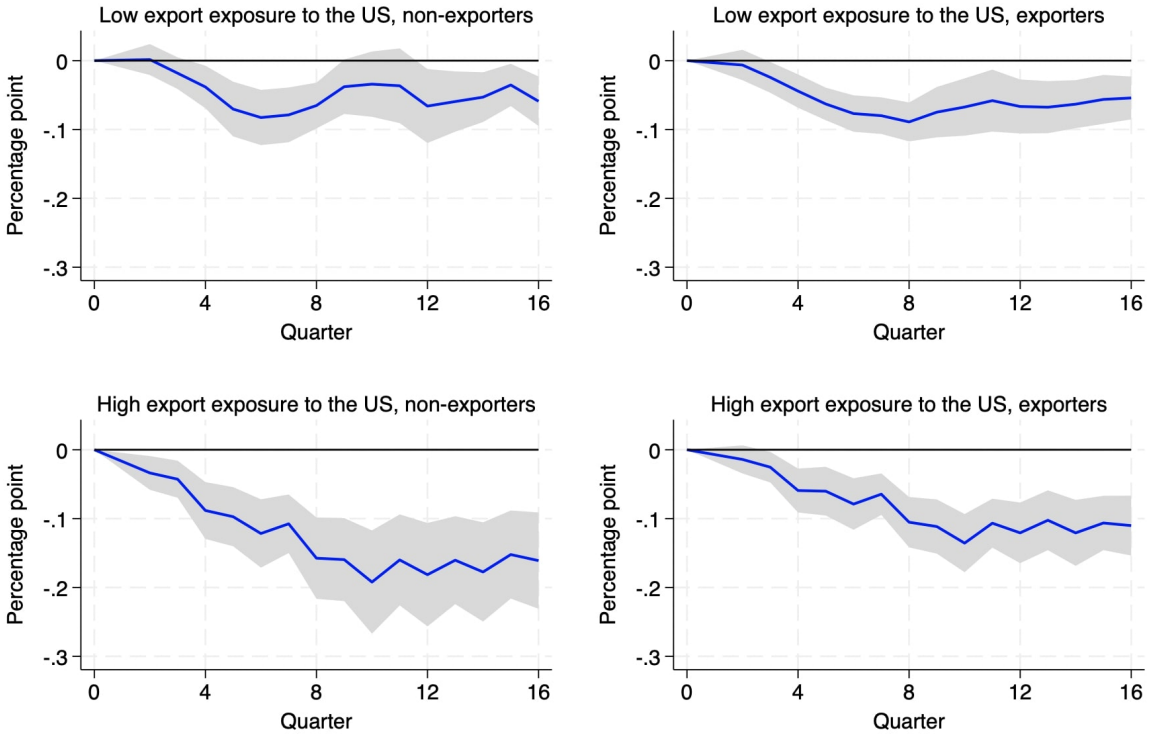
6.3.1 The Demand Channel

Export Exposure to the US. Starting with the characteristic of export exposure to the US, the negative significance on the interaction term between US monetary policy tightening and US export exposure in Tables 4 and 7 supports the hypothesis *H1* discussed in Section 2, confirming the presence of the *demand channel*. In economies where a larger share of ultimate exports is directed to the US, a contractionary US monetary policy shock triggers the decline of the US aggregate demand, leading to a decline in export volumes globally. As a result, firms in these economies lower prices and markups to maintain their export levels. Table 4 provides empirical evidence that firms in economies with higher export exposure to the US experience larger reductions in markups on average. However, do exporters behave differently than non-exporters in these economies? Table 6 answers this question. The positive significance of the triple interaction term of the exporter dummy over the 12 quarters following the policy shock suggests that while firm markups in EMEs decline overall, exporters are less harmed than non-exporters. Compared with the exporters that are directly affected by US monetary policy, non-exporters are indirectly affected on their markup reactions, especially in economies with higher export exposure to the US.

Compared to non-exporting firms, exporters operate in a more competitive environment as they are exposed to international markets and must contend with foreign competitors. This heightened competition limits their pricing power, leading to more concentrated and compressed markups. In contrast, non-exporters, shielded from international competition, experience less competitive pressure and tend to have more dispersed markups, with some dominant firms able to charge higher prices in domestic markets. In economies with higher export exposure to the US, this dynamic is further amplified, as exporters to the US face even greater competition than those exporting to other regions, resulting in even tighter constraints on their pricing strategies.

US monetary policy tightening is associated with a decline in US aggregate demand. In economies with lower export exposure to the US, exporters are less affected by this contraction of demand, and market competition remains relatively stable, allowing non-exporters to

(a) Level Effects



(b) Relative Effects

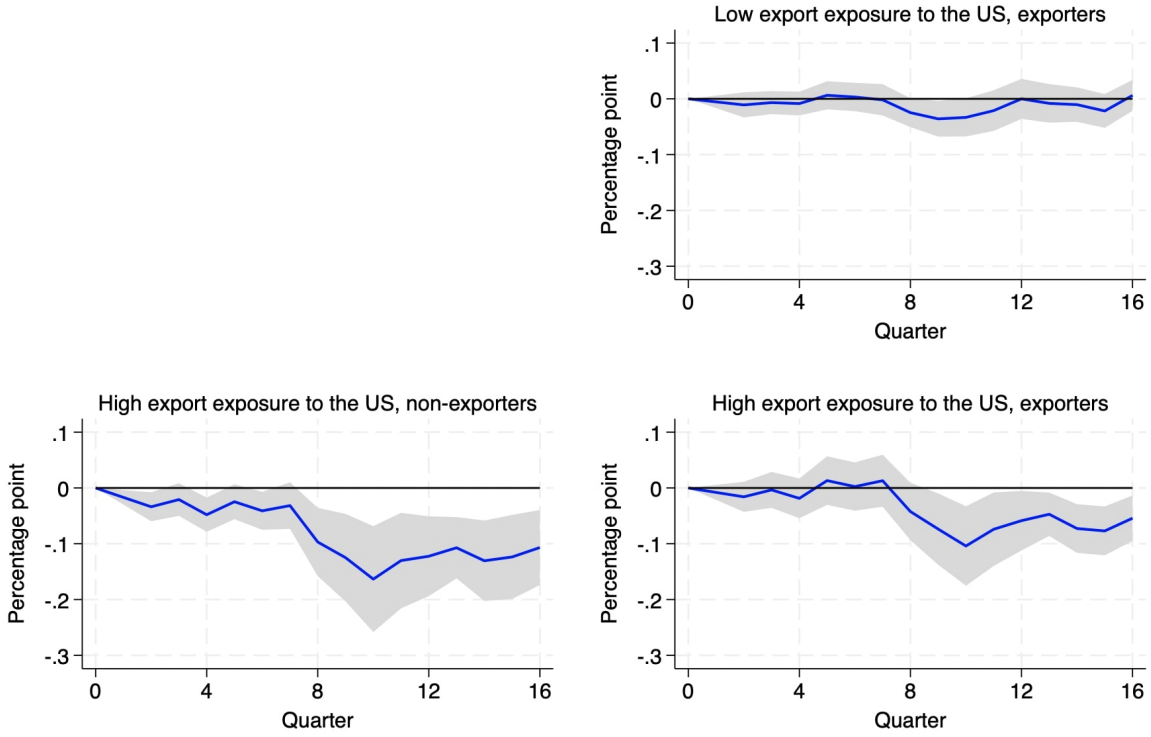


Figure 9: Impulse Response of EME Firm Markups to US Monetary Policy Tightening by Original Value-Added Exposure to the US and Exporting Status

Note: This figure shows the EME firm markup response to a 25 basis points US monetary tightening shock by group of export exposure to the US (measured by FDVAbyUS in equation (14)) and firm's exporting status. Panel (a) reports the level effects and panel (b) reports the effects relative to the firm group of non-exporters in the economies with low export exposure to the US. The grey shaded area represents 95% confidence bands. Confidence intervals are constructed based on two-way clustered standard errors at firm and quarter level.

maintain their markups. However, in higher US export-exposed economies, exporting firms lose competitiveness in foreign markets and strategically shift their focus to the domestic market. As a result, non-exporting firms, now facing increased competition, are forced to lower their prices even further. This pattern supports the demand channel, where US monetary policy tightening reduces firm markups in EMEs by curbing exports and intensifying competition within domestic markets. To illustrate the indirect exposure of non-exporters, Figure 9 presents the dynamic responses of firms by groups of exporting status and US export exposure. Panel (a) reports the level effects and panel (b) reports the effects relative to the group of non-exporters with lower export exposure to the US. Although all four groups of firms experience negative effects on markups from US monetary tightening, non-exporters within economies with higher US export exposure reduce markups by a larger magnitude than exporters. Furthermore, comparing non-exporters across different levels of US export exposure, non-exporters in economies with higher export exposure are more vulnerable to US monetary tightening than those in economies with lower US export exposure.

Table 8: Panel Regression Results of US Monetary Tightening on Exports and Sales Using Annual Data

	(1) Export value (Exporters)	(2) Total sales (Full sample)	(3) Domestic sales (Full sample)
$USmp_t$	-0.542**	-0.350	0.394*
	(0.253)	(1.716)	(0.217)
$USmp_{t-1}$	-0.438*	-1.373	0.300
	(0.242)	(2.320)	(0.254)
Exporter	-	0.021	-0.214***
		(0.023)	(0.045)
$USmp_t \times$Exporter	-	-0.089**	-0.018
		(0.041)	(0.062)
$USmp_{t-1} \times$Exporter	-	-0.018	0.139**
		(0.034)	(0.061)
Fixed Effects			
Country-Time FE	Yes	Yes	Yes
Sector-Time FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
R^2	0.481	0.117	0.146
Obs.	2,982	5,771	5,771

Note: This table reports the estimation results using annual firm-level data. Domestic sales is calculated as the difference between total sales and export value.

Table 8 provides additional evidence supporting this mechanism. In response to US monetary policy tightening, exporters' sales from exports decline significantly in the year of the shock. However, their domestic sales increase one year after the shock, reflecting the strategic shift. As external demand contracts due to US monetary policy tightening, exporters reduce

their focus on international markets and redirect efforts toward the domestic market. In turn, non-exporting firms, which previously held monopolistic positions in the domestic market, are forced to reduce their markups in response to the heightened competition brought on by the influx of exporters.

Backward GVC Participation. Focusing on backward GVC participation, the second indicator of the demand channel, the estimated results in Table 7 show that exporters with higher degree of backward GVC participation exhibit positive and significant markup responses compared to those with lower degree of backward GVC participation. This result suggests that backward GVC participation plays a positive role in mitigating the impact of US monetary tightening on firm markups, rejecting the hypothesis *H2* made in Section 2. Recalling the definition of the backward GVC participation index, which captures the ratio of foreign value added in gross exports, this finding highlights the interconnectedness of global production chains.

The positive effect of backward GVC participation can be understood through the demand and pricing dynamics within global value chains. Firms engaged in backward GVC participation import intermediate goods and use these inputs to produce final goods for exports. Their access to diversified input sources and global customers provides a buffer against demand shocks, allowing them to adjust their production processes or pricing strategies to maintain or even increase their markups during periods of US monetary tightening.

Firms with higher backward GVC participation may hold more pricing power due to their strategic position within the value chain, where they pass costs and policy spillovers to originating value-added firms. When US demand decreases after a US monetary tightening shock, the demand for imports of an intermediate goods producing firm, say firm j in country B, also decreases. In response, the value-added origin firm i in country A lowers its export prices, which reduces the marginal cost of firm j to produce final goods. Controlling for the price of the final goods—affected by the dollar invoicing ratio—firm j can increase its markups, as depicted in Table 6. In this mechanism, the spillovers to the exporters with a higher degree of backward GVC participation are passed through to the firms producing the intermediate goods, namely the value-added origin firms. Table 7 provides additional evidence when focusing on the role of export intensity by revealing an additional layer of heterogeneity in markup responses among exporters. Firms with higher export intensity in economies with greater backward GVC participation experience smaller reductions in markups compared to their lower export intensity counterparts. This suggests that the extent of a firm's reliance on exports can buffer the negative effects of demand fluctuations transmitted through the GVCs.

Firms involved in backward GVCs act as intermediaries in the global production process. These firms not only participate in international trade but also transmit US monetary policy spillovers to value-added origin firms within the supply chain. As intermediaries, they can leverage strategic complementarities in pricing, adjusting their markups in response to exchange rate movements and demand fluctuations. While higher backward GVC participation exposes firms to global demand fluctuations, it also positions them strategically to transmit these shocks upstream, potentially enabling them to maintain more stable or even higher markups compared to firms with lower GVC integration.

6.3.2 The Exchange Rate Channel

Using country-level characteristics to study firm markup responses, as reported in Table 4, I find that firms in economies with higher US dollar invoicing ratio are not affected by US monetary tightening on average. However, when introducing the exporter dummy variable to the model, I find that in economies with higher dollar invoicing ratio, exporters experience a greater reduction in markups compared to non-exporters, as presented in Table 6. This finding validates the hypothesis *H3* made in Section 2, confirming the presence of the *exchange rate channel*. It implies that the exchange rate channel via dollar invoicing of trade primarily affects exporting firms.

Under the dominant currency pricing paradigm, where a substantial share of global trade between non-US countries is invoiced in US dollars, firms face strategic complementarities in pricing. This results in a high exchange rate pass-through into import prices (in home currency), primarily driven by fluctuations in the US dollar exchange rate. When a higher ratio of exports is invoiced in US dollars, the appreciation of the dollar—following contractionary US monetary policy—raises the prices of imported goods in the home currency, which in turn reduces demand for exports. Exporters respond by lowering their export prices to maintain export volumes, leading to a decrease in firm markups after US monetary tightening.

For exporters with lower dollar invoicing ratios, the appreciation of US dollar is associated with the depreciation of their major invoicing currencies, which drives their export prices down. These exporters gain competitiveness in the global market and, as a result, may not need to adjust prices (may even raise prices). Therefore, they do not reduce markups in response to US monetary tightening.

The contrasting effects between firms with high and low dollar invoicing ratios underscore the heterogeneity in the exchange rate channel's transmission of US monetary policy spillovers.

Firms with greater exposure to dollar invoicing are more vulnerable to adverse shifts in the exchange rate and the associated pass-through into import and export prices, while firms with less dollar invoicing can often exploit the depreciation of their invoicing currencies to maintain or even improve their profitability. This highlights the critical role of invoicing currency composition in shaping firms' responses to external monetary shocks.

6.3.3 The Financial Channel

Focusing on the financial channel of US monetary policy spillovers, the results of the bivariate model in Figure 8 suggest that firms in economies with lower ratios of US debt experience larger reductions in markups in response to a contractionary US monetary policy shock. However, when estimating the multivariate model while accounting for other characteristics, the effect of the interaction term between US monetary tightening and the US debt ratio becomes insignificant. This finding suggests that the financial channel plays a limited role in transmitting US monetary policy spillovers to firm markups in EMEs.

A rise in US longer-term yields typically accompanies of US monetary policy tightening. Higher US longer-term yields lead international investors to rebalance their portfolios from foreign assets to US assets, tightening foreign financial conditions, particularly in emerging markets. In response to tightening financial conditions, firms often cut prices[33] and thus reduce markups as response in order to boost sales and hoard internal liquidity. Intuitively, firms that are more heavily indebted to US investors would be expected to be more financially vulnerable to US monetary policy shocks. However, the empirical finding suggests that the spillovers of contractionary US monetary policy to EME firm markups do not operate through the *financial channel*, rejecting the hypothesis *H4* made in Section 2.

In addition to the investment behavior of US investors, non-US investors are also likely to rebalance their portfolios in response to the rise in US longer-term yields. The appreciation of the US dollar following contractionary US monetary policy, along with the corresponding exchange rate shocks, further incentivizes non-US investors to shift their portfolio investments toward safer US assets. This "financial exposure" to non-US investors, however, is not captured by the indicator USdebtGDP. To provide additional evidence on the financial channel of US monetary policy spillovers, I use firm liquidity as the measure of the ultimate impact of US monetary tightening on firm balance sheets. Specifically, I calculate firm liquidity as the ratio of cash and cash equivalents to total liabilities. The results, reported in Figure B.5 and Table

[33]Gilchrist et al. (2017) and Renkin and Züllig (2021) provide evidence on the response of firms' pricing strategy to external shocks with the incentive of preserving liquidity.

B.4 in Appendix B, indicate that the financial channel remains muted with this indicator, suggesting the robustness of the estimation results.

6.3.4 Which Channel Dominates?

Having examined the significance and mechanism of each channel, I now turn to explore which channel plays a dominant role on the US monetary policy spillovers to firm markups in EMEs. Since the financial channel, measured by the ratio of debt held by US investors, proved insignificant, it is excluded from this analysis. Figure 10 reports the compositional effect of three characteristics with statistical significance over 16 quarters after a 25bps contractionary US monetary policy shock.

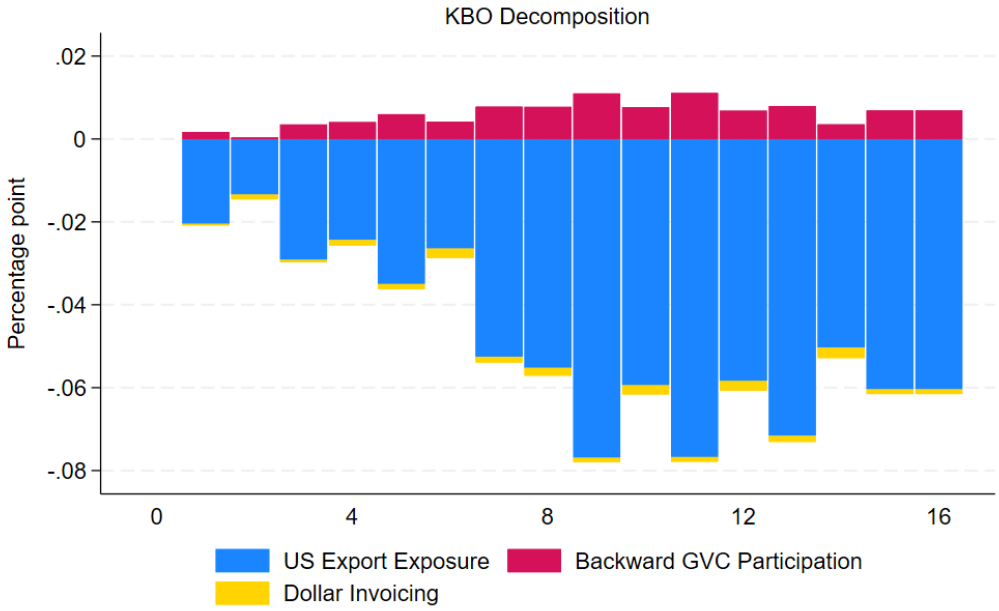


Figure 10: Decomposition of Transmission Channels

Note: This figure shows the Kitagawa-Blinder-Oaxaca (KBO) decomposition of EME firm markup responses to a 25 basis points US monetary policy tightening shock using country-level characteristics. Debt linkage with the US is excluded from the estimation given the insignificance of its effect.

As discussed earlier in this section, both US export exposure and backward GVC participation capture aspects of the demand channel. However, comparing the magnitudes of these indicators, US export exposure plays a dominant role in firm markup responses. For instance, in the fourth quarter after a 25bps contractionary US monetary policy shock, a one percentage point increase in US export exposure results in a 0.023pp decline in firm markups on average. In contrast, a one percentage point increase of backward GVC participation would raise firm markups by just 0.003pp.

The dollar invoicing ratio of exports, representing the exchange rate channel, has a smaller and more modest impact. By the fourth quarter, a one percentage point increase in the dollar

invoicing ratio reduces firm markups by only 0.001 percentage points. This comparison underscores that while variations in the dollar invoicing ratio have a limited impact, primarily affecting pricing and the financial dynamics, changes in US export exposure have a much larger and direct effect on production and, consequently, firm markups.

A 1pp change in export exposure represents a substantial shift in a firm's revenue source, as exports directly contribute to sales and production output. When export volumes decline due to reduced US demand, the impact on a firm's financial health and pricing strategy is immediate and significant, which leads to a large reduction in markups. In contrast, a 1pp change in the dollar invoicing ratio affects the pricing mechanism through currency fluctuations. Firms with high dollar invoicing are exposed to exchange rate volatility, which affects costs and pricing adjustments, but this does not translate into an equivalent impact on production or demand as directly as the loss of export sales does. Hence, while the exchange rate channel influences markups, its magnitude tends to be smaller compared to the direct effect of changing export volumes.

6.4 Marginal Effects

In the previous section, I have discussed the mechanisms of US monetary policy spillovers to firm markups in EMEs and evaluated the compositional effect of each channel. In this section, I extend the analysis by presenting the marginal effects of US monetary tightening as a function of the value of each characteristic. Figure 11 reports the marginal effects of a 25bps US monetary tightening shock on EME firm markups across the distribution of country-level characteristics, offering a nuanced view of how degrees of exposure shape firm responses. Each panel shows the marginal effects in the fourth and the eighth quarters after the policy tightening, alongside the actual distribution of characteristics.

As presented in the top left panel, export exposure to the US is mainly concentrated between 1% and 5% level, with few economies having larger US export exposure, such as Mexico (having around 15% of the original value added ultimately exporting to the US). The marginal effect of the tightening on firm markups becomes more pronounced as export exposure increases in both quarters. For instance, in the fourth quarter after a 25bps US monetary tightening shock, firms in economies with 3% of US export exposure would reduce markups by 0.2pp, whereas firms in economies with 5% US export exposure would face a sharper reduction of 0.3pp, assuming all other variables remain at the mean. This effect becomes even more amplified by the eighth quarter, with the gap in markup responses widening further, as depicted by the red line in the

figure.

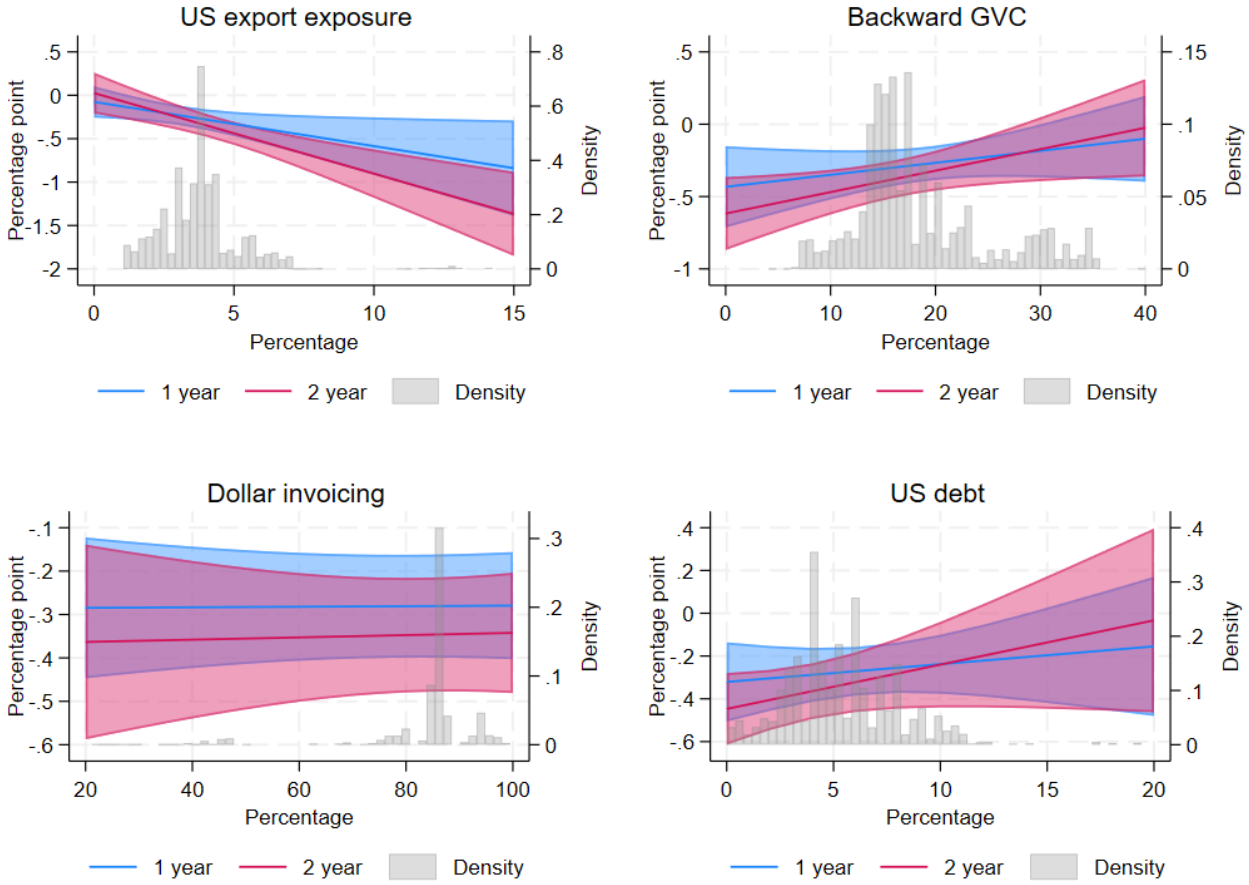


Figure 11: Marginal Effects of a 25bps US Monetary Tightening Shock on EME Firm Markups and the Distribution of Country-Level Characteristics

Note: This figure shows the marginal effects of a 25bps US monetary tightening shock on firm markups in EMEs. Each panel focuses on the distribution of one country characteristic depending on the distribution of each characteristic in the first and second year after the policy shock. The histogram plot in gray shaded area presents the distribution of each characteristic. Confidence intervals are at 95% level and constructed based on two-way clustered standard errors.

The distribution of backward GVC participation is notably more dispersed, with most economies exhibiting values between 5% and 36%. As previously discussed, higher backward GVC participation acts as a buffer, mitigating the negative effect of US monetary policy tightening on firm markups in EMEs. Following a 25bps US monetary policy tightening shock, firms in economies with 15% of backward GVC participation would reduce markups by 0.3pp in the fourth quarter, and this reduction would deepen to 0.4pp by the eighth quarter, keeping other variables at the mean. However,in economies where backward GVC participation is higher, at 30%, firms would reduce markup by only 0.2pp ind the fourth quarter and remains at the same value of markups in the eighth quarter. This result suggests that firms with greater integration into backward GVCs are better positioned to shield their markups from the adverse effects of US monetary tightening over time.

The marginal effect depending on dollar invoicing ratio of exports is presented in the bottom left panel of Figure 11. The distribution shows that most economies have a higher ratio of dollar invoicing on exports, around 90%, while another group of economies has a significantly lower ratio, around 40%. Following a 25bps contractionary US monetary policy shock, firms in economies with a dollar invoicing ratio of about 86% would reduce markups by 0.28pp, keeping other variables at the mean. However, the variation in the marginal effects based on the distribution of dollar invoicing is relatively minor. This finding is consistent with the finding in the previous section, where dollar invoicing of exports significantly affect firm markup responses in EMEs but the magnitude of this effect is relatively small. Moreover, the role of dollar invoicing primarily applies to exporting firms, while the differing responses between exporting and non-exporting firms are not captured using country-level characteristics alone.

As previously discussed, the ratio of debt held by US investors does not appear to significantly drive the heterogeneous markup responses. However, the marginal effect reported in the bottom right panel of Figure 11 suggests that there is a positive relationship between markup responses and the distribution of US debt. After a 25bps US monetary tightening shock, firms in economies with a 2% ratio of US debt would reduce markups by 0.3pp in the fourth quarter, whereas firms in economies with a 12% ratio of US debt would see a smaller reduction of 0.2pp.

In Appendix B, I show the marginal effects of US monetary policy tightening on firm markups for firms situated at the 25th and 75th percentiles of the distribution of each characteristic (Figure B.8), and for firms at the 25th and 75th percentiles of the distribution of each characteristic using firm-level characteristics (Figures B.9 and B.10). I find that the result of marginal effects is consistent with various distribution indicators.

7 Markup Responses Across Regions

In this section, I disentangle the markup responses to US monetary policy across regions. I categorize 22 EMEs into three regional groups: Asia, Americas, and EMEA[34]. I then explore the underlying mechanisms that drive the heterogeneous responses in firm markups across these regions, examining how factors such as export exposure, exchange rate dynamics, and global value chain participation contribute to these regional differences.

As presented in Figure 12, firms in emerging Asia are more negatively by US monetary tightening shocks than firms from other regions in the sample of EMEs. After a 25bps con-

[34]Asia includes Malaysia, China, India, Indonesia, Thailand, Philippines, Pakistan, and Bangladesh. EMEs in Americas are Brazil, Peru, Colombia, Chile, Argentina, and Mexico. EMEs in Europe include Russia, Poland, Romania, Hungary, Ukraine. EMEs in Middle East and Africa include Turkey, South Africa, and Morocco.

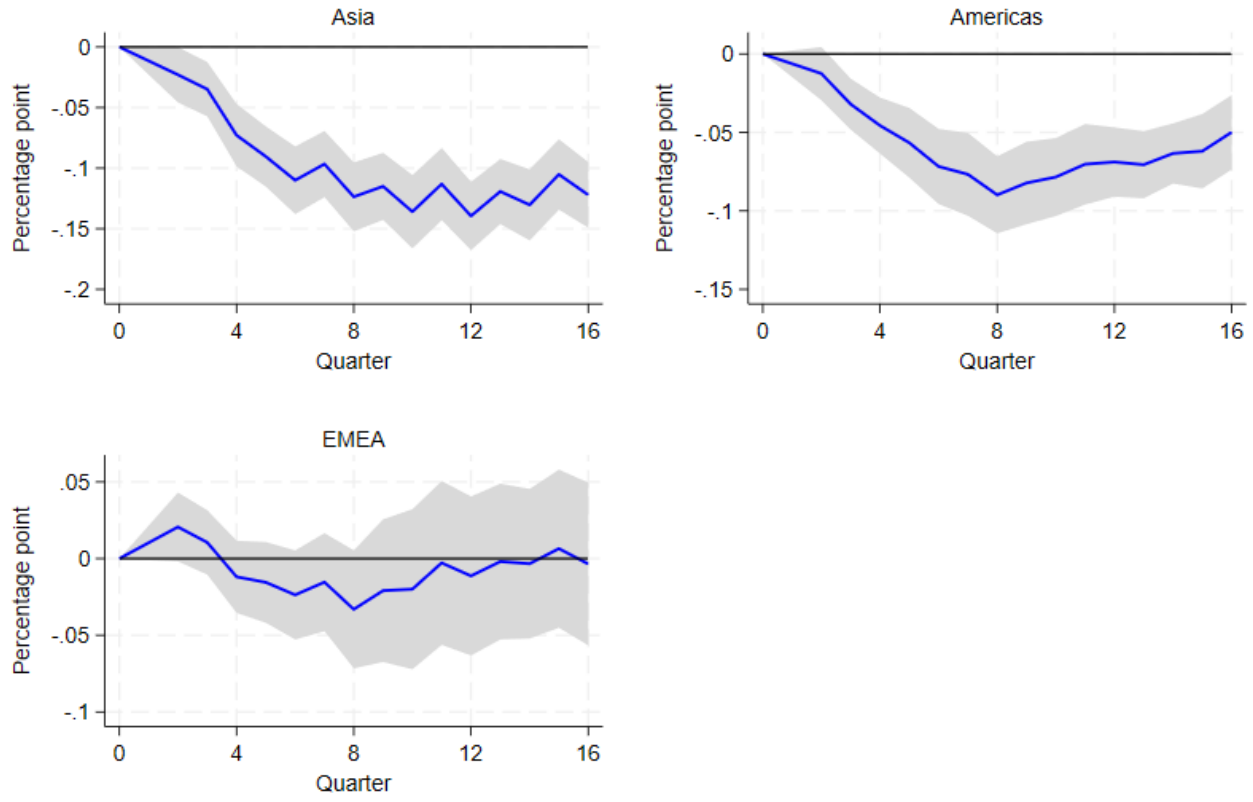


Figure 12: Impulse Response of Markups to a 25bps US Monetary Policy Tightening Across Regions

Note: This figure shows the impulse response functions of EME firm markups to a 25bps contractionary US monetary policy shock by regions of Asia, Americas, and EMEA. The grey shaded area represents 95% confidence bands. Confidence intervals are constructed based on two-way clustered standard errors.

tractionary US monetary policy shock, public firms in emerging Asia experience a reduction in markups up to −0.11pp on average in the sixth quarter, with this effect remaining persistent over the following four years, as the impulse response function does not converge to the original level. Publicly listed firms in emerging Americas also exhibit negative responses to US monetary tightening, though the magnitude is smaller, with the peak effect of −0.09pp occurring two years after the shock. In contrast, firms in EMEA show no significant change in markups, and any initial fluctuation converges back to the pre-shock level within four years[35].

Figure B.11 in Appendix B further highlights the relative dynamic responses of firms in the Americas and EMEA regions compared to those in Asia. The results confirm a statistically significant difference between the firm group in Asia and the other two regions. Specifically, firms in EMEA and the Americas demonstrate relatively positive markup responses compared

[35]In Appendix B.4.4, I further divide the full sample into two groups based on the dominant currency in exports. In specific, economies with an average US dollar invoicing ratio exceeding 50% are categorized as dollar-denominated regions, while others are categorized as euro-denominated regions. The results show a significant difference in markup responses to contractionary US monetary policy: firms in dollar-denominated regions experience a significant reduction in markups, whereas firms in euro-denominated regions show an insignificant increase with smaller magnitudes.

to their counterparts in Asia, reflecting the more pronounced and persistent impact of US monetary policy on Asian firms.

7.1 Which Characteristics Explain the Regional Heterogeneity?

In this section, I explore the potential explanations for the regional heterogeneity in markup responses by examining the key characteristics discussed in Section 5. The first characteristic that affects US monetary policy transmission to firm markups in EMEs is the export exposure to the US. As discussed in the previous section, firms in economies with higher export exposure to the US are more negatively affected by US monetary policy tightening. Here, I assess whether the regional differences in Figure 12 can be attributed to this characteristic.

The top left panel of Figure B.12 presents the time series plot of the ratio of value added origin of final demand by the US relative to the global demand for each region. The data reveals that EMEA countries have consistently lower ratio of exports to the US in terms of value added origin, with the share being around 2% over the sample period. In contrast, EMEs in Asia and Americas have higher ratio of exports to the US in terms of final demand, with values ranging between 4% and 8%, fluctuating over the years. Notably, the ratio for Asia and Americas as the original exporter decreased during 2008 and 2009, implying The Great Trade Collapse. To sum up, the demand channel of US monetary policy spillovers is valid when focusing on the heterogeneous markup responses by region.

As discussed in the previous section, exporters with a higher dollar invoicing ratio tend to reduce their markups in response to US monetary tightening, while those with lower dollar invoicing ratios generally increase markups. Looking at the regional breakdown of markup responses, firms in EMEA increase markups following US monetary tightening, whereas firms in emerging Asia and Americas experience negative impacts. This raises the question: Are these heterogeneous responses driven by dollar invoicing of exports?

In the top right panel of Figure B.12, I present the time series of ratio of exports that are invoiced in US dollars relative to total exports by region. Emerging market economies in the Americas have the highest dollar invoicing ratio in exports, with an average of 96.5% over the sample period. Dollar invoicing is also dominant in emerging Asia, where it averages 87.7%. In contrast, EMEA has a significantly lower share of dollar invoicing, averaging just 40.1% over the same period. This disparity in dollar invoicing ratios helps explain the divergent markup responses across regions. Firms in the Americas and Asia—with higher dollar invoicing exposure—reduce markups in response to US monetary tightening, while firms in EMEA—with

lower dollar invoicing exposure—are less affected and can even increase their markups.

Backward GVC participation reveals a different pattern when comparing the impulse responses of firm markups across regions. Since 2008, backward GVC participation has been declining in Asia, and a similar trend is observed in the Americas since 2004. However, EMEA has seen a consistent increase in backward GVC participation over the past two decades, rising from 7.4% in 2002 to 19.6% in 2018. This increasing GVC participation in EMEA partially explains the positive effect of backward GVC participation on firm markups, as higher GVC integration allows firms to better maintain or increase markups in the face of external shocks like US monetary tightening[36].

7.2 Regional Effect or Characteristic Effect?

In Section 7.1, I discuss the heterogeneous markup responses to US monetary policy across regions, identifying the characteristics—such as export exposure to the US, dollar invoicing of exports, and backward GVC participation—that explain the heterogeneity of markup responses. In this section, I examine whether the regional heterogeneity can be fully explained by these characteristics or if there remains a distinct regional effect that is not captured by them. To explore this potential regional effect, I estimate markup responses while accounting for these characteristics and introducing a regional dummy variable. Estimation results are reported in Table 9.

With the presence of regional variables, the demand channel, captured by the export exposure to the US and backward GVC participation, remains statistically significant, confirming its robust role in the transmission of US monetary policy to EME firm markups. However, the exchange channel, represented by dollar invoicing of exports, appears muted, with a relatively small magnitude. This finding suggests that regional factors absorb some of the heterogeneity that was initially attributed to dollar invoicing. The financial channel, captured by the ratio of debt held by US investors, remains muted as in Table 4.

Focusing on the interaction terms between US monetary policy and regional dummy variables, the results indicate that the heterogeneous markup responses of firms in emerging Asia and the Americas are not fully explained by the four characteristics, particularly beyond the eighth quarter after the policy shock. However, as presented in the last row of Table 9, much of the heterogeneity in the markup responses of firms in emerging Asia and EMEA is largely explained by differences in the characteristics, suggesting a more comprehensive explanation of

[36]In Appendix B, I explore further the composition of exporters and non-exporters in each region and investigate whether exporters behave differently than non-exporters.

Table 9: Estimation Results with Characteristics and Regional Variables (Reference region: Asia)

$\Delta^h \ln(markup)_{i,t}$	(1) h=0	(2) h=4	(3) h=8	(4) h=12	(5) h=16
USmp	-0.0331	-0.1383***	-0.1842***	-0.1987***	-0.1795***
	(0.0305)	(0.0454)	(0.0526)	(0.0366)	(0.0411)
USmp×US Export Exposure	-0.0035	-0.0326	-0.0490**	-0.0632***	-0.0600***
	(0.0150)	(0.0195)	(0.0199)	(0.0152)	(0.0140)
USmp×Backward GVC	-0.0003	0.0085	0.0215**	0.0247***	0.0222***
	(0.0045)	(0.0074)	(0.0082)	(0.0058)	(0.0060)
USmp×Dollar Invoicing	0.0009	0.0004	-0.0006	-0.0006	0.0001
	(0.0006)	(0.0009)	(0.0008)	(0.0007)	(0.0011)
USmp×US Debt	0.0016	0.0012	-0.0111	0.0093	0.0219
	(0.0029)	(0.0167)	(0.0220)	(0.0167)	(0.0232)
USmp×Americas	0.0311	0.0497	0.0838*	0.0910**	0.0829***
	(0.0230)	(0.0380)	(0.0440)	(0.0374)	(0.0305)
USmp×EMEA	0.0590**	0.0496	0.0707	0.1333	0.1175
	(0.0228)	(0.0458)	(0.0678)	(0.0834)	(0.0976)
Fixed Effects					
Firm FE	Yes	Yes	Yes	Yes	Yes
R^2	0.4369	0.3881	0.3932	0.4301	0.4666
Observations	150,935	149,162	147,624	145,917	143,963

Note: This table reports the dynamic responses of EME firm markups to a 25bps US monetary tightening shock using country-level characteristics and regional dummy variables. The reference region is emerging Asia. It controls for firm fixed effects. Confidence intervals are constructed based on two-way clustered standard errors.

regional heterogeneity for these regions.

What drives the heterogeneous markup responses of firms in emerging Americas compared to those in Asia? To further investigate the mechanism behind this finding, I examine the role of exchange rate regimes in EMEs. Specifically, I use the exchange rate regime dataset constructed by Ilzetzki et al. (2019) and create a dummy variable that equals 1 if the economy maintains a pegged exchange rate[37]. Table 10 reports the estimation results.

Introducing the exchange rate regime into the estimation does not affect the statistical significance of the four characteristics. However, the difference in firm markup responses between emerging Asia and the Americas becomes insignificant, while the interaction term of US monetary tightening and FX peg shows a significant negative effect. This result suggests that the heterogeneous responses of firm markups in emerging Asia versus the Americas can largely be explained by the exchange rate regimes in these economies. Figure B.15 presents the composition of exchange rate regimes across emerging Asia and the Americas over the sample period.

[37]These include de facto crawling band that is narrower than or equal to +/- 2%, de facto crawling peg, pre announced crawling band that is narrower than or equal to +/- 2% or de facto horizontal band that is narrower than or equal to +/- 2%, pre announced crawling peg, de facto moving band narrower than or equal to +/- 1%, de facto peg, pre announced horizontal band that is narrower than or equal to +/- 2%, pre announced peg or currency board arrangement, and no separate legal tender or currency union.

Table 10: Estimation Results with Characteristics, Regional Variables (Reference region: Asia), and Exchange Rate Regime

$\Delta^h \ln(markup)_{i,t}$	(1) h=0	(2) h=4	(3) h=8	(4) h=12	(5) h=16
USmp	-0.0331	-0.0648	-0.0355	-0.0559	-0.0631
	(0.0288)	(0.0568)	(0.0639)	(0.0485)	(0.0391)
USmp×US Export Exposure	-0.0037	-0.0217	-0.0278*	-0.0439***	-0.0455***
	(0.0115)	(0.0154)	(0.0139)	(0.0118)	(0.0123)
USmp×Backward GVC	-0.0002	0.0014	0.0073	0.0113**	0.0116***
	(0.0024)	(0.0032)	(0.0047)	(0.0045)	(0.0038)
USmp×Dollar Invoicing	0.0009	0.0013	0.0012	0.0012	0.0016*
	(0.0009)	(0.0011)	(0.0012)	(0.0009)	(0.0009)
USmp×US Debt	0.0016	-0.0020	-0.0177	0.0029	0.0167
	(0.0028)	(0.0163)	(0.0203)	(0.0150)	(0.0216)
USmp×FX Peg	0.0001	-0.0818	-0.1650*	-0.1579***	-0.1280**
	(0.0446)	(0.0845)	(0.0865)	(0.0528)	(0.0482)
USmp×Americas	0.0314	-0.0207	-0.0576	-0.0433	-0.0250
	(0.0266)	(0.0511)	(0.0510)	(0.0501)	(0.0409)
USmp×EMEA	0.0579**	-0.0029	-0.0397	0.0229	0.0174
	(0.0272)	(0.0447)	(0.0636)	(0.0851)	(0.0850)
Fixed Effects					
Firm FE	Yes	Yes	Yes	Yes	Yes
R^2	0.4369	0.3883	0.3937	0.4304	0.4669
Observations	150,935	149,162	147,624	145,917	143,963

Note: This table reports the dynamic responses of EME firm markups to a 25bps US monetary tightening shock using country-level characteristics, regional dummy variables, and dummy variable of pegged exchange rate regime. The reference region is emerging Asia. It controls for firm fixed effects. Confidence intervals are constructed based on two-way clustered standard errors.

Compared to the Americas, emerging Asia has a higher proportion of economies with pegged exchange rate regimes, which contributes to explaining the regional differences in firm markup responses to US monetary policy.

8 Conclusion

This paper provides empirical evidence that US monetary policy has significant spillovers on firm markups of publicly listed firms in EMEs. In response to a contractionary US monetary policy shock, EME firms reduce markups, with three key transmission channels at play. The demand channel is the most prominent, as reduced aggregate demand following US monetary tightening lowers exports, triggering exporting firms to shift focus to domestic markets and compete more intensively with non-exporting firms. Non-exporting firms, initially facing less intense competition, reduce markups in a larger magnitude than exporting firms. Firms participating in backward global value chains, however, pass through the spillovers to originating value-added firms and experience smaller reductions in their own markups. The exchange rate

channel operates through US dollar invoicing on exports, where firms with a higher dollar invoicing ratio on exports experience larger reductions in markups in response to contractionary US monetary policy. The financial channel, measured by the debt linkage with the US, appears muted in its effect on firm markup responses. Decomposing the transmission characteristics, I find that export exposure to the US plays the dominant role in the policy spillovers.

The findings of this paper have important policy implications, particularly for EMEs that are highly integrated into global trade and financial systems. The significant and persistent reduction in firm markups following US monetary tightening highlights the vulnerability of EMEs to external monetary shocks, especially through the demand and exchange rate channels. Policies should enhance domestic demand resilience and diversify export markets. Given the notable role of the exchange rate channel, EMEs might consider strategies to reduce reliance on US dollar invoicing, potentially through promoting local currency trade agreements or hedging mechanisms to buffer against exchange rate fluctuations. In addition, tailored policies may be necessary to address the specific vulnerabilities of firms in different regions, where the effects of US monetary policy tightening are more pronounced and persistent.

There are several questions left for future research. First, it would be interesting to further examine the roles of dollar invoicing and export exposure to the US at a more granular level if the invoicing and exports data at firm level is available for a more comprehensive firm coverage including private firms in EMEs. Second, Firms may exhibit asymmetric responses to US monetary policy tightening versus monetary easing. Third, it is worth exploring the macroeconomic implications of the US monetary policy spillovers, such as the effects on labor share and productivity. Lastly, comparing the effect of EME domestic monetary policies versus US monetary policy on EME firm markups would have important policy insights. However, this would need to construct the monetary policy shocks for EMEs and I leave it for future work.

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Appendix

A Data

A.1 Data Cleaning and Variable Constructions

The primary steps taken for data cleaning are described as follows.

- I drop firms from the sample if they are in the sector of finance, insurance, and real estate.
- I drop inactive firms.
- I drop firms if they do not report sales, total assets, and total debt.
- I drop firms if both the cost of goods sold (COGS) and selling, general and administrative expenses (SGA) data is missing.
- I drop firms if total assets are negative, or if employment is negative, or if sales are negative in any year.
- For semi-annual frequency data, I fill one-quarter gaps in the firm-specific series of these variables by linear interpolation following Meier and Reinelt (2022).
- I drop any observations with zero or negative capital, labor, materials, sales, or labor costs following Raval (2023a).
- I winsorize ratio of revenue to assets at 0.1% and 99.9% of their distribution to eliminate outliers that may affect the estimation of markups.
- The original data from Worldscope is expressed in nominal US dollars. To ensure the dataset is comparable across countries and over time, I follow Díez et al. (2021) and convert the original data to nominal national currencies, then deflate to real national currencies using GDP deflator data from IMF International Financial Statistics, then convert back to real US dollars using the purchasing power parity (PPP) data from the World Bank.
- Capital stock is measured by the gross value of property, plants, and equipment following De Loecker et al. (2020), Demirer (2022), and Hubmer and Restrepo (2023).
- Labor is measured by the number of employees following Demirer (2022).

- Labor's revenue share is the ratio of total wage expenditure to total sales following Zhang (2019) and Demirer (2022).
- Materials cost is measured as the deflated cost of goods sold plus administrative and selling expenses less depreciation and wage expenditures following Demirer (2022) and Raval (2023a).
- After the estimation of firm-level markups, I winsorize the markup estimates at the 1% and 99% of their distribution to eliminate outliers.

A.2 Additional Summary Statistics

Table A.1: Summary Statistics by Country

	Argentina		Bangladesh		Brazil		Chile	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Sales	167.80	602.82	115.86	176.92	987.15	3,315.59	556.19	1,180.33
COGS	102.32	354.54	76.43	135.83	603.74	2,063.81	384.25	874.75
SGA	22.74	75.06	14.15	34.09	136.22	376.20	78.96	187.46
Total Assets	911.33	2,772.61	746.71	946.83	6,871.69	26,481.06	3,572.18	6,782.77
Capital Stock	1,211.04	5,384.36	496.43	957.82	4,797.73	23,836.21	3,006.35	5,966.86
Total Debt	244.36	615.98	200.33	422.11	2,306.57	9,083.89	1,133.16	2,241.52
Leverage	0.23	0.19	0.25	0.21	0.34	0.23	0.27	0.16
Age	28.07	6.69	20.32	8.98	20.63	8.94	28.12	9.52
Nb. Employees	2,955.30	5,083.16	2,173.16	2,504.86	17,427.00	30,614.69	8,469.14	20,879.40
	China		Colombia		Hungary		India	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Sales	663.60	5,122.00	873.93	2,297.17	957.13	2,306.72	353.96	1,788.89
COGS	526.34	4,177.34	538.03	1,334.06	711.16	1,886.78	272.82	1,530.74
SGA	66.67	351.15	93.17	241.41	57.61	94.24	48.39	412.65
Total Assets	3,266.12	16,182.55	7,556.86	16,171.71	4,307.66	8,803.80	1,878.42	9,145.59
Capital Stock	1,699.67	15,941.05	5,385.94	15,831.47	4,942.22	11,073.90	1,063.81	5,863.45
Total Debt	1,006.55	4,552.55	2,178.42	5,247.42	969.78	2,112.54	614.03	3,226.14
Leverage	0.22	0.35	0.18	0.15	0.23	0.16	0.27	0.34
Age	18.36	8.42	25.15	7.30	25.26	6.92	26.22	8.33
Nb. Employees	5,837.07	20,354.70	3,952.18	7,489.60	6,002.91	8,391.50	4,397.55	19,629.30
	Indonesia		Malaysia		Mexico		Morocco	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Sales	290.10	728.15	190.87	552.62	2,045.90	7,197.66	394.28	876.04
COGS	197.50	500.55	146.85	445.22	1,073.21	3,059.44	236.60	543.22
SGA	36.06	102.68	12.59	32.68	427.30	1,547.04	18.40	89.12
Total Assets	1,616.05	3,879.15	1,538.78	5,303.93	11,493.51	43,714.92	1,167.00	2,613.98
Capital Stock	1,209.60	3,954.06	1,021.76	5,242.46	11,872.22	70,747.94	1,200.80	4,018.86
Total Debt	524.03	1,384.80	473.83	2,051.23	3,901.38	16,969.26	301.68	829.49
Leverage	0.97	34.64	0.19	0.17	0.29	0.77	0.19	0.16
Age	22.55	9.94	26.10	8.22	27.00	8.30	21.82	5.84
Nb. Employees	3,740.48	10,023.19	3,507.16	8,587.43	22,972.16	41,220.57	2,542.72	3,436.07
	Pakistan		Peru		Philippines		Poland	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Sales	272.76	655.31	333.83	734.66	548.66	1,332.14	262.90	1,214.63
COGS	222.69	614.36	184.37	442.91	390.38	1,047.25	206.04	1026.48
SGA	13.73	24.55	48.01	125.44	79.50	186.50	28.33	95.43
Total Assets	1,121.42	1,964.69	2,205.02	5,011.65	4,572.56	10,368.81	1,080.43	4,179.97
Capital Stock	744.65	1,631.95	2,019.51	5,041.49	2,306.61	5,558.08	966.30	4,592.80
Total Debt	275.52	651.09	466.49	1,216.15	1,784.61	5,011.62	237.52	1,021.38
Leverage	0.26	0.22	0.21	0.16	0.28	3.32	0.19	0.20
Age	28.50	6.50	25.93	6.64	27.48	9.10	19.49	6.20
Nb. Employees	2,680.34	4,394.97	3,114.79	6,661.05	4,014.41	9,407.39	2,423.96	6,007.92
	Romania		Russia		South Africa		Thailand	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Sales	280.35	638.90	3,498.96	9,291.88	1,266.31	2,173.25	429.43	2,407.87
COGS	165.40	419.85	2,004.61	4,461.77	851.10	1,432.26	341.00	2,062.09
SGA	29.49	48.66	475.34	1,846.81	231.54	416.44	38.42	143.33
Total Assets	1,554.74	3,894.91	16,602.28	49,433.06	3,077.22	6,369.79	2,067.15	8,969.01
Capital Stock	1,575.49	4,690.57	12,991.65	55,240.16	2,248.25	5,391.59	1,582.05	8,784.40
Total Debt	201.38	496.22	4,508.30	13,726.59	711.43	1,591.90	747.04	3,222.25
Leverage	0.15	0.17	0.29	0.33	0.20	0.16	0.26	0.32
Age	22.05	7.07	18.50	4.11	29.28	11.90	23.94	9.83
Nb. Employees	3,376.26	4,955.37	23,707.85	60,245.62	1,266.31	2,173.25	429.43	2,407.87
	Turkey		Ukraine					
Variable	Mean	Std. Dev.	Mean	Std. Dev.				
Sales	298.18	1,077.97	244.87	265.72				
COGS	230.57	899.85	166.99	186.40				
SGA	31.39	108.69	18.93	23.93				
Total Assets	1,340.57	5,101.54	1,158.60	1,333.48				
Capital Stock	830.90	3,017.63	2,215.72	9,888.73				
Total Debt	439.36	2,276.94	78.30	136.41				
Leverage	0.27	0.31	0.07	0.09				
Age	25.92	9.67	24.32	8.32				
Nb. Employees	3,672.14	19,023.65	2,531.17	11,845.22				

Table A.2: Sample Coverage By Economy

Year	Argentina	Bangladesh	Brazil	Chile	China	Colombia	Hungary	India	Indonesia	Malaysia	Mexico	Morocco	Pakistan	Peru	Philippines	Poland	Romania	Russia	South Africa	Thailand	Turkey	Ukraine
2000	2.5%		6.9%	4.2%	6.9%	0.9%	1.3%	0.5%	0.1%	36.1%	5.2%		0.6%	1.7%	2.3%	1.3%		0.1%	7%	0.6%		
2001	5.3%		11.1%	19.2%	11.4%	0.2%	11.7%	9%	7.9%	44%	7.5%	0.6%	7.8%	8.9%	15.2%	2.1%		7.7%	32.8%	30.5%	5.6%	
2002	10.9%		13.1%	31.3%	15.9%	0.2%	10.7%	3.7%	13.7%	44.9%	11%	0.6%	8.2%	10.4%	18.9%	4.5%		11.8%	35.4%	30.8%	9.8%	
2003	9.5%		14.2%	32.6%	18.8%	0.2%	12.2%	4.5%	14.8%	48.2%	12.1%	3.9%	12%	10.7%	20.7%	7.7%		14%	40.8%	35.2%	8.1%	
2004	9%		15%	36.6%	22.4%	0.2%	13.2%	7.3%	16.1%	49.1%	13%	4.6%	13.1%	13.3%	21.5%	8.4%		16.7%	39%	42.6%	15%	
2005	9%	0.1%	15.7%	47.7%	25.2%	0.3%	14.6%	7.7%	16.4%	51.6%	14.9%	6.8%	14.4%	15.6%	22.7%	10.6%	1.8%	46.6%	38.2%	48.3%	10.1%	0.7%
2006	8.8%	0.1%	16.8%	45.1%	28.4%	0.9%	15.9%	10.3%	15.2%	52.6%	15.9%	7.4%	20%	17.5%	24.3%	12.7%	2.4%	53.8%	40.6%	51.2%	21.9%	0.5%
2007	9.1%	0.1%	20%	50.8%	29.2%	0.9%	15.4%	13.4%	16.4%	52.4%	17.1%	8.4%	19.7%	21.7%	24.4%	12.8%	2%	61.1%	45.6%	50.1%	22.2%	0.7%
2008	8.9%	0.5%	21.4%	62.6%	30.9%	3.2%	18.6%	18.7%	17.7%	57.4%	17.7%	9.6%	21.1%	19.9%	24.8%	15.7%	5.3%	83.8%	51.4%	63.6%	23.9%	0.7%
2009	8.5%	1.8%	19.1%	55.6%	30.3%	10.9%	17.5%	18.3%	16.6%	62.8%	18.9%	13.7%	20.5%	19.4%	23.6%	16.4%	5.6%	92.9%	51.1%	54.1%	21.6%	1.6%
2010	8.1%	3%	20.9%	53%	37.4%	12.8%	22.1%	16%	17.4%	61.6%	19.7%	16.1%	22.7%	20.1%	26.2%	19.5%	7.1%	101.5%	48.7%	56.8%	33.4%	2.9%
2011	7.9%	3.6%	22.9%	54%	39.9%	16.3%	25.4%	19.3%	19%	59.8%	21.6%	17.7%	23.2%	19.7%	29.4%	23.6%	8.1%	100.3%	49.2%	71.3%	23.5%	2.8%
2012	7.6%	3.4%	23.7%	56.6%	39.9%	16.1%	25.4%	20.8%	47.1%	67%	23.1%	18.5%	23.8%	21%	33.1%	26.5%	8.7%	96.3%	51.4%	74.8%	23.5%	4%
2013	7.3%	3.4%	22.3%	58.5%	38.8%	18.2%	24.2%	20.5%	20%	67.6%	22.5%	16.1%	26.3%	20.5%	36%	25.7%	9.2%	93.8%	51%	75.3%	20.5%	5.1%
2014	7.5%	4.6%	22.3%	59.1%	38.1%	17.6%	20.8%	23.4%	20.1%	67.5%	22.5%	16.9%	23.6%	21%	43.8%	24.7%	8.9%	130.4%	52.5%	78.9%	20%	5.6%
2015	6.7%	4.2%	23.2%	53.5%	35.7%	18.8%	17.7%	23.8%	18.5%	64.5%	23.2%	13.3%	20.5%	20.9%	42.1%	24.4%	7.7%	185.7%	52%	67%	19%	5.3%
2016	7.8%	3.1%	24%	51%	38%	21.4%	16.1%	22.7%	17.7%	62.8%	24.5%	12.7%	17.5%	22.3%	40.4%	24.3%	7.5%	196.9%	50%	61%	18.4%	3.9%
2017	8.2%	4.6%	23.5%	51.4%	42%	20.5%	16.9%	21.3%	18.8%	60.6%	24.6%	12.8%	18.6%	22.5%	43.9%	24.5%	7.7%	191.2%	52.8%	63.6%	21.4%	3.6%
2018	11.1%	4.9%	25.5%	52.1%	43.6%	20.8%	18.5%	23.2%	20.1%	59.1%	24.7%	12.5%	20.1%	23.3%	47%	25.3%	7.9%	211.8%	53.3%	70.1%	24.5%	2.9%

A.3 Additional Figures of Firm Markups

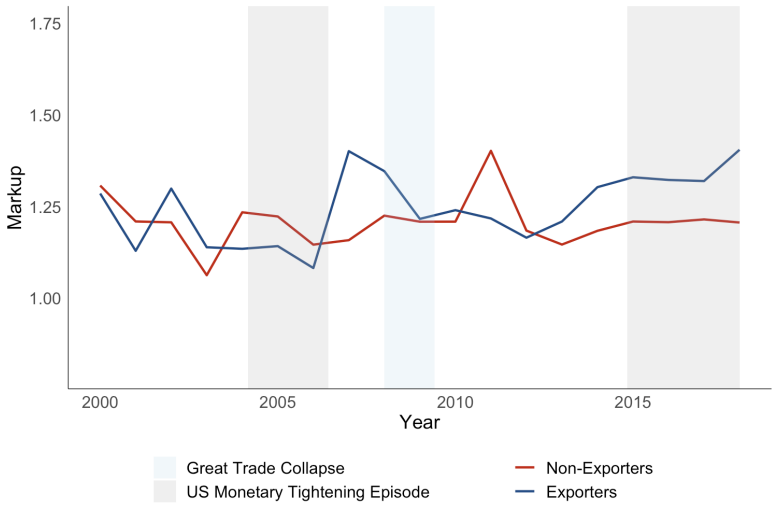


Figure A.1: Aggregate Firm Markups in Emerging Market Economies: Exporters vs. Non-Exporters

Note: This figure shows the aggregate firm markups by exporting status of 22 emerging market economies weighted by firm sales. The light blue shaded area represents the period of the Great Trade Collapse, and the grey shaded area represents the period of US monetary tightening episodes.

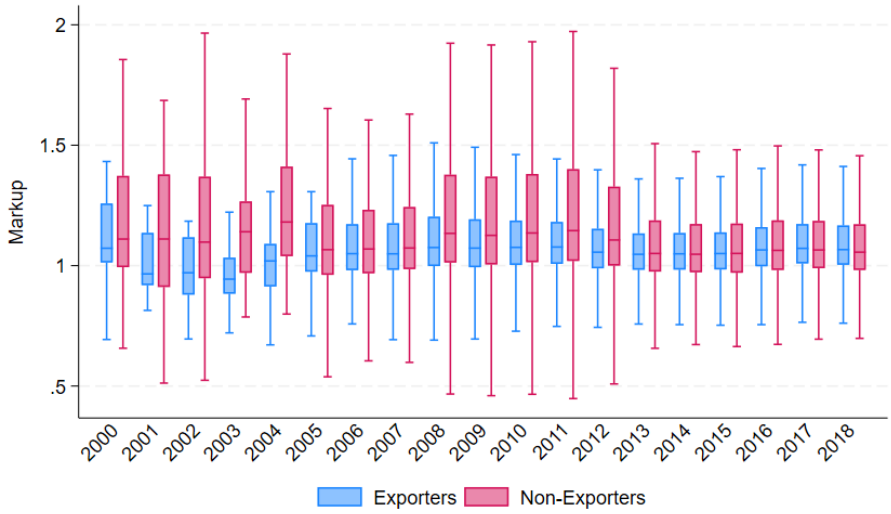


Figure A.2: Evolution of Firm Markups by the Exporting Status

Note: This figure shows the time series of firm markups in EMEs by the exporting status. Within each quarter and each market, firm markups are winsorized at the 1% and 99% cutoff to avoid any outliers.

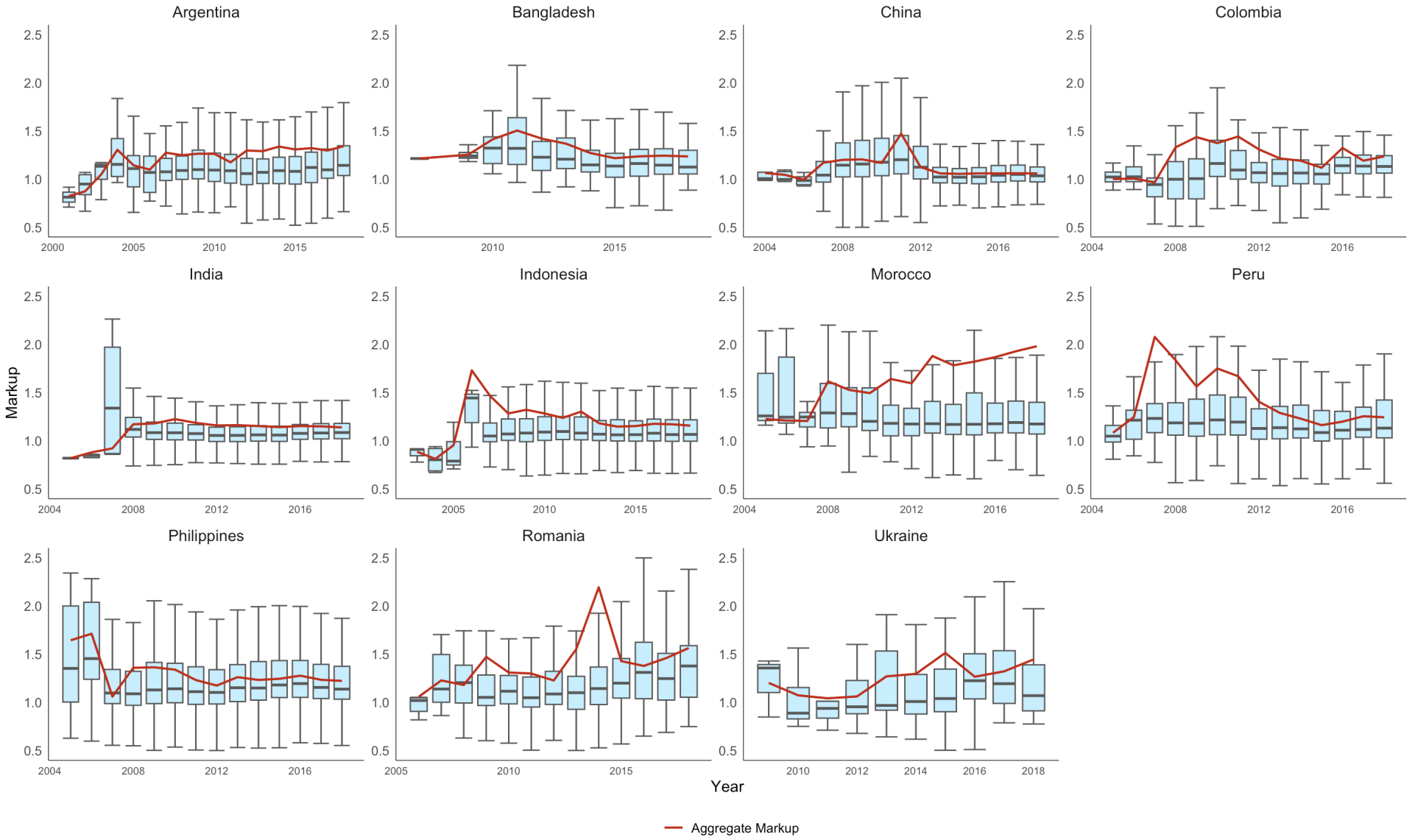


Figure A.3: Evolution of Markups By Economy

Note: The red solid line represents the average markup weighted by firm sales in each economy. The lightblue boxes are the boxplots of markup distributions over the sample period, with the median markup represented by the central line within each box.

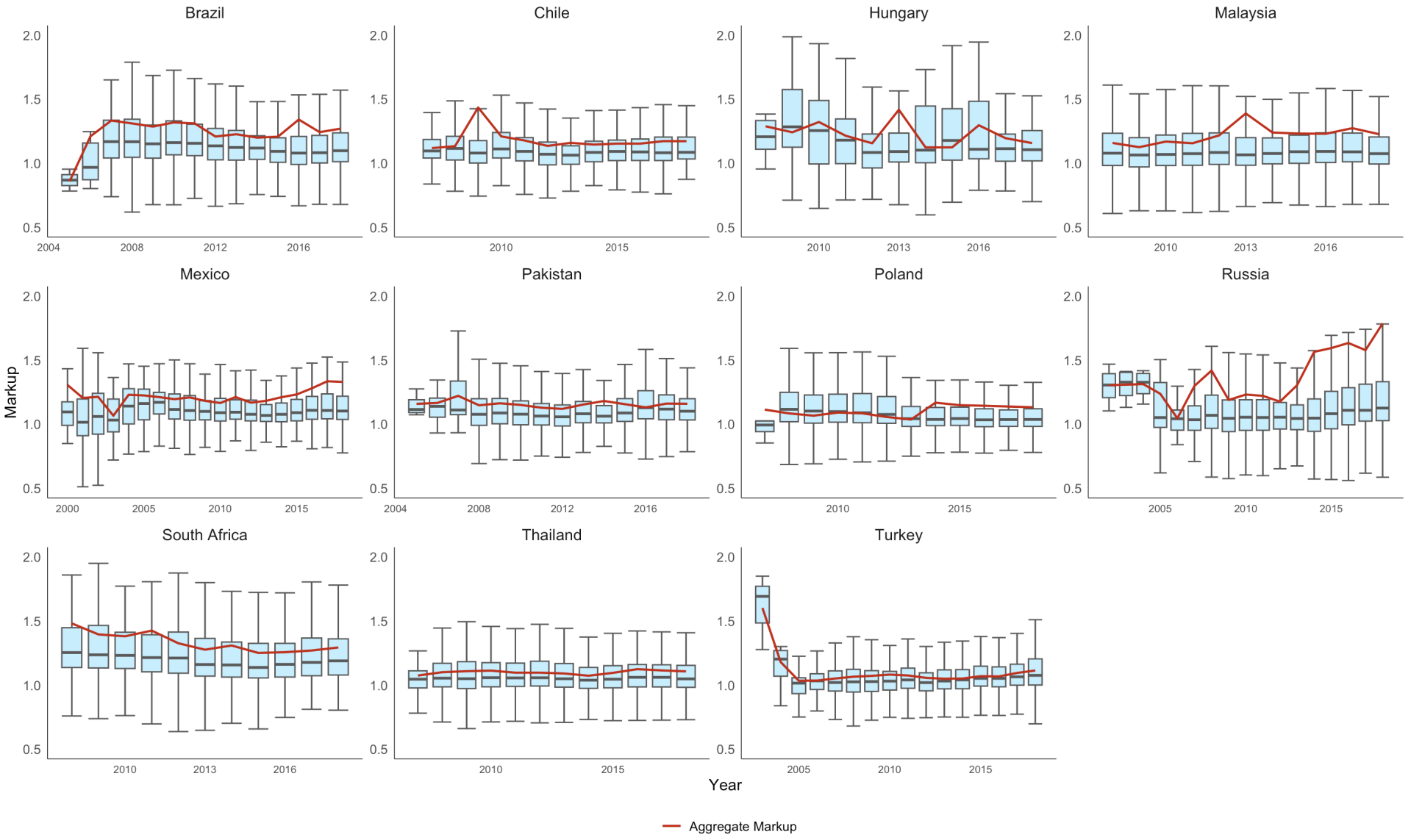


Figure A.4: Evolution of Markups By Economy (Continued)

Note: The red solid line represents the average markup weighted by firm sales in each economy. The lightblue boxes are the boxplots of markup distributions over the sample period, with the median markup represented by the central line within each box.

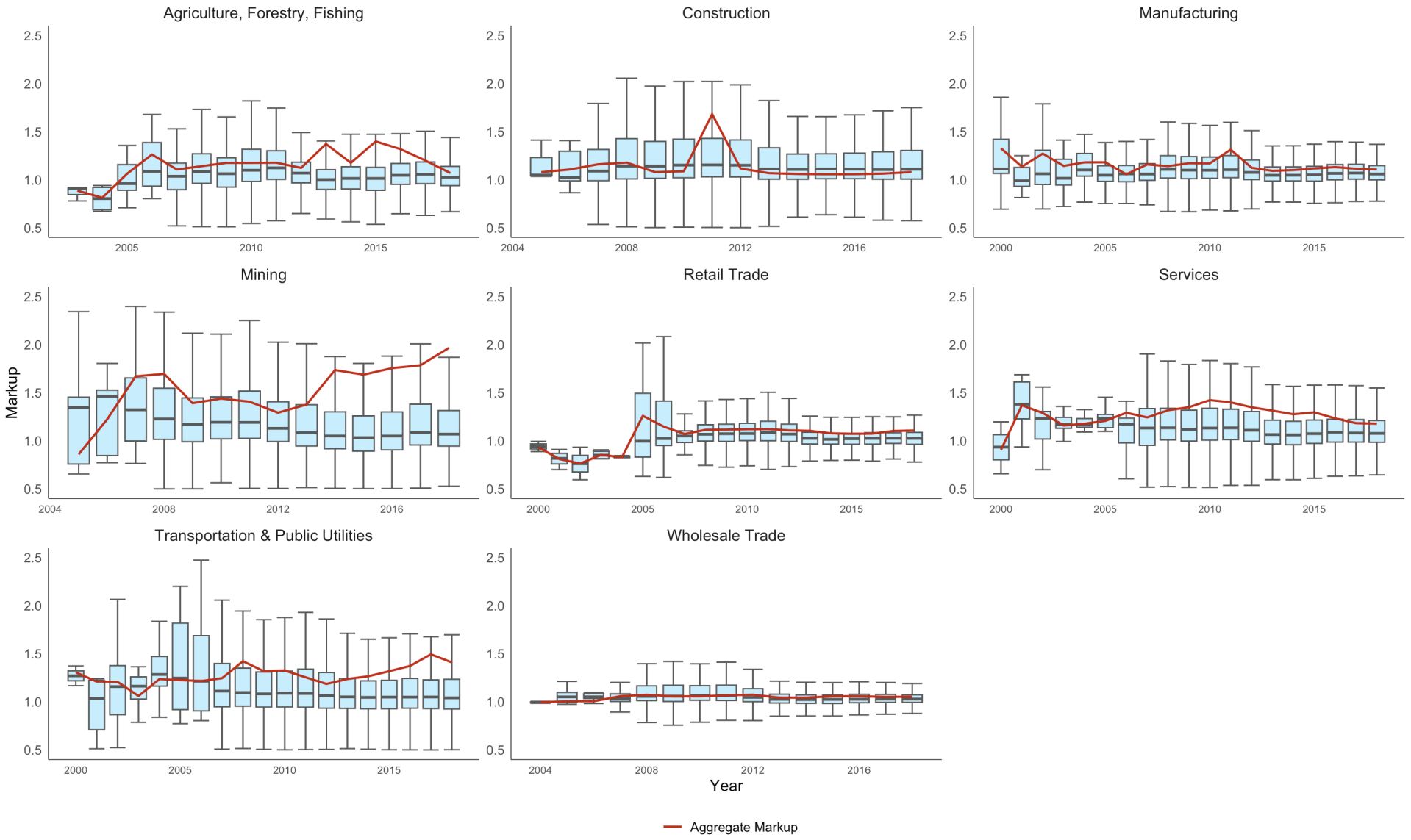


Figure A.5: Evolution of Markups By Sector

Note: The red solid line represents the average markup weighted by firm sales in each sector. The lightblue boxes are the boxplots of markup distributions over the sample period, with the median markup represented by the central line within each box.

A.4 Construction of Indicators

A.4.1 Export Exposure to the US

Figure A.6 reports the time series of the original value added ratio of final demand by the US at the aggregate level. When aggregating the value added origin of final demand across 22 EMEs, the data shows that the ratio of US demand relative to global demand remained slightly below 0.05 from 2000 until 2006. A sharp decline occurred between 2007 and 2009, coinciding with the great trade collapse, and this pattern is particularly pronounced in economies with a higher US value-added demand ratio (represented by the 75th percentile of the distribution in the figure). After this downturn, the ratio fluctuates around 0.03, maintaining this level until the end of the sample period.

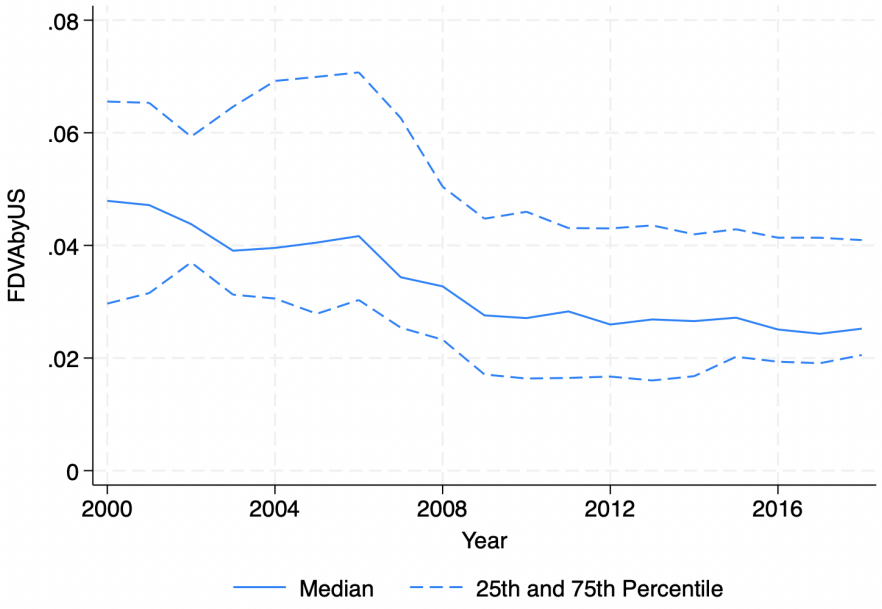


Figure A.6: The US Share of the Global Value-Added Demand Originating from EMEs

Note: This figure shows the time series of the US share of global value-added demand originating from 22 EMEs from 2000 to 2018. The share is calculated at country level following equation (14). The blue solid line represents the median and the blue dashed lines denote the 25th and the 75th percentiles of the distribution.

A.4.2 Global Value Chain Participation

Figure A.7 reports the time series of backward GVC participation. The median value increased slightly over the sample period from 0.15 in 2000 to 0.19 in 2018. The time series of forward GVC participation is relatively stable over the sample period, with the median fluctuating around 0.76, as presented in Figure A.8.

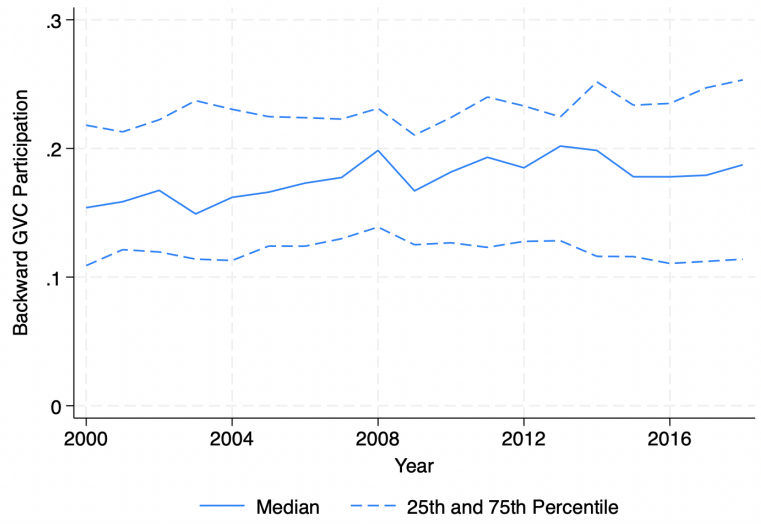


Figure A.7: Backward GVC Participation in EMEs

Note: This figure shows time series of the backward GVC participation index in 22 EMEs from 2000 to 2018 using the country-year level data from OECD TiVA Database. The solid line denotes the median and dashed lines represent the 25th and the 75th percentiles of the distribution.

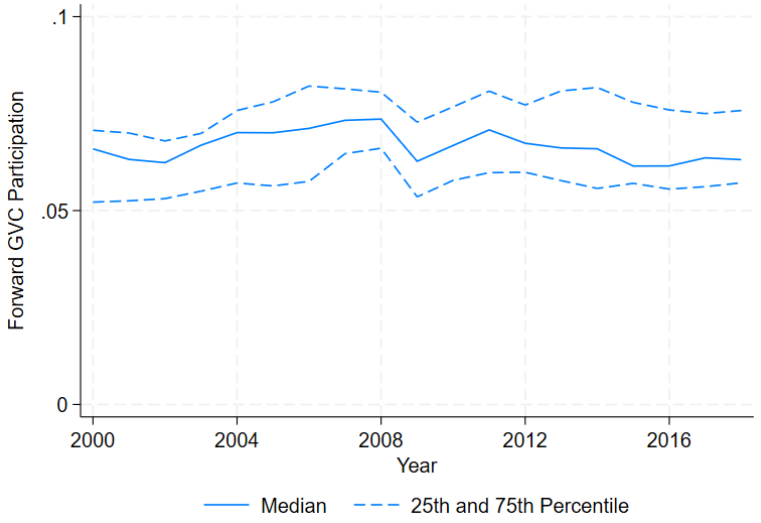


Figure A.8: Forward GVC Participation in EMEs

Note: This figure shows time series of the forward GVC participation index in 22 EMEs from 2000 to 2018 using the country-year level data from OECD TiVA Database. The solid line denotes the median and dashed lines represent the 25th and the 75th percentiles of the distribution.

A.4.3 Dollar Invoicing of Exports

Figure A.9 presents the time series of dollar invoicing ratio of exports and imports at the aggregate level over the sample period. In emerging market economies, the ratio of dollar invoicing in trade is relatively high compared to the share of trade involving the US as a direct trading partner, fluctuating around 70% for exports and 60% for imports. Focusing on the median of the distribution, there is a significant increase in the dollar invoicing ratio for exports between 2006 and 2008, from 0.44 to 0.78, after which the ratio stabilizes around 0.80. For imports, the median ratio of US dollar invoicing steadily rises from 0.61 in 2000 to 0.79 in 2018. However, the 25th and 75th percentiles for both exports and imports remain stable throughout the sample period, indicating that the increase in dollar invoicing is concentrated around the middle of the distribution, with the lower and upper quartiles showing consistent invoicing patterns.

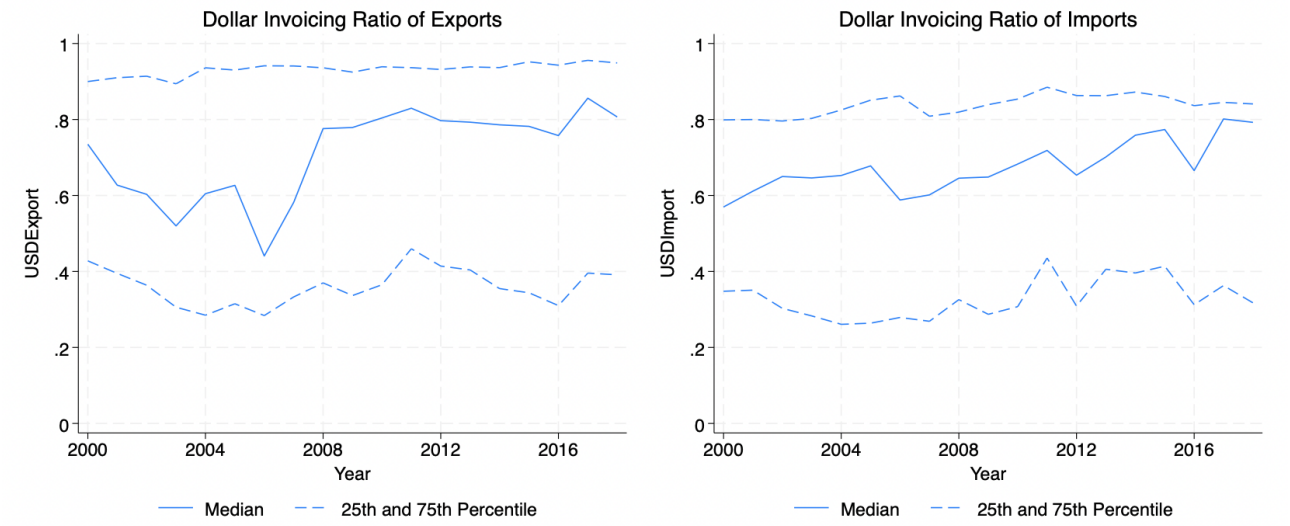


Figure A.9: The Ratio of US Dollar Invoicing of Trade in EMEs

Note: This figure shows time series of the US dollar invoicing ratio of exports and imports in 22 EMEs from 2000 to 2018 using the country-year level data in Boz et al. (2022). Solid lines denote the median and dashed lines represent the 25th and the 75th percentiles of the distribution.

A.4.4 Debt Linkage with the US

Figures A.10 and A.11 report the time series of the ratio of US investors' security holdings relative to GDP and output, respectively. Over the sample period, the median of US investors' security holdings account for 4% of GDP and the upper quartile of the distribution rises up to 8% in 2017.

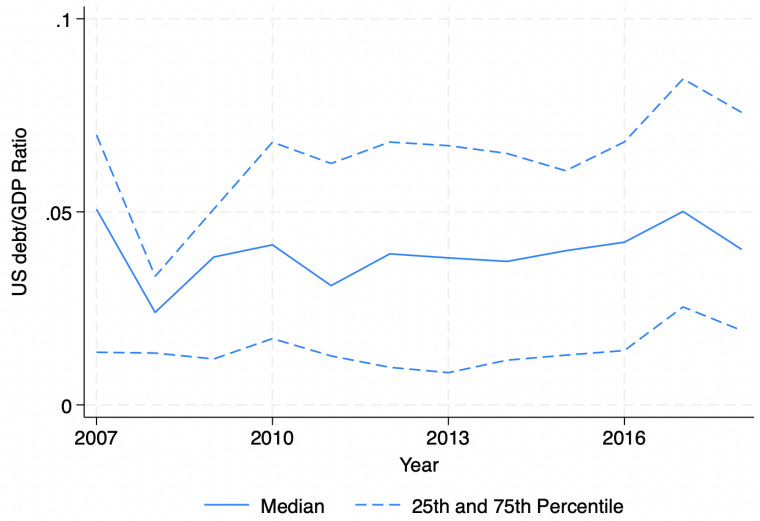


Figure A.10: The Ratio of US Investors' Security Holdings Relative to GDP in EMEs
Note: This figure shows the time series of the ratio of security holdings of US investors relative to GDP in 22 EMEs from 2000 to 2018 using country-year level data in Coppola et al. (2021). The solid line denotes the median and dashed lines represent the 25th and 75th percentiles of the distribution.

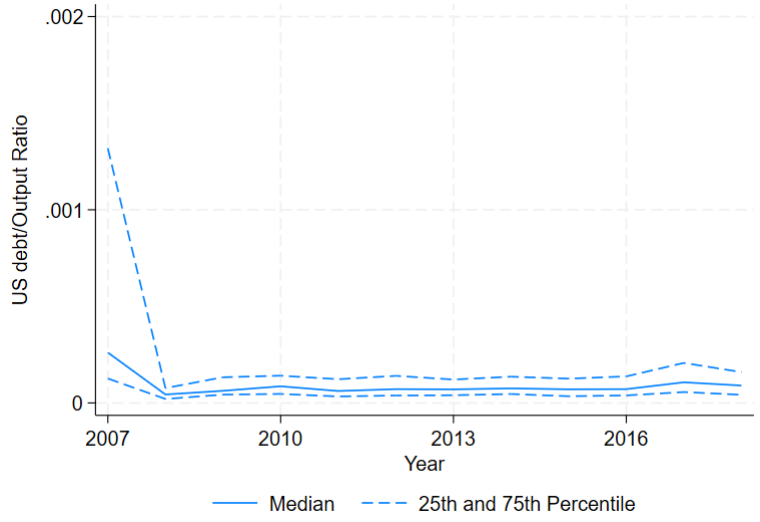
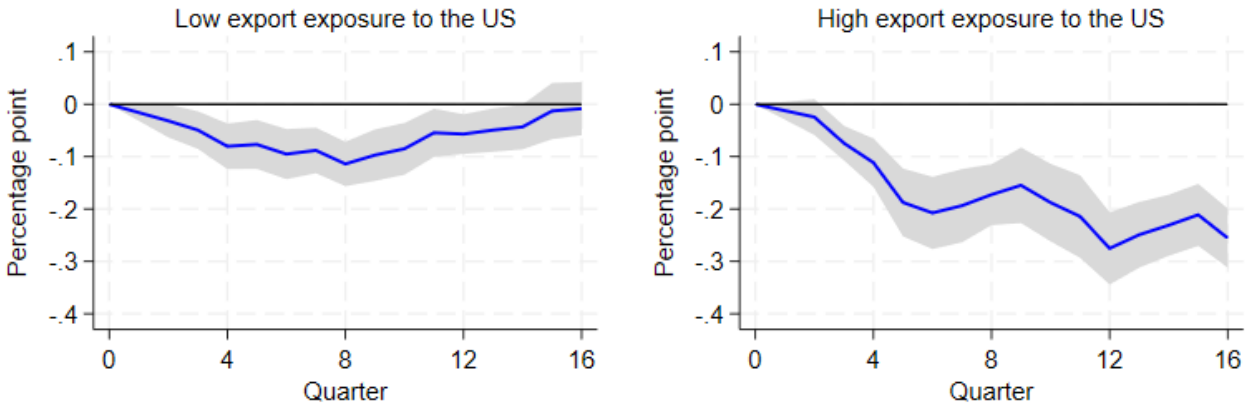


Figure A.11: The Ratio of US Investors' Security Holdings Relative to Output in EMEs
Note: This figure shows the time series of the ratio of security holdings of US investors relative to output in 22 EMEs from 2000 to 2018 using country-year level data in Coppola et al. (2021). The solid line denotes the median and dashed lines represent the 25th and 75th percentiles of the distribution.

B Additional Empirical Results

B.1 Additional Results Using the Bivariate Approach

(a) Level Effect



(b) Relative Effect

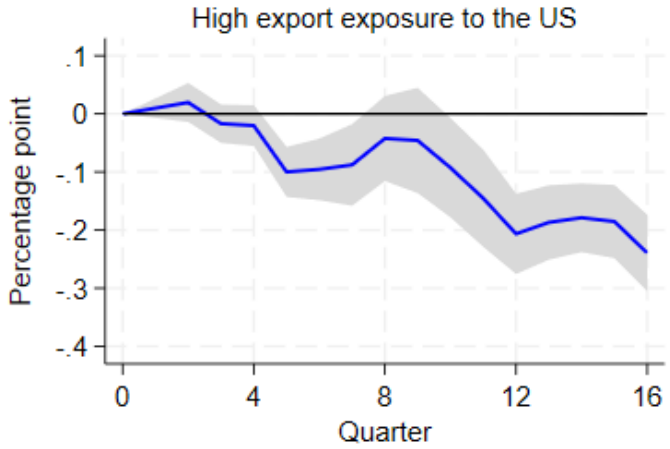
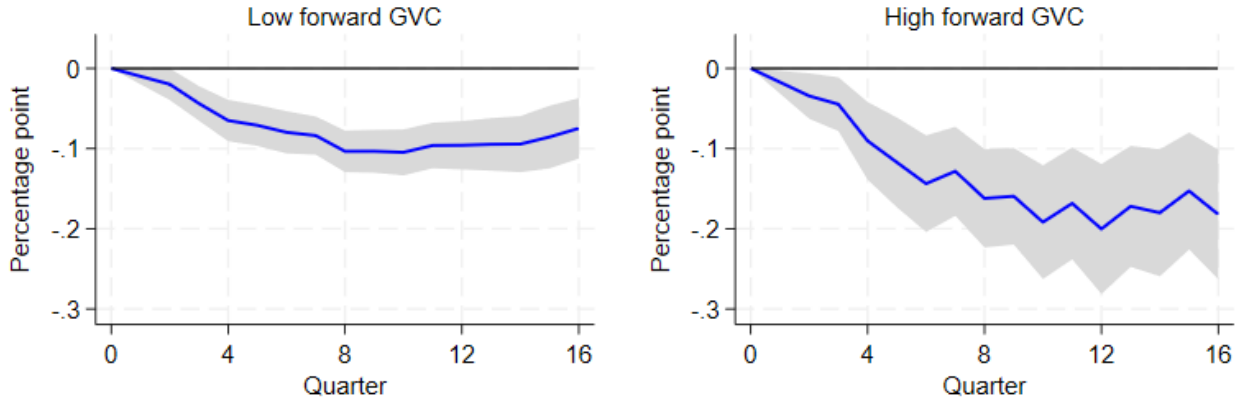


Figure B.1: Impulse Response of Markups to US Monetary Policy Tightening by Export Exposure to the US (Measured by the Gross Export Exposure to the US)

Note: This figure shows the EME firm markup response to a 25 basis points US monetary tightening shock. Panel (a) shows the result by group of export exposure to the US (measured by EXtoUS in equation (13)) and panel (b) reports the relative effect for the firms with higher export exposure to the US relative to that with lower export exposure to the US. The grey shaded area represents 95% confidence bands. Confidence intervals are constructed based on two-way clustered standard errors at country and time level.

(a) Level Effect



(b) Relative Effect

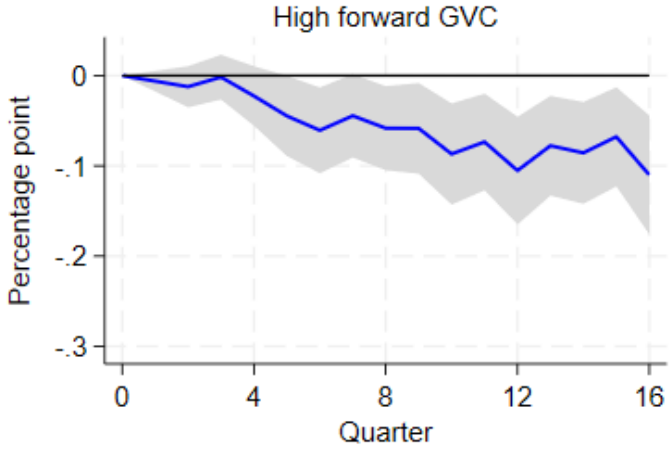
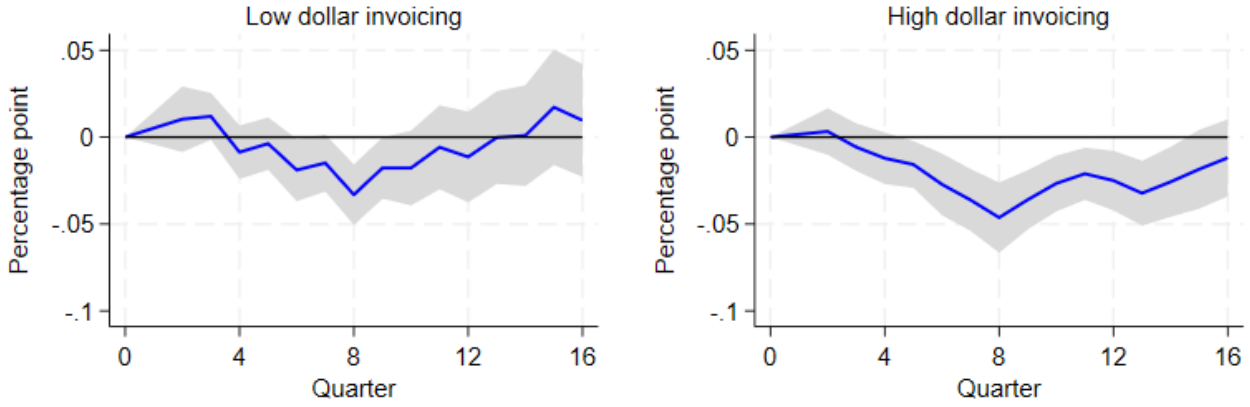


Figure B.2: Impulse Response of Markups to US Monetary Policy Tightening by Forward Global Value Chain (GVC) Participation

Note: This figure shows the EME firm markup response to a 25 basis points US monetary tightening shock. Panel (a) show the result by group of forward global value chain (GVC) participation and panel (b) reports the relative effect for firms in the group of higher forward GVC participation relative to that of lower forward GVC participation. The grey shaded area represents 95% confidence bands. Confidence intervals are constructed based on two-way clustered standard errors at country and time level.

(a) Level Effect



(b) Relative Effect

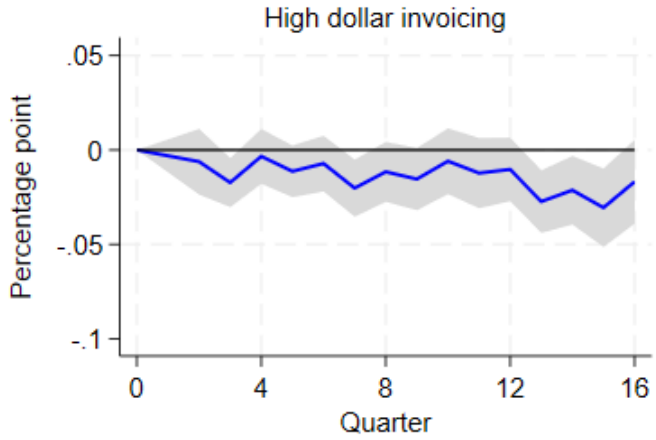
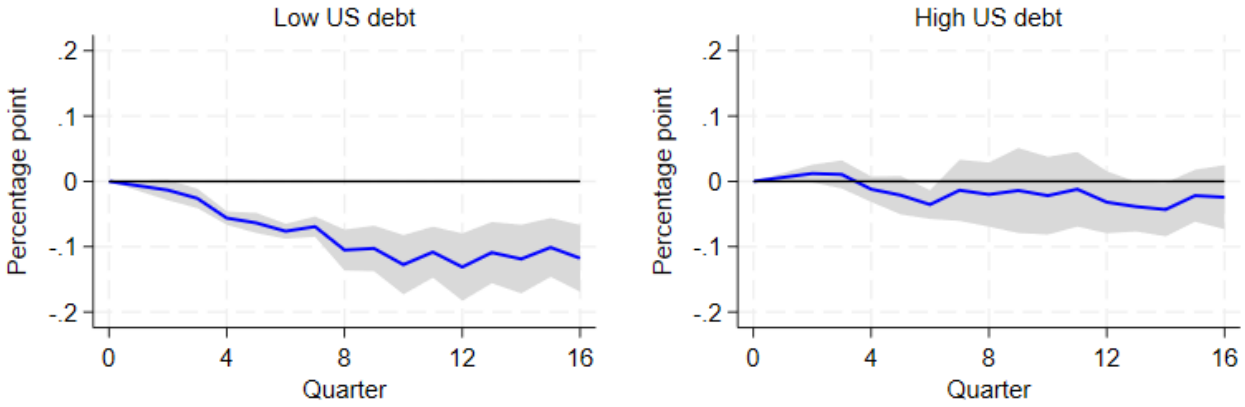


Figure B.3: Impulse Response of Markups to US Monetary Policy Tightening by Dollar Invoicing of Imports

Note: This figure shows the EME firm markup response to a 25 basis points US monetary tightening shock. Panel (a) reports the result by group of US dollar invoicing of imports and panel (b) shows the relative effect for the firms with higher US dollar invoicing ratio relative to that with lower US dollar invoicing ratio. The grey shaded area represents 95% confidence bands. Confidence intervals are constructed based on two-way clustered standard errors at country and time level.

(a) Level Effect



(b) Relative Effect

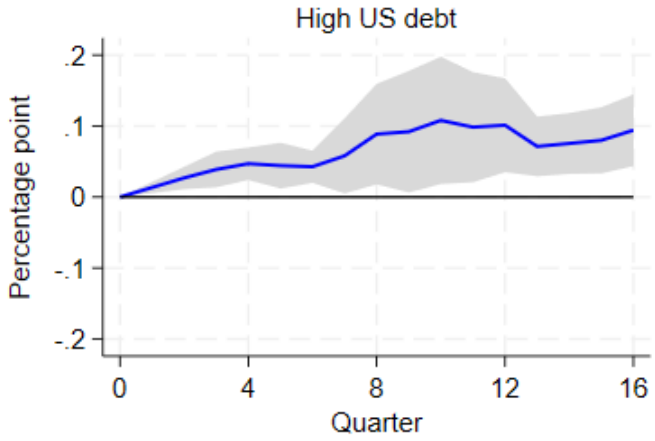
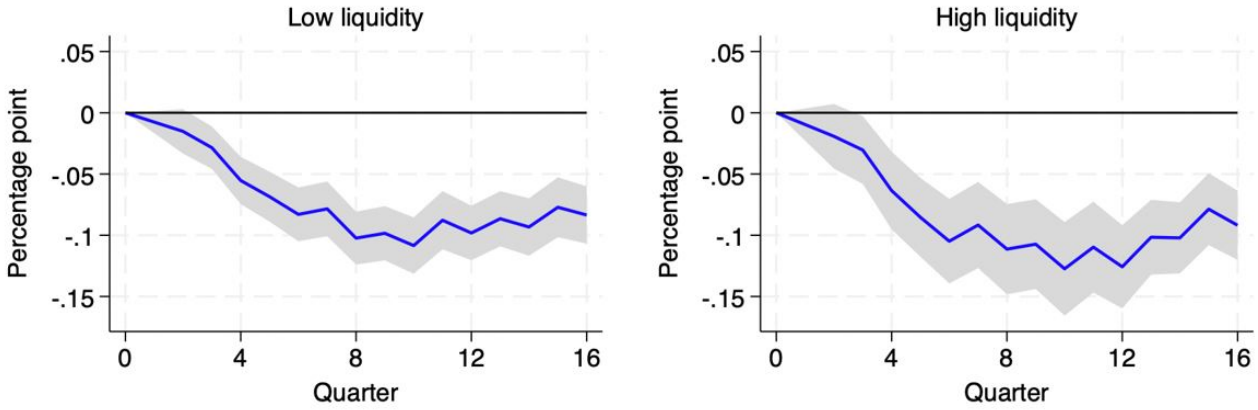


Figure B.4: Impulse Response of Markups to US Monetary Policy Tightening by Debt Holdings of US Investors (Measured by the Ratio of Securities Held by US Investors on the Nationality Basis)

Note: This figure shows the EME firm markup response to a 25 basis points US monetary tightening shock. Panel (a) show the result by group of security holdings owned by US investors on the nationality basis (measured by USdebtOutput in equation (17)) and panel (b) reports the relative effect for firms with higher ratio of corporate debt held by US investors relative to that with lower ratio of debt held by US investors. The grey shaded area represents 95% confidence bands. Confidence intervals are constructed based on two-way clustered standard errors at country and time level.

(a) Level Effect



(b) Relative Effect

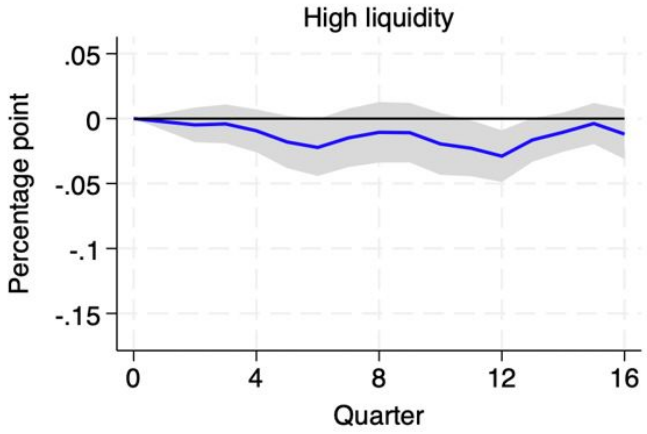


Figure B.5: Impulse Response of Markups to US Monetary Policy Tightening by Firm Liquidity (Measured By the Ratio of Cash and Cash Equivalents to Total Liabilities)

Note: This figure shows the EME firm markup response to a 25 basis points US monetary tightening shock. Panel (a) show the result by group of firm liquidity and panel (b) reports the relative effect for high-liquidity firms relative to that for low-liquidity firms. The grey shaded area represents 95% confidence bands. Confidence intervals are constructed based on two-way clustered standard errors at firm and quarter level.

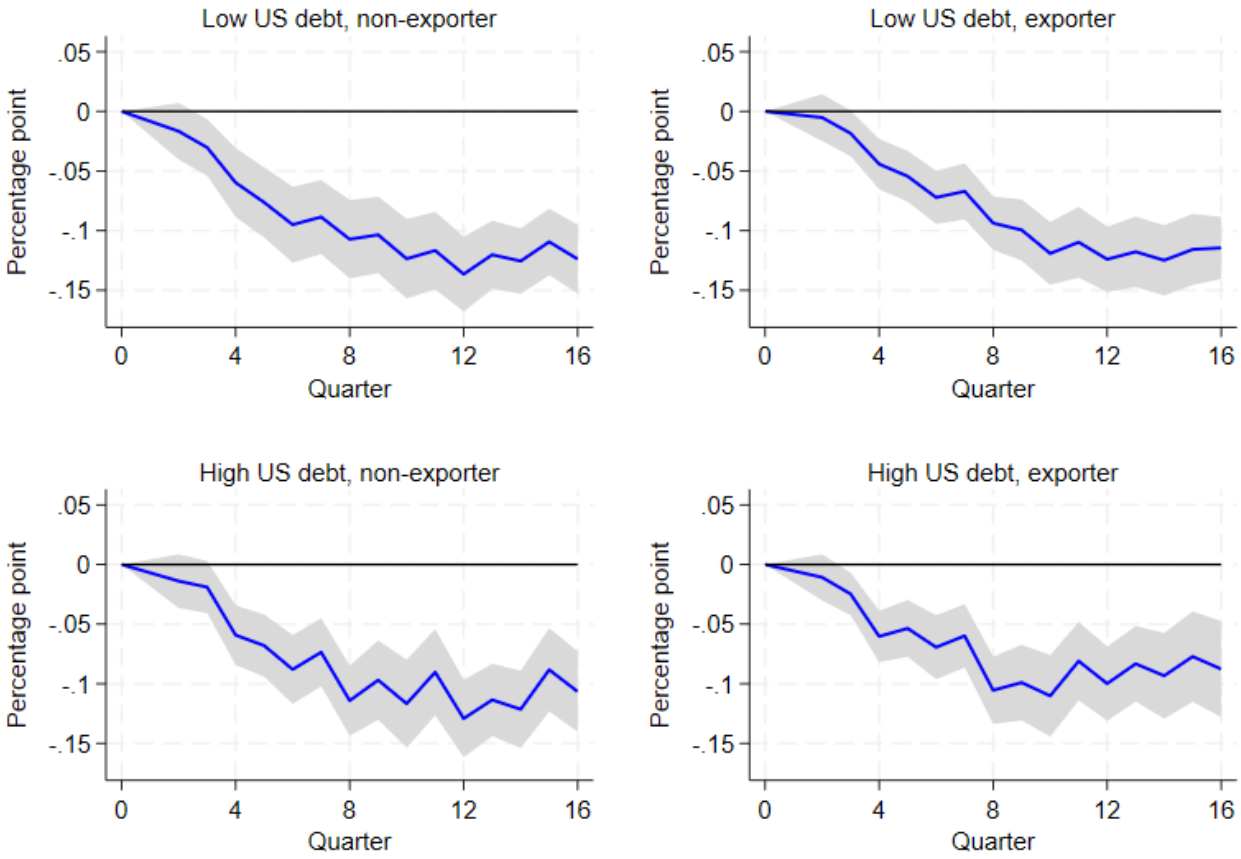


Figure B.6: Impulse Response of Markups to US Monetary Policy Tightening by the Debt Linkage with US Investors and Exporting Status

Note: This figure shows the EME firm markup response to a 25 basis points US monetary tightening shock. Panel (a) show the result by group of firm liquidity and panel (b) reports the relative effect for high-liquidity firms relative to that for low-liquidity firms. The grey shaded area represents 95% confidence bands. Confidence intervals are constructed based on two-way clustered standard errors at firm and quarter level.

B.2 Additional Results Using the Multivariate Approach

Table B.1: EME Exporters' Markup Responses to US Monetary Policy Tightening Using Country-Level Characteristics with the Export Intensity

$\Delta^h \ln(markup)_{i,t}$	(1) h=0	(2) h=4	(3) h=8	(4) h=12	(5) h=16
USmp	0.1206	0.0813	-0.0512	0.0027	0.0749
	(0.0984)	(0.1739)	(0.1690)	(0.1562)	(0.1750)
US Export Exposure$_c$	-0.0017	-0.0121	-0.0207**	-0.0360***	-0.0436***
	(0.0066)	(0.0096)	(0.0096)	(0.0101)	(0.0101)
Backward GVC$_c$	-0.0028	-0.0082***	-0.0107***	-0.0094***	-0.0094***
	(0.0018)	(0.0024)	(0.0029)	(0.0030)	(0.0030)
Dollar Invoicing$_c$	0.0015	0.0047*	0.0080**	0.0093*	0.0113**
	(0.0011)	(0.0026)	(0.0038)	(0.0049)	(0.0054)
US Debt$_c$	0.0037	0.0067*	0.0093**	0.0103***	0.0085**
	(0.0023)	(0.0040)	(0.0043)	(0.0037)	(0.0038)
Export Intensity$_i$	-0.0040	-0.0648	-0.0220	0.0918	0.2155
	(0.0757)	(0.1451)	(0.1271)	(0.1831)	(0.2122)
USmp×US Export Exposure$_c$	0.0002	-0.0305**	-0.0732***	-0.0829***	-0.0393***
	(0.0119)	(0.0145)	(0.0136)	(0.0144)	(0.0142)
USmp×Backward GVC$_c$	-0.0011	0.0019	0.0125***	0.0105***	0.0026
	(0.0032)	(0.0054)	(0.0032)	(0.0030)	(0.0042)
USmp×Dollar Invoicing$_c$	-0.0012	-0.0016	-0.0016	-0.0012	-0.0017
	(0.0008)	(0.0012)	(0.0016)	(0.0016)	(0.0019)
USmp×US Debt$_c$	-0.0084	0.0066	0.0192**	0.0169*	0.0130
	(0.0083)	(0.0086)	(0.0079)	(0.0089)	(0.0098)
USmp×Export Intensity$_i$	0.2280	-0.1960	-0.1246	0.1247	-0.7809
	(0.4289)	(0.8987)	(0.4919)	(0.7863)	(0.7533)
US Export Exposure$_c$×Export Intensity$_i$	-0.0002	-0.0261*	-0.0205	0.0145	0.0367
	(0.0119)	(0.0137)	(0.0202)	(0.0225)	(0.0309)
Backward GVC$_c$×Export Intensity$_i$	0.0004	0.0046	0.0036	-0.0012	-0.0053
	(0.0026)	(0.0033)	(0.0041)	(0.0053)	(0.0068)
Dollar Invoicing$_c$×Export Intensity$_i$	0.0004	0.0013	0.0014	-0.0002	-0.0015
	(0.0008)	(0.0013)	(0.0013)	(0.0016)	(0.0018)
USdebt$_c$×Export Intensity$_i$	-0.0023	0.0025	-0.0084	-0.0148**	-0.0065
	(0.0052)	(0.0055)	(0.0074)	(0.0058)	(0.0069)
USmp×US Export Exposure$_c$×Export Intensity$_i$	0.0016	-0.0688	-0.0025	-0.0479	-0.1194**
	(0.0275)	(0.0541)	(0.0330)	(0.0366)	(0.0541)
USmp×Backward GVC$_c$×Export Intensity$_i$	-0.0013	0.0178	0.0111	0.0220*	0.0383***
	(0.0053)	(0.0157)	(0.0090)	(0.0131)	(0.0136)
USmp×Dollar Invoicing$_c$×Export Intensity$_i$	-0.0017	0.0012	0.0012	-0.0028	0.0065
	(0.0045)	(0.0083)	(0.0046)	(0.0074)	(0.0073)
USmp×US Debt$_c$×Export Intensity$_i$	-0.0082	0.0044	-0.0219	-0.0044	0.0071
	(0.0148)	(0.0265)	(0.0239)	(0.0209)	(0.0248)
Fixed Effects					
Firm FE	Yes	Yes	Yes	Yes	Yes
R^2	0.3477	0.3658	0.4110	0.4444	0.4760
Obs.	35319	34934	34485	33971	33335

Note: This table reports the estimation results of exporting firms using firm export intensity together with country-level characteristics of export exposure to the US, dollar invoicing for exports, debt linkage with the US measured by securities held by US investors, and backward GVC participation. It controls for firm fixed effects. Confidence intervals are constructed based on two-way clustered standard errors.

Table B.2: EME Firm Markup Responses to US Monetary Policy Tightening Using Firm-Level Characteristics (Controlling for Country-Time Fixed Effects)

$\Delta^h \ln(markup)_{i,t}$	(1) h=0	(2) h=4	(3) h=8	(4) h=12	(5) h=16
USmp×US Export Exposure	0.0121	-0.0122	-0.0062	-0.0134**	-0.0377***
	(0.0091)	(0.0112)	(0.0081)	(0.0058)	(0.0107)
USmp×Backward GVC	0.0009	0.0082***	0.0124**	0.0127***	0.0148***
	(0.0026)	(0.0027)	(0.0048)	(0.0044)	(0.0037)
USmp×Dollar Invoicing	-0.0010*	-0.0018***	-0.0023***	-0.0018**	-0.0004
	(0.0005)	(0.0004)	(0.0006)	(0.0007)	(0.0007)
USmp×US Debt	0.0030	-0.0063	-0.0232	-0.0010	0.0058
	(0.0021)	(0.0128)	(0.0168)	(0.0100)	(0.0166)
Fixed Effects					
Country-Time FE	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
R^2	0.4761	0.4522	0.4552	0.4832	0.5102
Obs.	150,915	149,138	147,602	145,893	143,941

Note: This table reports the estimation results using firm-level characteristics of export exposure to the US, backward GVC participation, dollar invoicing for exports, and debt linkage with the US measured by securities held by US investors. It controls for country-time fixed effects and firm fixed effects. Confidence intervals are constructed based on two-way clustered standard errors at firm and quarter level.

Table B.3: EME Firm Markup Responses to US Monetary Policy Tightening Using Firm-Level Characteristics (Controlling for Country-Time and Sector-Time Fixed Effects)

$\Delta^h \ln(markup)_{i,t}$	(1) h=0	(2) h=4	(3) h=8	(4) h=12	(5) h=16
USmp×US Export Exposure	0.0154	-0.0083	-0.0011	-0.0070	-0.0243**
	(0.0094)	(0.0089)	(0.0079)	(0.0043)	(0.0095)
USmp×Backward GVC	0.0027	0.0084***	0.0113**	0.0110***	0.0115***
	(0.0026)	(0.0025)	(0.0050)	(0.0039)	(0.0037)
USmp×Dollar Invoicing	-0.0015***	-0.0017***	-0.0022***	-0.0017***	-0.0005
	(0.0004)	(0.0004)	(0.0005)	(0.0006)	(0.0007)
USmp×US Debt	0.0025*	-0.0034	-0.0118	0.0040	0.0074
	(0.0013)	(0.0078)	(0.0107)	(0.0059)	(0.0120)
Fixed Effects					
Country-Time FE	Yes	Yes	Yes	Yes	Yes
Sector-Time FE	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
R^2	0.4385	0.4247	0.4333	0.4649	0.4926
Obs.	176,622	171,649	167,359	163,295	159,376

Note: This table reports the estimation results using firm-level characteristics of export exposure to the US, backward GVC participation, dollar invoicing for exports, and debt linkage with the US measured by securities held by US investors. It controls for country-time, sector-time fixed effects and firm fixed effects. Confidence intervals are constructed based on two-way clustered standard errors at firm and quarter level.

Table B.4: EME Firm Markup Responses to US Monetary Policy Tightening Using Firm-Level Characteristics (Liquidity)

$\Delta^h \ln(markup)_{i,t}$	(1) h=0	(2) h=4	(3) h=8	(4) h=12	(5) h=16
USmp×US Export Exposur	0.0125	-0.0077	0.0044	-0.0045	-0.0200***
	(0.0088)	(0.0087)	(0.0067)	(0.0028)	(0.0054)
USmp×Backward GVC	0.0012	0.0065***	0.0100**	0.0106***	0.0100***
	(0.0020)	(0.0020)	(0.0045)	(0.0032)	(0.0034)
USmp×Dollar Invoicing	-0.0010*	-0.0014***	-0.0021***	-0.0015***	-0.0001
	(0.0005)	(0.0004)	(0.0005)	(0.0005)	(0.0008)
USmp×Liquidity	-0.0006	-0.0002	-0.0004	-0.0002	0.0009
	(0.0005)	(0.0003)	(0.0006)	(0.0005)	(0.0026)
Fixed Effects					
Country-Time FE	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
R^2	0.4347	0.4203	0.4289	0.4606	0.4887
Obs.	176,917	171,941	167,652	163,589	159,673

Note: This table reports the estimation results using firm-level characteristics of export exposure to the US, backward GVC participation, dollar invoicing for exports, and liquidity. It controls for country-time fixed effects and firm fixed effects. Confidence intervals are constructed based on two-way clustered standard errors at firm and quarter level.

Table B.5: EME Firm Markup Responses to US Monetary Policy Tightening Using Country-Level Characteristics with the Exporter Dummy Variable (Controlling for Country-Time and Sector-Time Fixed Effects)

$\Delta^h \ln(markup)_{i,t}$	(1)	(2)	(3)	(4)	(5)
	h=0	h=4	h=8	h=12	h=16
USmp×US Export Exposure×Exporter	0.038***	0.012	0.028**	0.037**	0.017
	(0.008)	(0.011)	(0.013)	(0.015)	(0.028)
USmp×Backward GVC×Exporter	-0.005**	-0.004**	-0.002	-0.005***	-0.001
	(0.002)	(0.001)	(0.004)	(0.002)	(0.004)
USmp×Dollar Invoicing×Exporter	-0.270***	-0.266***	-0.338**	-0.113	-0.034
	(0.063)	(0.069)	(0.146)	(0.208)	(0.336)
USmp×US Debt×Exporter	-0.002	0.002	0.008	0.002	-0.012
	(0.005)	(0.005)	(0.009)	(0.005)	(0.007)
Fixed Effects					
Country-Time FE	Yes	Yes	Yes	Yes	Yes
Sector-Time FE	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
R^2	0.480	0.458	0.461	0.488	0.514
Obs.	150,604	148,837	147,314	145,615	143,673

Note: This table reports the estimation results using exporter dummy together with country-level characteristics of export exposure to the US, dollar invoicing for exports, debt linkage with the US measured by securities held by US investors, and backward GVC participation. It controls for country-time, sector-time, and firm fixed effects. Confidence intervals are constructed based on two-way clustered standard errors at firm and quarter level.

B.3 Additional Results of Marginal Effects

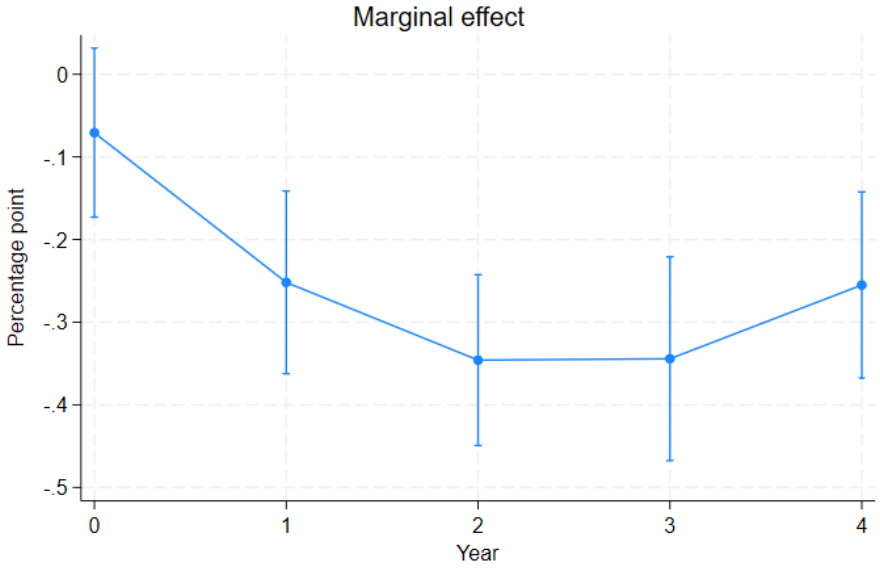


Figure B.7: Marginal Effects of a 25bps US Monetary Tightening Shock on EME Firm Markups
Note: This figure shows the aggregate marginal effects of a 25bps US monetary tightening shock on firm markups in EMEs. Confidence intervals are at 95% level and constructed based on two-way clustered standard errors.

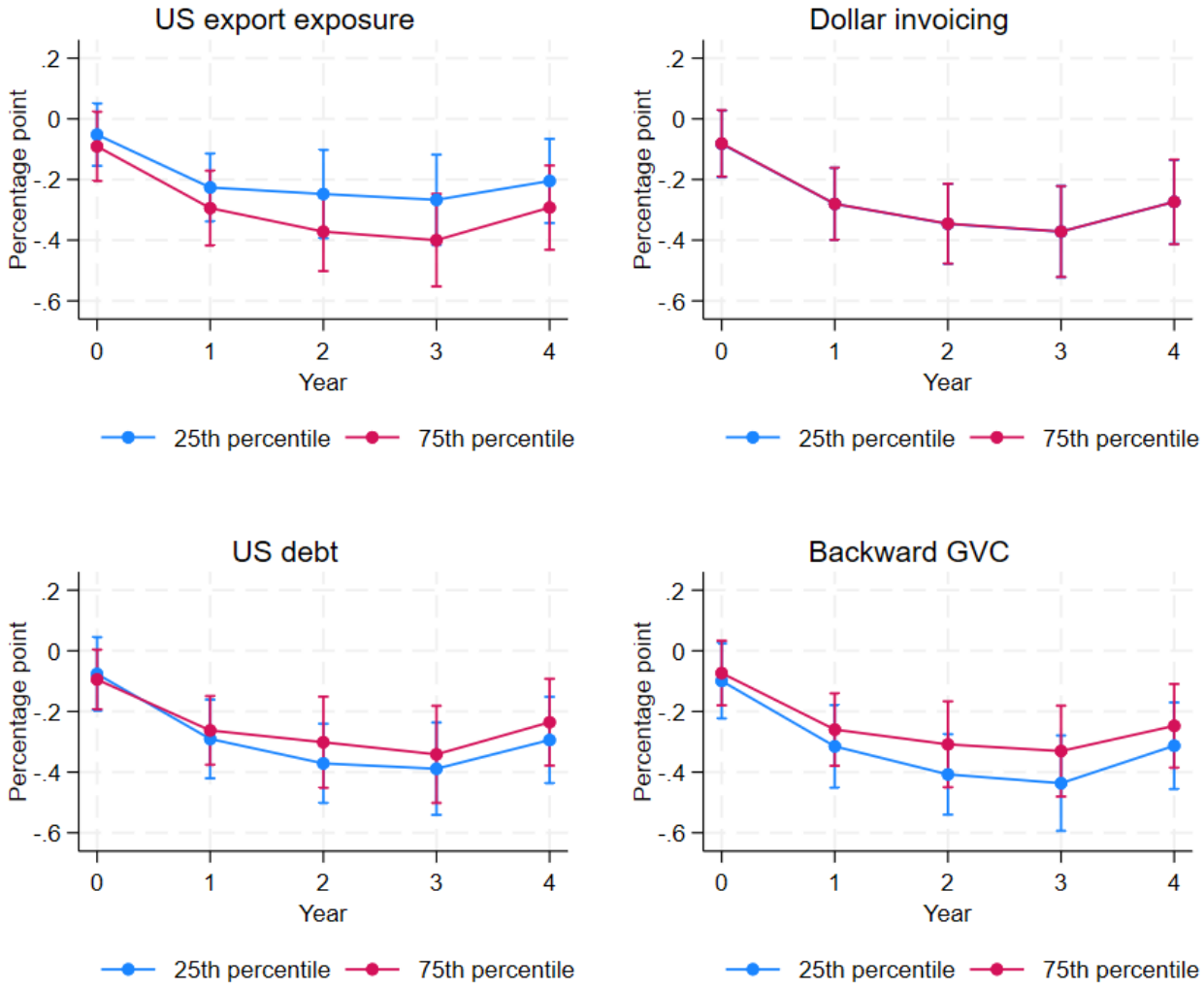


Figure B.8: Marginal Effects of a 25bps US Monetary Tightening Shock on EME Firm Markups Using Country-Level Characteristics

Note: This figure shows the marginal effects of a 25bps US monetary tightening shock on firm markups in EMEs. Each panel focuses on the distribution of one country-level characteristic and plots the marginal effect of 25th and 75th percentile of the distribution of each characteristic every four quarters after the policy shock. Confidence intervals are at 95% level and constructed based on two-way clustered standard errors.

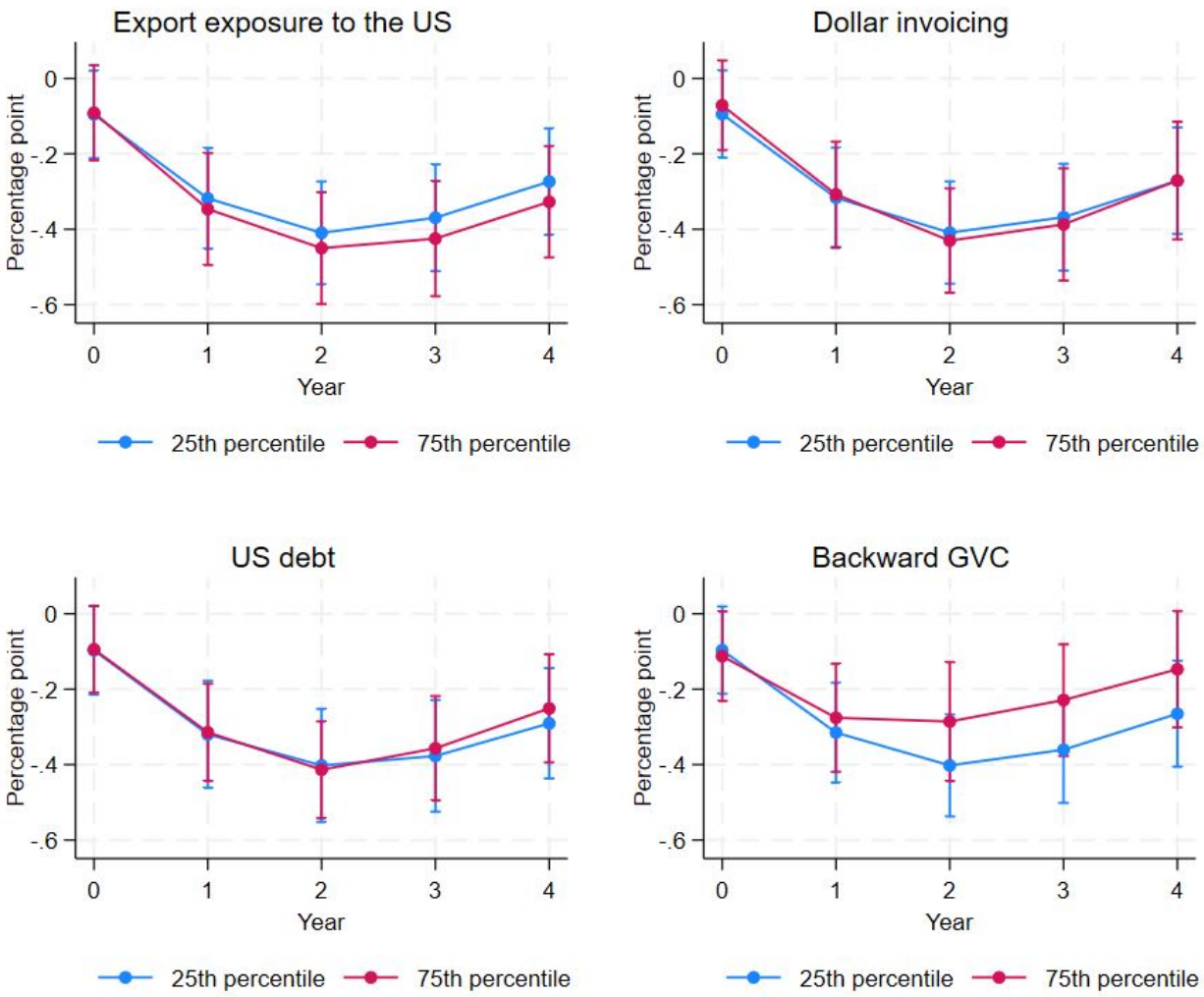


Figure B.9: Marginal Effects of a 25bps US Monetary Tightening Shock on EME Firm Markups Using Firm-Level Characteristics

Note: This figure shows the marginal effects of a 25bps US monetary tightening shock on firm markups in EMEs. Each panel focuses on the distribution of one firm-level characteristic and plots the marginal effect of 25th and 75th percentile of the distribution of each characteristic every four quarters after the policy shock. Confidence intervals are at 95% level and constructed based on two-way clustered standard errors.

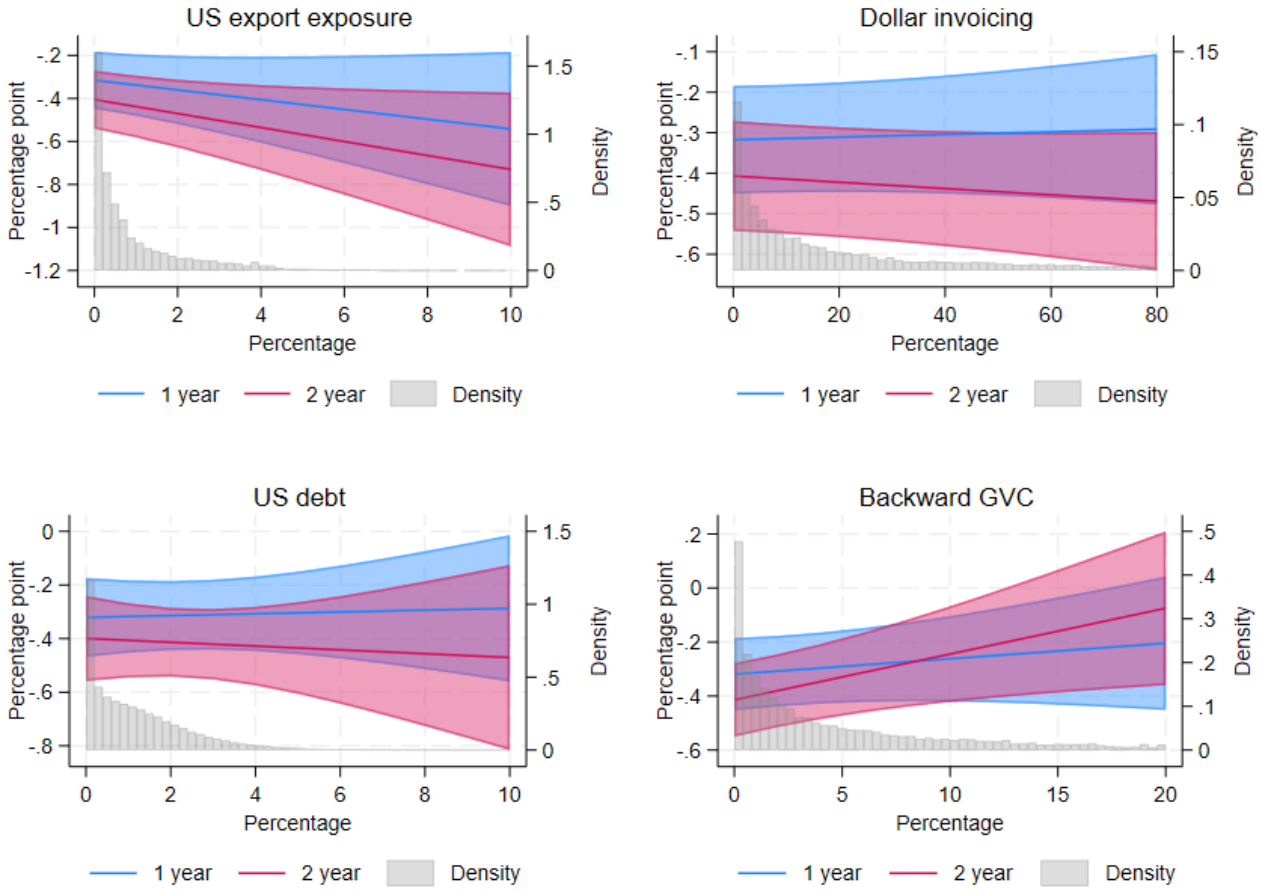


Figure B.10: Marginal Effects of a 25bps US Monetary Tightening Shock on EME Firm Markups and the Distribution of Firm-Level Characteristics

Note: This figure shows the marginal effects of a 25bps US monetary tightening shock on firm markups in EMEs. Each panel focuses on the distribution of one firm-level characteristic depending on the distribution of each characteristic in the first and second year after the policy shock. The histogram plot in gray shaded area presents the distribution of each characteristic. Confidence intervals are at 95% level and constructed based on two-way clustered standard errors.

B.4 Additional Results of Regional Heterogeneity

B.4.1 Relative Effects

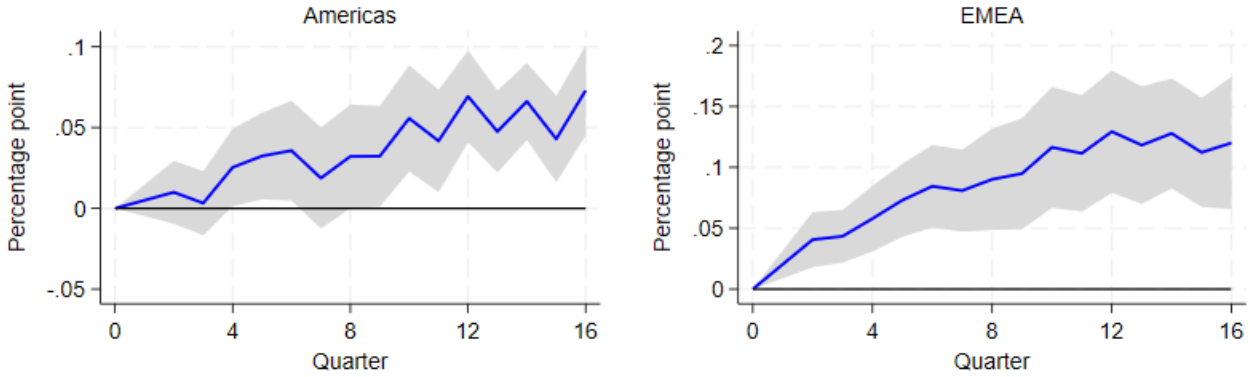


Figure B.11: Impulse Response of Markups to a 25bps US Monetary Policy Tightening By Region (Relative Effect)

Note: This figure shows the impulse response functions of EME firm markups to a 25bps contractionary US monetary policy shock by regions of Americas and EMEA relative to Asia. The grey shaded area represents 95% confidence bands. Confidence intervals are constructed based on two-way clustered standard errors.

B.4.2 Time Series of Characteristics Across Regions

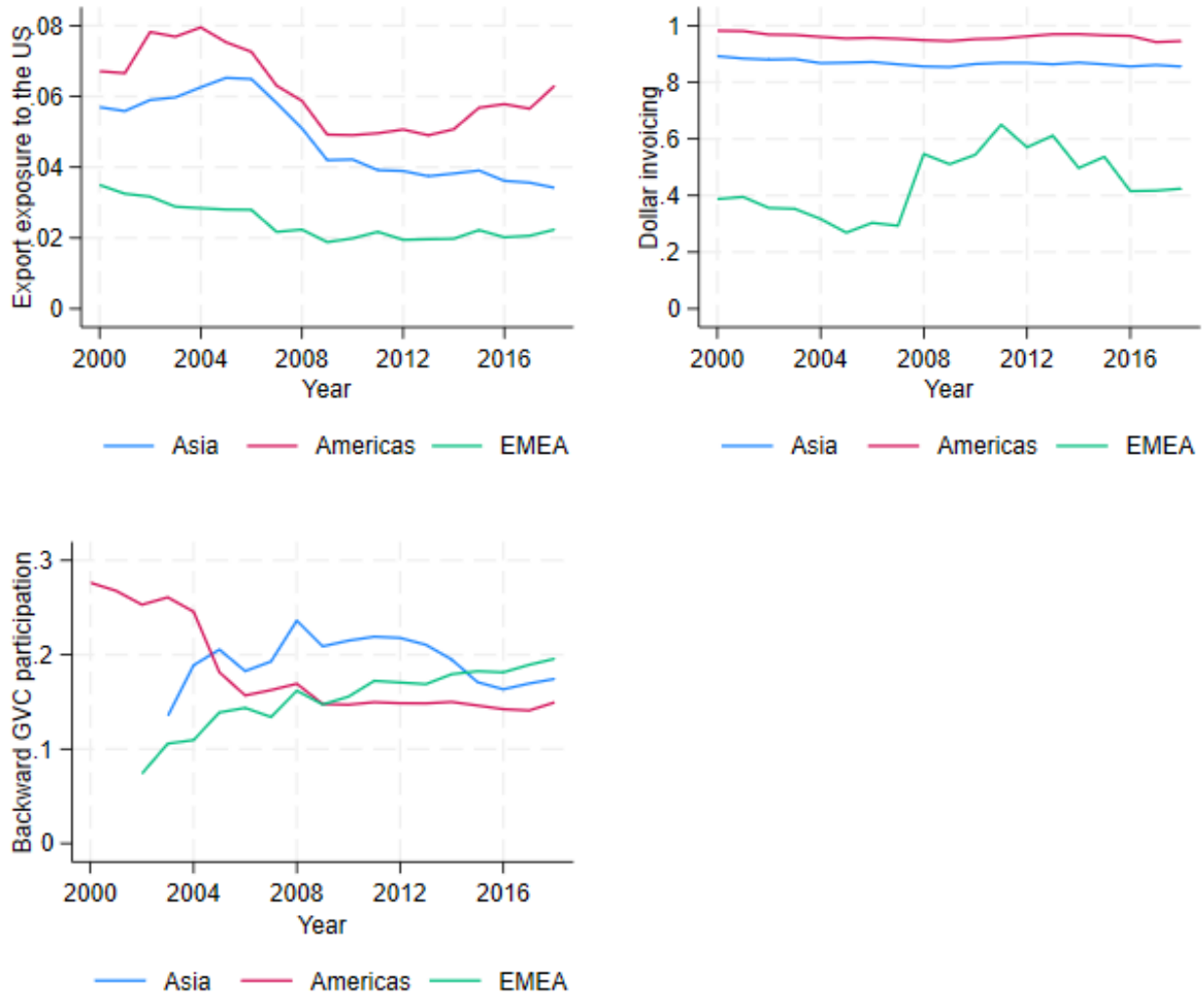


Figure B.12: Time Series of Characteristics Across Regions

Note: This figure presents the time series of characteristics of export exposure to the US, US dollar invoicing ratio on exports, and backward GVC participation. Regional values are calculated using the simple average across countries. Sample period ranges from 2000 to 2018.

B.4.3 Exporters vs. Non-Exporters

In this section, I explore the composition of exporters and non-exporters in each region and investigate whether exporters behave differently than non-exporters.

I compute the average share of exporters across countries and year for each region. As presented in Table B.6, I also report the average share of exporters weighted by output. In emerging EMEA, 27.8% of publicly listed firms are exporters and their output constitutes 40.9% of the total output among all firms in the region. In contrast, only 12.7% of the publicly listed firms in Emerging Americas are exporters and their output only accounts for 27.5% of the total output of all the public firms in the region.

Table B.6: Ratio of Exporters By Region or Economy

Region	Avg. exporters (number of firms)	Weighted avg. exporters (number of firms)	Avg. exporters (sales)	Weighted avg. exporters (sales)
Asia	26.6%	26.8%	31.4%	31.8%
Americas	16.7%	12.7%	21.8%	27.5%
EMEA	27.2%	27.8%	40.0%	40.9%

Note: Avg. exporters (number of firms) = average ratio of the number of exporters in each region across years, *Weighted avg. exporters (number of firms)* = average ratio of the number of exporters weighted by the number of total firms in each economy and each year, *Avg. exporters (sales)* = average ratio of exporters in terms of sales of each region across years, *Weighted avg. exporters (sales)* = average ratio of exporters in terms of sales weighted by total sales in each economy and each year.

Since the output share of exporters accounts for less than half of the aggregate output in each region, the next step is to examine how non-exporters respond to US monetary policy shocks in each region. Figure B.13 reports the impulse response functions of markups to a 25bps US monetary tightening by exporting status and region. In Emerging Asia and EMEA, exporting firms are more responsive but with different directions of their responses. In Asia, exporting firms decrease their markups in response to US monetary tightening and the peak effect is -0.12 percentage points in the ninth quarter after the policy shock and then markups converge back to its original level with fluctuations. In EMEA, exporting firms increase their markups significantly after US monetary tightening. The impulse response shows a upward trend especially two years after the shock. Non-exporters in EMEA are not significantly affected by US monetary tightening in terms of markup responses. However, in Emerging Americas, non-exporting firms are more responsive compared with exporting firms. To sum up, both exporters and non-exporters contribute to the regional heterogeneity.

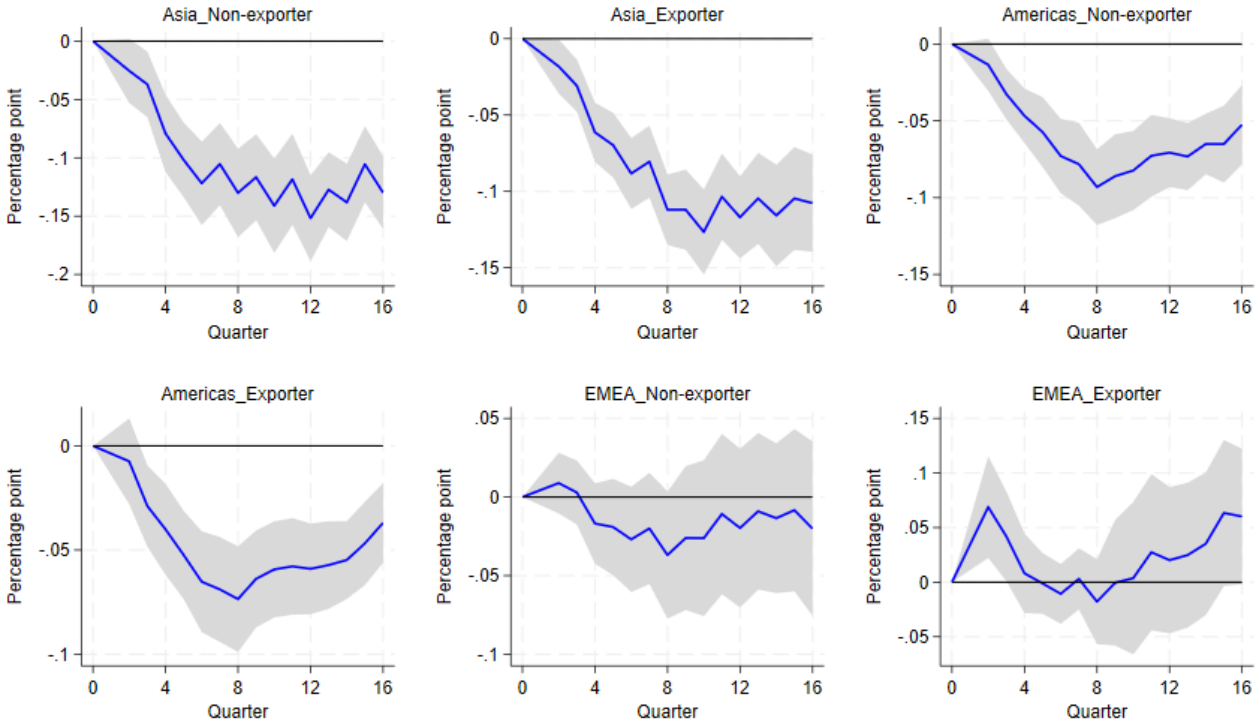
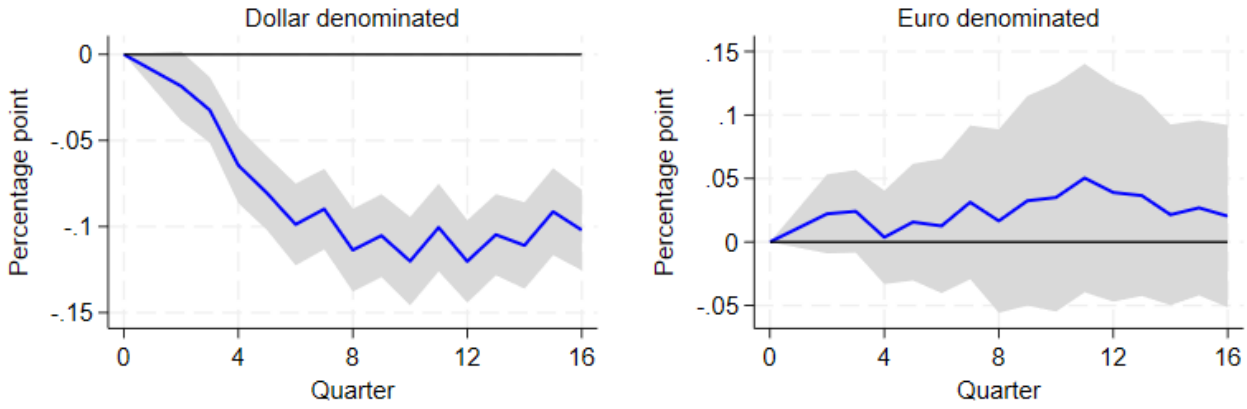


Figure B.13: Impulse Response of Markups to a 25bps US Monetary Policy Tightening By Exporting Status and Region

Note: This figure shows the impulse response functions of EME firm markups to a 25bps contractionary US monetary policy shock by exporing status across regions. The grey shaded area represents 95% confidence bands. Confidence intervals are constructed based on two-way clustered standard errors.

B.4.4 Dollar-Denominated Regions vs. Euro-Denominated Regions

(a) Level Effect



(b) Relative Effect

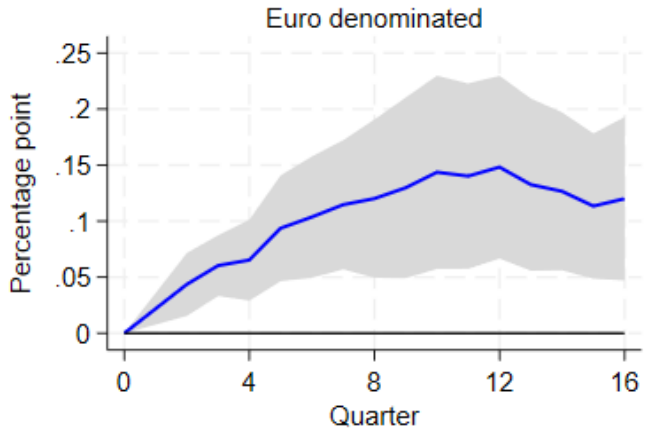


Figure B.14: Impulse Response of Markups to US Monetary Policy Tightening across Currency Regions

Note: This figure shows the EME firm markup response to a 25 basis points US monetary tightening shock. Panel (a) shows the result of US dollar-denominated regions and euro-denominated regions and panel (b) reports the relative effect for the firms in the euro-denominated region relative to those in the US dollar-denominated region. The grey shaded area represents 95% confidence bands. Confidence intervals are constructed based on two-way clustered standard errors.

B.4.5 Exchange Rate Regimes Across Regions

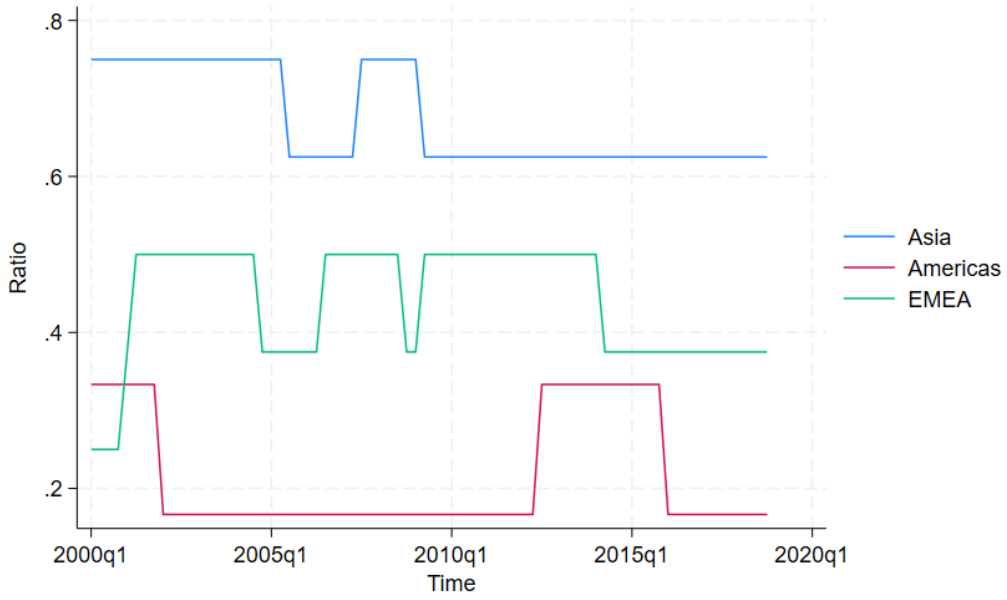


Figure B.15: Time Series of the Ratio of Economies with Pegged Exchange Rates Across Regions
Note: This figure presents the time series of the ratio of economies with pegged exchange rate regimes across regions. The FX regime data is obtained from Ilzetzki et al. (2019). Sample period ranges from 2000 to 2018.