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Nuwat Nookhwun and Pym Manopimoke

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Disaggregated Inflation Dynamics in Thailand: Which Shocks Matter?*

Nuwat Nookhwun Pym Manopimoke †

Bank of Thailand‡

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Abstract

This paper examines the role of sector-specific and common macroeconomic shocks towards explaining the dynamics of disaggregated price series and overall headline inflation in Thailand. Based on applying a Bayesian factor-augmented VAR model with zero and sign restrictions on a large dataset of macroeconomic and disaggregated price data, we identify domestic and global structural macroeconomic shocks and study their contributions to inflation volatility and dynamics. We find that sector-specific shocks account for over 80 percent of the variation in disaggregated price series. Common macroeconomic shocks, on the other hand, drive the majority of inflation dynamics at the aggregated level, in which most of these common shocks have origins that are global in nature. For Thailand, global demand and oil price shocks are the two main drivers of headline inflation, and transmit mainly through energy prices. We also find that the dominant role of global shocks helps explain the rather low persistence of Thai inflation movements, as they generate lower overall inflation persistence than domestically-oriented shocks.

Keywords: disaggregated prices, inflation, factor-augmented VAR, sign restrictions, monetary policy

JEL Classifications: C32, E31, E37.

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‡Address: 273 Samsen Road, Wat Samphraya, Phra Nakhon, Bangkok 10200, Thailand. Manopimoke: Deputy Director, Monetary Policy Department, E-mail: PymM@bot.or.th. Nookhwun (Corresponding Author): Principal Researcher, Puey Ungphakorn Institute for Economic Research, E-mail: NuwatN@bot.or.th.

1 Introduction

The unprecedented surge in inflation across the globe during the post Covid-19 pandemic period has sparked renewed interest in studying the drivers and dynamics of inflation. The role of global shocks, in particular, has come under scrutiny, particularly towards being able to understand how they influence inflation volatility and persistence. A vast literature has long highlighted the important role of global shocks towards explaining inflation dynamics, especially in advanced economies (Ciccarelli and Mojon, 2010; Neely and Rapach, 2011; Forbes, 2019a,b). However, the empirical evidence has been more mixed for emerging economies. For example, Parker (2018) argues that the observed explanatory power of global inflation does not extend to middle and low income economies, while Ha et al. (2019) similarly show that fluctuations in inflation for emerging and developing economies are mostly driven by domestic shocks from the supply side. In contrast, Finck and Tillmann (2022) study six Asian emerging market economies, including Thailand, and find that global shocks explain large parts of inflation and economic activity.

This paper aims to quantify and trace out the dynamic impact of global shocks on disaggregated and aggregated price dynamics for an emerging economy, namely Thailand. We join a growing literature that has gone beyond aggregate price analysis and utilized rich information sets in disaggregated price series to investigate the impact of different types of shocks on inflation dynamics (Boivin et al., 2009; Reis and Watson, 2010; Borio et al., 2021; Luciani, 2020; Apaitan et al., 2020). In doing so, we estimate a Bayesian factor-augmented VAR (FAVAR) a la Bernanke et al. (2005) and Boivin et al. (2009), and rely on a set of zero and sign restrictions to identify structural macroeconomic shocks of interest, and quantify their contributions for individual inflation series. Apart from being able to identify global shocks, we approach also allows us to identify a rich set of domestically-oriented shocks and sector-specific shocks as well. Therefore, within this framework, we are able to compare the dynamic effects of global versus various types of other shocks on disaggregated and aggregated price dynamics in Thailand.

We view that Thailand serves as an interesting case study for several reasons. Similar to other emerging market economies, Thailand has a large share of its expenditure share weight tied to food and energy components, making price processes more susceptible to large relative price shocks that are mostly global in nature. The fact that Thailand's international trade is well above 100 percent of its total output also indicates that its economy could be highly vulnerable to global shocks. Despite these features however, overall headline and core inflation in Thailand has been relatively low and stable for the past two decades. Thus being able to understand how large global shocks transmit through individual price processes within the context of Thailand should help us further our knowledge on how shocks matter and drive inflation dynamics and persistence at the aggregate level more generally.

Our work is related to a growing strand of literature that utilizes a large set of disaggregated price data to analyze the roles of various types of shocks for inflation dynamics (Boivin et al., 2009; Reis and Watson, 2010; Luciani, 2020; Borio et al., 2021). Compared to earlier work however, our framework differs by offering a rather comprehensive analysis on the role of a rich set of identified shocks. Aside from common versus idiosyncratic shocks, we further disentangle common macroeconomic shocks into seven structural drivers, namely, demand, supply, and monetary policy shocks that stem from both domestic and foreign origins, as well as oil price shocks. This allows us to compare their heterogeneous impact on price processes, in contrast to some earlier work that tends to focus on studying only a subset of shocks. For example, Balke and Wynne (2007), Nakajima et al. (2010),Bils et al. (2003), Lastrapes (2006) and Baumeister et al. (2013) focus on the relative price effects of either monetary policy or productivity shock or both. Boivin et al. (2009) emphasize the role of monetary policy shocks in generating US inflation persistence, while Mumtaz and Surico (2009) focus on the role of international shocks for UK inflation. In addition, Reis and Watson (2010) only distinguish between pure inflation versus relative price movements that stem from idiosyncratic and common sources.

We also build on a growing literature that emphasizes a critical role for global shocks towards driving inflation dynamics, and offer added insights by tracing out their heterogeneous effects at the sectoral level. Existing work for Thai inflation has shown an outsized role for global factors in explaining Thai inflation dynamics (Manopimoke and Direkudomsak, 2015; Apaitan et al., 2020), but only at the agggregate level. According to recent papers, the contributions of global factors to inflation vary across sectors, depending largely on the degree of trade openness (Monacelli and Sala, 2009). Parker (2018) shows that global factors explain a large share of the variance in food and energy prices, particularly energy prices, in line with studies that argue that core and wage inflation is a domestic process that is insulated from global forces (Forbes, 2019b). How global shocks transmit to prices of different sectors indeed has important implications for the distribution of prices. For example, Mumtaz and Surico (2009) show that a positive international supply shock makes the distribution of the components of the UK consumption deflator negatively skewed.

Finally, our work contributes to the line of research that investigates how underlying shocks matter for inflation persistence. Closest in spirit to our paper is Boivin et al. (2009) who, based on a FAVAR framework, emphasize the role of common shocks, especially monetary policy shocks, in generating US inflation persistence, while inflation variations associated with sector-specific shocks are short-lived. Our paper, however, delves deeper by identifying a richer set of structural common shocks that accompanies both domestic and global ones. Understanding inflation persistence has been a longstanding issue central towards determining how monetary policymakers should respond to inflation shocks.

A preview of our results are as follows. First, over the past two decades, we find that sector-specific rather than common macroeconomic shocks drive the majority of individual inflation rate movements (85%) in Thailand. Common shocks, on the other hand, drive the vast majority (57%) of aggregate headline inflation dynamics. Since the effect of idiosyncratic shocks are rather immediate and short-lived, this explains why most inflation components in Thailand are volatile, while inflation at the more aggregated level has been more stable as common shocks tend to generate more persistence. Another key finding pertains to the important role that foreign shocks play in driving Thai inflation dynamics, particularly its pronounced role for aggregate inflation rate movements. Over 40 percent of the shocks that drive overall CPI inflation have origins that are global in nature, with global demand and oil price shocks being the two main drivers. The rest of the contributions to headline inflation variance is shared by domestic macroeconomic shocks and sector-specific shocks.

We also document heterogeneous responses of disaggregated prices and aggregate inflation to structural macroeconomic shocks. Focusing on the transmissions of global shocks, we find that they mainly transmit through energy prices. That is, both global demand and oil price shocks lead to highly dispersed and skewed responses among disaggregated prices as energy prices respond most strongly. Meanwhile, domestic shocks pass on to a large extent to fresh food prices, whereas core inflation is generally less responsive to macroeconomic shocks. Finally, based on a historical decomposition of shocks over the past two decades for Thailand, global shocks, and oil price shocks in particular, have not only played a key role in driving overall variation in Thai inflation dynamics, but is a key reason why overall persistence in Thailand has been low. This is because global shocks that are a key driver of Thai inflation movements are also found to exhibit lower inflation persistence when compared to domestic-oriented shocks. These findings underscore the importance of taking into consideration the underlying source of shocks when analyzing inflation dynamics, which indeed delivers important implications for monetary policy.

The rest of the paper is organized as follows. The next section describes the open-economy FAVAR model. Section 3 describes the data and estimation techniques while Section 4 discusses the empirical findings. Section 5 concludes with key policy implications.

2 The Open-Economy FAVAR Model

We adopt an open-economy Factor-augmented VAR (FAVAR) model to study the dynamic effects of various macroeconomic shocks on disaggregated price series. The advantage of the FAVAR is that it can incorporate a far wider information set than typically assumed in small-scale VARs, which includes a large number of individual price series as well as additional information contained in various macroeconomic variables that are processed by central banks.[1]

Our FAVAR model consists of two blocks, one is the "domestic" block describing Thailand's economy, while the other is the "foreign" or the rest of the world block, representing Thailand's major trading partners. The information contained in the two groups are summarized by K factors in $C_t = [F_t^* F_t^{Thai}]'$, where asterisks denote the foreign economies. These K factors form a dynamic system that evolves according to the following transition equation:

$$C_t = \Phi(L)C_{t-1} + v_t. \tag{1}$$

In the above specification, Φ is a conformable lag polynomial of finite order, while v_t is the i.i.d. error term with mean zero. The factors in C_t summarize information contained in a large set of N observable series in X_t, according to an observational equation of the form:

$$X_t = \Lambda C_t + e_t, \tag{2}$$

where Λ is a N $\times$ K matrix of factor loadings, and e_t are the zero-mean error terms that are uncorrelated with the common components in C_t.

We assume that the foreign block F_t^* consists of three factors, $F_t^* = \{\Delta Y_t^*, \Pi_t^*, Oil_t^*\}$. ΔY_t^* represents a foreign real economic activity factor, Π_t^* denotes a foreign inflation factor, and Oil_t^* is an observed factor that captures movements in world crude oil prices. As in Mumtaz and Surico (2009), we assume that the foreign activity factor is extracted from all foreign real activity series in our panel, while similarly, all foreign inflation series loads on the foreign inflation factor. This helps provide economic interpretation to the statistical factors, before we identify structural

[1] It has also been argued that the use of this additional information has helped alleviate the well-known identification problem in small-scale VARs that is associated with the omitted variables problem such as the price puzzle.

macroeconomic shocks at a later stage by directly imposing restrictions on the impulse responses of these factors.[2] Finally, an important assumption is that while factors in the foreign block F_t^* may affect one another, they are not to be influenced by domestic variables in F_t^{Thai}.

Turning to the domestic bloc, the dynamics of the Thai variables are captured by 4 domestic factors, $F_t^{Thai} = \{\Delta Y_t, \Pi_t, R_t, ER_t\}$. The latter two factors are observed, which include the Thai policy interest rate (R_t) and the percentage change in the Thai baht exchange rate against foreign currencies (ER_t). Similar to its foreign counterpart, the Thai real activity factor (ΔY_t) is extracted from various domestic real economic activity series. However, we assume that the Thai inflation factor (Π_t) is identified based on information contained within a large set of aggregate and disaggregated inflation series, according to the following equations:

$$\pi_t = \lambda C_t^{**} + e_t. \tag{3}$$

In the above specification, inflation series in π_t are allowed to load not only on the Thai inflation factor, but also on other macroeconomic factors as well. More specifically, $C_t^{**} = \{\Delta Y_t, \Pi_t, ER_t, Oil_t^*\}$.[3] In a way, the specification in (3) is in line with a standard open-economy Phillips curve, where domestic inflation depends on a domestic output gap and a set of global variables such as exchange rates and oil prices. The system of equations in (3) that links disaggregated price series to various macroeconomic factors also allows us to disentangle the impact of sectoral versus common drivers on inflation.

3 Data and Estimation Methodology

As in Boivin et al. (2009), we estimate the open-economy FAVAR model as summarized by equations (1)-(2) based on a two-step procedure. In the first step, we extract principal components from the large data set to obtain estimates of the

[2]See Uhlig and Ahmadi (2012) for an alternative approach that imposes restrictions on the responses of observables instead. According to this approach, there is no need for an economic interpretation of the estimated factors.

[3]This excludes the policy interest rate under the rationale that the impact of monetary policy on price prices is typically channeled through the domestic economic activity factor that reflect variations in aggregate demand. The decision to exclude the policy rate is also to avoid price puzzles, i.e., a positive contemporaneous correlation between interest rates and prices. In addition, due to multicollinearity issues between domestic and foreign activity factors, and between domestic and foreign inflation factors, we exclude foreign activity and inflation factors from the specification. According to Mumtaz and Surico (2009), it is crucial to allow price series to load on various common factors aside from the domestic inflation factor to capture heterogeneous price responses to shock, otherwise the dynamics of these disaggregated price series would be dominated by the inflation factor alone.

unobserved common factors in C_t. In the second step, we include observed factors to obtain a complete set of common factors. The resulting structural FAVAR model is then estimated via Bayesian methods, with a set of zero and sign restrictions for the identification of structural shocks. Details are as follows.

3.1 Data Description

The dataset is a balanced panel of 332 quarterly series, spanning 2002Q2 to 2019Q4.[4] For foreign unobserved factors, we use data from Thailand's 14 major trading partners,[5] where real activity is extracted from real Gross Domestic Product (GDP) and industrial production data, while inflation is extracted from inflation rates as calculated from the consumer price index (CPI) and GDP deflators. Global oil prices are proxied by Dubai crude oil prices. As for the Thai macroeconomic factors, real activity is extracted from 30 series which include for example, real GDP and its components, the manufacturing production index, private consumption and investment indicators. The Thai policy rate is proxied by the one-day bilateral repurchase rates, while we use the nominal effective exchange rate of the Thai baht to represent domestic exchange rates. Details of these macroeconomic time-series are provided in the Appendix.

Regarding the individual price series that are used to construct the Thai inflation factor, we utilize price series data from the Ministry of Commerce at the most disaggregated level which contains around 400 Entry Level Items (ELIs), representing items such as rice, corn, shampoo, and hair cuts. Note that the number of these ELIs vary each base year as the composition of the basket is updated. We clean the price dataset in the following ways. First, we exclude ELIs that are not available for the entire sample period. However, for those ELIs with missing observations but have expenditure share weight that exceeds 0.5 percent according to the weights in the 2018 CPI basket, we opt to keep the series.[6] Second, we exclude ELIs that show no price changes for more than 80 percent of the observations, implying a price duration of more than 4 quarters. Last, we also exclude ELIs that are highly correlated with others. We find that most of these excluded price series are typically categories that are subject to government measures such as student uniforms, water

[4]While data is readily available to the current period, we exclude data from the COVID-19 period from our estimation sample due to potential structural changes and heightened volatility. However, data from the full sample which includes the COVID-19 period is utilized for the historical shock decomposition exercise in Section 4.5.

[5]14 countries include Australia, China, Eurozone, Hong Kong, India, Indonesia, Japan, Malaysia, Phillippines, Singapore, South Korea, Taiwan, United Kingdom, United States, which accounts for more than 70% of Thailand's overall trade value.

[6]These items, for example, include internet service charges, gasohol-91 petrol price, gasohol-95 petrol price and travel expenses for visiting relatives.

fees, pens and pencils. After cleaning the dataset, we are left with a total of 231 ELIs with total expenditure share weight of 83.3%, which still explains a sizable share of the full dataset.

Table 1 reports summary statistics of the ELI series as categorized into 3 major groups - raw food, energy and core items. The LHS columns show the summary statistics for the full CPI basket, whereas the RHS columns show statistics for our cleaned dataset. Some interesting observations emerge. First, similar to other emerging economies, the Thai CPI basket contains a large share of food items that total at 40.8 percent. Half of these are raw food, whose prices are rather volatile, while the rest are prepared food, non-alcoholic beverages, seasonings and condiments which are part of core inflation. Energy items account for around 12.2 percent, while core inflation accounts for around two-thirds of the CPI basket. Of all items, housing rent, which is part of service category, holds the largest expenditure share weight of 14.5 percent.

Table 1: Summary of CPI Items

	CPI Basket: Base Year 2018		Our Sample		
	Number of Items	Expenditure Weight (a)	Number of Items	Expenditure Weight (b)	(a)/(b)
Raw Food	115	20.7%	74	18.1%	87.6%
Energy	11	12.2%	7	10.9%	89.0%
Core	304	67.1%	150	54.4%	81.0%
Core: Food	49	20.1%	29	17.0%	84.9%
Core: Non-food	255	47.1%	121	37.3%	79.3%
Core: Service	90	28.3%	35	22.6%	79.8%
Core: Durable	36	7.4%	22	7.1%	94.9%
Core: Nondurable	178	31.3%	93	24.7%	78.8%
All	430	100.0%	231	83.3%	83.3%

Note: The CPI basket for the base year 2018 is used in the computation of CPI from 2021 onward. Expenditure weights shown in the Table are based on expenditure shares in year 2021.
Source: Ministry of Commerce and authors' calculation

3.2 Model Estimation and Shock Orthogonalization

Our estimation is based on a two step procedure. First, we obtain unobserved common factors by extracting the first principal component from relevant macroeconomic series. Towards estimating the domestic inflation factor, we follow Boivin et al. (2009) and adopt the following iterative procedure. First, we extract the first principal component from 231 individual inflation series, headline, and core inflation. Then, we regress each individual inflation series π_{it} on this first principal component and other pre-determined factors in C_t^{**}, and compute $\pi_{it}^{'}$ by subtracting the fitted components of the factors other than the domestic price factor from π_{it}. Then, we estimate the first principal component of $\pi_{it}^{'}$, and repeatedly regress this component on the individual inflation series until convergence. This is to ensure that the estimated inflation factor recovers the dimensions of common price dynamics that is purged of other macroeconomic factors in C_t^{**}.

After obtaining the unobserved common factors, we use Bayesian methods with Minnesota-style priors to estimate the SVAR in (1), where we assume two lags for the endogenous variables.[7] Since we are interested in the role of global versus domestic shocks on Thai inflation, we impose a combination of short and long-run zero restrictions and sign restrictions during estimation to identify seven structural macroeconomic shocks. The seven shocks identified include four domestic shocks, namely a domestic demand shock, domestic supply shock, domestic monetary policy shock and exchange rate shock, as well as three global shocks, including a global demand shock, global supply shock and oil price shock.

Our shock identification procedure is as summarized in Table 2. Note that it is similar in spirit to Ha et al. (2019), except that these authors do not rely on zero restrictions. In our study, sign restrictions are imposed for one period, i.e. the contemporaneous impact after each shock. Other details and interpretations of the restrictions are as follows. First, we assume that only supply shocks, either with domestic or global origin, can affect the growth rate or level of output in the long run. This is consistent with the notion that only changes in technology can affect the long-run productive capacity of an economy (Blanchard and Quah, 1989). Next, as is standard for structural VARs of small open economies, we impose short-run zero restrictions on the contemporaneous impact of domestic shocks on global factors.[8] Other short-run sign restrictions on domestic shocks include a positive supply shock that leads to a positive response in real activity but a fall in inflation. We also restrict demand shocks to induce a positive correlation between real activity and inflation, as well as the domestic policy rate to signify a countercyclical monetary policy response. Exchange rates also react in a way that is consistent with the uncovered interest parity condition. Monetary policy shocks are identified such that

[7]Following Forbes et al. (2020), we employ the algorithm suggested by Rubio-Ramírez et al. (2010) and extended by Binning (2013) for under-identified models. The percentiles and confidence intervals are constructed from the final 1,000 repetitions in the Gibbs sampling procedure. We benefit greatly from MATLAB codes provided by Boivin et al. (2009) and Forbes et al. (2018).

[8]Zero long-run restrictions are not needed since we have already imposed zero restrictions on the VAR coefficients of domestic factors onto global factors. So, domestic shocks do not affect global factors both in the short and long run. Imposing zero long-run restrictions would also result in model over-identification.

a lower interest rate is associated with an improvement in real economic activity and prices alongside a depreciation of the nominal exchange rate. Finally, an exogenous exchange rate appreciation implies a fall in prices, while the central bank responds by cutting the policy rate.[9]

Last, we turn to the identification of global shocks. First, the identified global supply shock is intended to capture supply-side variations unrelated to the oil market. Oil price shocks, on the other hand, should capture such events as oil supply disruptions often coinciding with armed conflict or civil unrest or militant attacks on pipelines, as well as OPEC decisions to restrain production (Ha et al., 2019). This creates a distinction between these two shocks. On the one hand, positive global supply shocks exert downward pressure on inflation while spurring economic activity, the latter in turn raising world oil prices. Therefore, such shocks result in a negative association between oil prices and global inflation. On the other hand, an exogenous spike in world oil price is assumed to result in a rise in global inflation but declines in economic activity. With a negative association between the two variables, we can say that adverse global supply shocks and oil price shocks both lead to stagflationary effects on global growth and inflation. As for the global demand shock, foreign inflation, economic activity and oil prices all comove in the same direction.

Once the SVAR in (1) is estimated to trace out the dynamic effects of each structural shock on macroeconomic factors, we perform an OLS regression of (3). This is to obtain the shock impact on disaggregated price series. According to (3), sectoral inflation rates are linked to macroeconomic and sectoral-specific factors, thus estimating this system of equations by OLS will help us disentangle fluctuations in individual inflation rates that stem from the various common and sector-specific shocks.

4 Empirical Findings

In this section, we discuss our empirical findings along various dimensions. First, we show summary statistics pertaining to the volatility and persistence of common and sector-specific components of disaggregated and aggregated inflation series. Then, we discuss estimation results from the FAVAR, where we focus on the contribution of the seven structural shocks on inflation dynamics, as well as dynamic

[9]The restriction on the monetary-policy response to exchange rate shock is necessary, as it helps disentangle exchange rate shock from a monetary policy shock. Relaxing this restriction does not change the results, as the policy rate still in most draws declines in response to a Thai baht appreciation.

Table 2: SVAR Identification

	Domestic supply shock	Domestic demand shock	Monetary policy shock	Exchange rate shock	Global supply shock	Global demand shock	Oil price shock
	Short-run restrictions						
Thai economic activity	+	+	-				
Thai inflation	-	+	-	-			
Thai policy rate		+	+	-			
Exchange rate		+	+	+			
Foreign economic activity	0	0	0	0	+	+	-
Foreign inflation	0	0	0	0	-	+	+
Global oil price	0	0	0	0	+	+	+
	Long-run restrictions						
Thai economic activity		0	0	0			
Thai inflation							
Thai policy rate							
Exchange rate							
Foreign economic activity						0	
Foreign inflation							
Global oil price							

Note: Sign restrictions are imposed on impulse responses in the contemporaneous period of shock.

effects of these shocks on individual price series. We next investigate whether each structural macroeconomic shock leads to differences in inflation persistence. Finally, we discuss the results from a historical shock decomposition of inflation that can help shed light on the drivers of Thai inflation over past decades.

4.1 Inflation Volatility and Persistence

Table 3 presents summary statistics of the standard deviations and persistence of common ($\lambda_i' C_t^{**}$) and sector-specific components (e_{it}) for disaggregated and aggregated price series. We also show summary statistics for different groupings of price series by taking weighted averages.[10] The R^2 measures in the table denote

[10] To compute the weighted-average statistics from disaggregated price series, we use 2021 expenditure share weights. However, since there are excluded items from the CPI basket, we re-adjust item weights such that they sum up to one while ensuring that the aggregated weights of the seven main CPI categories equal their actual weights based on the full CPI basket in 2021. Doing so is to ensure that we do not overweight raw food and energy products, which represent a higher expenditure share in our sample than in the actual basket. The seven main CPI categories consist of food and non-alcoholic beverages (40.9%); apparel and footwear (2.2%); housing and furnishing (22.5%); medical and personal care (5.7%); transportation and communication (22.8%); recreation and education (4.5%); tobacco and alcoholic beverage (1.4%), where the number in parentheses shows expenditure weights based on the entire CPI basket in 2021. Note that standard deviations of the common component is calculated as: $\sqrt{sd^2(\pi_{it}) R_i^2}$, whereas that of the sector-specific component corresponds to $\sqrt{sd^2(\pi_{it})(1 - R_i^2)}$.

the fraction of variance in inflation explained by the common component, which is calculated as $R_i^2 = \frac{var(\lambda_i' C_t^{**})}{var(\pi_{it})}$.

Table 3: Volatility and Persistence of Quarterly Inflation Series

	Standard deviations			R^2	Persistence		
	Inflation	Common comp.	Sector-specific		Inflation	Common comp.	Sector-specific
Aggregated Series							
Headline inflation	0.83	0.68	0.47	0.67	0.36	0.34	-0.09
Core inflation	0.30	0.23	0.19	0.58	0.52	0.66	0.37
Disaggregated Series							
Average (weighted)	2.37	0.78	2.18	0.15	0.20	0.43	0.13
Average (unweighted)	2.50	1.21	2.03	0.21	0.26	0.48	0.18
Median	0.93	0.30	0.81	0.09	0.25	0.47	0.18
Minimum	0.14	0.02	0.14	0.01	-1.89	-0.23	-0.99
Maximum	23.38	7.68	22.94	0.76	0.84	0.72	0.85
Std	3.88	1.26	3.71	0.15	0.34	0.23	0.29
Categories (weighted average)							
Raw Food	4.59	1.41	4.33	0.14	0.18	0.52	0.13
Energy	7.34	5.24	4.62	0.51	0.09	0.23	-0.16
EnergyX	7.88	6.72	4.07	0.70	0.09	0.10	-0.23
Core	0.90	0.37	0.80	0.18	0.33	0.51	0.25
CoreX	1.13	0.47	1.00	0.21	0.23	0.54	0.15
Core: Food	1.23	0.72	0.98	0.37	0.36	0.65	0.15
Core: Non-food	0.76	0.21	0.73	0.10	0.31	0.45	0.30
Core: Durable	1.87	0.46	1.81	0.07	0.26	0.45	0.26
Nondurable	3.26	1.73	2.53	0.29	0.23	0.49	0.08
Service	1.16	0.38	1.09	0.10	0.33	0.47	0.34
Core: ServiceX	0.78	0.24	0.73	0.11	-0.04	0.50	0.08
Core: Nondurable	1.05	0.55	0.87	0.28	0.31	0.58	0.14

Note: Sample is 2002Q2-2019Q4. Common components are $\lambda_i' C_t^*$ and sector-specific components are e_{it}. R^2 statistics measure the fraction of the variance of inflation π_{it} explained by common components. Persistence is based on estimated AR processes with 2 lags, where we report the sum of AR coefficients. Weighted average of statistics for disaggregated price series is obtained using expenditure shares in year 2021 as weights. EnergyX excludes electricity fee and LPG price. CoreX and Core:ServiceX both exclude housing rent.

How much does the common versus sector-specific components of inflation contribute to inflation volatility and persistence? According to Table 3, we find that overall, sector-specific shocks are a predominant driver of Thai disaggregated price series, accounting for over 80 percent of the variation. This finding coincides with those of Apaitan et al. (2020), who utilizes the dynamic factor model of Reis and Watson (2010) and documents a large role for idiosyncratic shocks towards explaining the movements of individual CPI series in Thailand. We also find in our analyses that this pattern holds across various subgroups and stands out in particular for the 'raw food' and 'service' components, where the latter has the lowest average R_i^2 of only 11 percent. Strikingly, even the 'core' component has an average R_i^2 of as low as 18 percent, meaning that the remaining 81 percent of its volatility is explained by idiosyncratic components.

There are, however, a few exceptions. A common component explains roughtly 52 percent of the variance in the 'energy' component. This share rises to 70 percent for 'energyx' which only includes prices of retail oil, that is, excluding electricity fees and liquid petroleum gas (LPG) prices. The importance of the common factor for the energy component likely reflects the impact of global oil price variations, in which we will explore in more depth in the next subsection. Finally, we observe that among core items, there exists some variation, where the role of common shocks are largest for food prices, but still accounts for less than 40 percent of overall price variations.

In line with the prominent role for sector-specific components in expalining movements of disaggregated price series, We also observe from Table 3 that there is considerable heterogeneity in inflation volatility across sectors. This is mainly attributed to sector-specific price variations. Focusing on inflation subgroups, while idiosyncratic shocks lead to high volatility in 'raw food', and 'energy' prices, they are considerably less volatile for core inflation items.

Next, we examine common versus sector-specific drivers of aggregated inflation series. It is evident that movements at the aggregated level are less volatile than at the disaggregated level, as the standard deviation is quite low at 0.3 for core inflation, and 0.83 for headline inflation. Interestingly, most of this volatility can be attributed to fluctuations in common macroeconomic factors (R^2= 0.58 fore core and 0.67 for headline inflation). There are two potential explanations. First, sector-specific components or the noisy components of inflation may cancel out in each period. Second, the characteristics of headline inflation may inherit the properties of energy prices which are volatile and take up a non-trivial share of the consumption basket. However, despite sector-specific shocks playing a smaller role in explaining aggregated price dynamics, idiosyncratic shocks are still considered to be quite high at 33 percent. This implies that while headline inflation can, to some extent, reflect economy-wide price pressures, there still remains a significant portion that is driven by noisy price movements that can obscure underlying price pressures.

Finally, we assess the degree of persistence across common and idiosyncratic inflation components. In doing so, we fit each inflation series as well as its two components to an autoregressive process of 2 lags, and measure the degree of persistence by the sum of the coefficients on all lags. Results appear in the last three columns of Table 3. We find that fluctuations in aggregated inflation measures have moderate degrees of persistence at 0.52 and 0.36 for core and headline inflation, respectively. These result contrasts those of Boivin et al. (2009), where U.S. headline inflation exhibits higher persistence of 0.9.[11] As for the degree of persistence for disaggregated inflation series in Thailand, a similar picture of rather transient fluctuations emerge, albeit with some heterogeneity across categories. While items within the prepared food sectors display highest degree of inflation persistence, it is still considered to be moderate at 0.36. On the lower end, inflation persistence of energy and service (excluding housing rent) components are close to zero.

A closer inspection of Table 3 reveals that inflation persistence is mainly driven by common shocks. The persistence of the common component of headline and core inflation stands at 0.34 and 0.66 respectively, compared to the lower persistence of sector-specific components at -0.09 and 0.37.[12] This pattern is also observed in the subgroup categories of inflation, particularly raw food and non durable items in core inflation, where the persistence of the component is much higher than those of idiosyncratic shocks. These results help shed light on the underlying source of inflation persistence, where persistence at the aggregate level is higher than disaggregated price series due to the important role of common macroeconomic shocks. This finding echoes those of Boivin et al. (2009) for the U.S. case, but may contrast other findings in the literature. For example, Graeve and Walentin (2015) show that after controlling for micro-price features such as measurement error, sales and item substitutions, aggregate and sectoral shocks both can generate substantial inflation persistence.

4.2 Global and Domestic Drivers of Inflation

Given the important role that common shocks play in explaining the fluctuations in aggregate price dynamics, we further examine whether domestic or external shocks dominate common price movements. In doing so, we examine the 20-quarter forecast error variance decomposition results for each macroeconomic variable from the structural VAR system in Eq. (1) to attribute the share of variance explained by the seven structural shocks. To quantify the impact on individual price series, we use the relationship as in Eq. (3), where for each series, the variance share attributed to each structural shock is multiplied by the corresponding R^2 of that

[11]Note that these differences in findings may also reflect different time periods under study, as Monacelli and Sala (2009) finds much lower persistence at 0.1 for advanced economies, including the U.S. during 1991-2004.

[12]Note that the negative sign on the persistence coefficient belonging to the sector specific component in headline inflation carries over from the behavior of the energy component. The negative sign implies that sector-specific shocks revert in the subsequent quarter after the initial shock tends to overshoot upon impact.

series.[13]

As shown in Table 4, common drivers of Thai inflation are highly global in nature, where we classify global supply, global demand and oil prices as global shocks. We find that global shocks explain more than 40 percent of the variation in headline inflation, which is in line with the results of Manopimoke and Direkudomsak (2015) that also documents a prominent role for a global inflation factor for Thailand. As Thailand is a highly open economy with a degree of trade openness that exceeds 100 percent, it is not surprising that this high share of 40 percent appears to be higher than the importance of global shocks for inflation rates of the average EME from the cross-country analysis of Ha et al. (2019). Similar to Ha et al. (2019) however, we find that among global shocks, global demand and oil price shocks are most dominant, accounting for 23 and 12 percent of the variance in headline inflation, respectively.

On the other hand, we find a smaller role for domestic shocks as drivers of overall headline inflation. Domestic demand shocks explain only 5 percent of variations in headline inflation, which is consistent with a flat Phillips curve for Thailand (Manopimoke and Direkudomsak (2015)). At the same time, the contributions of exchange rate shocks are negligible, suggesting low exchange rate pass-through to consumer prices. However, there are some differences for the role of domestic versus global shocks for core inflation. For core inflation, domestic shocks play a more important role than global counterparts, explaining around one-third of total variations. Of all domestic shocks, domestic supply shocks have the largest contributions, whereas domestic demand and exchange rate shocks play minor roles. Our results, therefore, suggest that core inflation can still capture, to some extent, domestically-oriented inflationary pressures.

Finally, turning to analyze disaggregated price dynamics, we show that on average, global shocks explain just around 8 percent of variations in disaggregated prices, while domestic shocks account for 7 percent. The remaining 85 percent comes from sector specific shocks. However, when considering the sub-categories of the CPI basket, energy products stand out as an anomaly, as global shocks explain about half of this sector's price variations. For retail oil prices, such contributions reach even higher at 66 percent, while domestic shocks represent only a negligible share. This finding echoes Parker (2018), where the authors argue that global content can be large for only a subset of prices.

Figure 1 shows the variance decomposition results from all 231 disaggregated inflation series, which confirm the limited influence of global factors. The outsized

[13]We assume $var(\pi_{it}) = \sum_j (\lambda_i^j)^2 var(C_t^{**,j})$, where $C_t^{**,j}$ denotes each common factor j within C_t^{**}. We ignore the covariance among common factors.

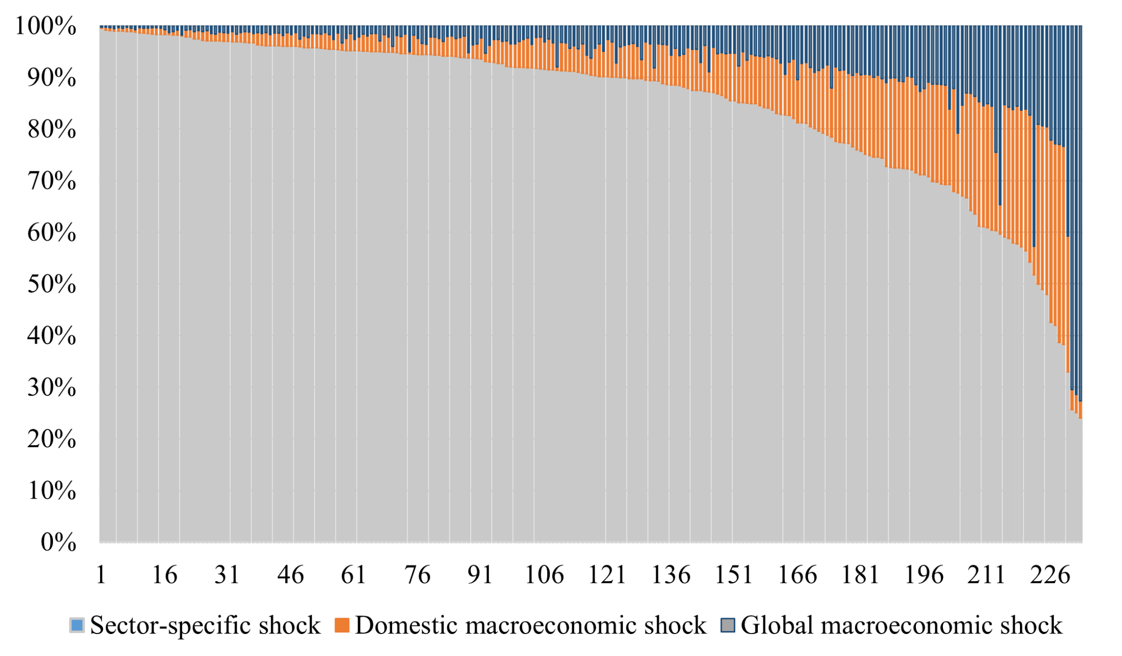
role of idiosyncratic shocks can clearly be seen from the gray bars, which show that more than 220 items in the CPI basket have sector-specific shocks explaining more than half of their variations. The influence of global shocks as shown in blue bars are only large for a few items, particularly retail oil prices, that are shown in the rightmost columns. Finally, an interesting observation is that for most items in the CPI basket, domestic shocks as shown in the orange bars are indeed more influential than global shocks. As such, our findings imply that while global shocks appear to dominate movements of overall headline inflation, this is mainly due to its outsized role on driving energy prices that lead to large relative price responses. We explore this issue further in the next subsection.

Table 4: Share of Variance of Quarterly Inflation Series Explained by Each Identified Common Shock

	Domestic supply shock	Domestic demand shock	Monetary policy shock	Exchange rate shock	Global demand shock	Global supply shock	Oil price shock	Sum domestic shocks	Sum global shocks	Sector-specific shocks
Aggregated Series										
Headline inflation	0.10	0.05	0.08	0.03	0.23	0.06	0.12	0.26	0.41	0.33
Core	0.13	0.07	0.11	0.04	0.15	0.03	0.05	0.35	0.23	0.42
Disaggregated Series										
Average (weighted)	0.03	0.02	0.02	0.01	0.04	0.01	0.02	0.08	0.07	0.85
Average (unweighted)	0.04	0.02	0.03	0.01	0.07	0.02	0.03	0.10	0.12	0.79
Median	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.05	0.04	0.91
Minimum	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
Maximum	0.15	0.08	0.12	0.04	0.37	0.11	0.25			
Std	0.03	0.02	0.03	0.01	0.05	0.01	0.03			
Categories (weighted average)										
Raw Food	0.03	0.02	0.03	0.01	0.04	0.01	0.01	0.09	0.06	0.86
Energy	0.02	0.01	0.01	0.01	0.24	0.07	0.16	0.05	0.47	0.49
EnergyX	0.02	0.01	0.01	0.01	0.33	0.10	0.23	0.04	0.66	0.30
Core	0.04	0.02	0.03	0.01	0.05	0.01	0.02	0.11	0.07	0.82
CoreX	0.05	0.03	0.04	0.01	0.05	0.01	0.02	0.13	0.08	0.79
Core: Food	0.09	0.05	0.07	0.03	0.09	0.02	0.03	0.23	0.14	0.63
Core: Non-food	0.02	0.01	0.02	0.01	0.02	0.01	0.01	0.06	0.04	0.90
Core: Durable	0.02	0.01	0.01	0.01	0.02	0.00	0.01	0.04	0.03	0.93
Nondurable	0.05	0.02	0.04	0.01	0.10	0.03	0.05	0.12	0.17	0.71
Service	0.02	0.01	0.02	0.01	0.02	0.01	0.01	0.05	0.04	0.90
Core: ServiceX	0.02	0.01	0.02	0.01	0.03	0.01	0.01	0.07	0.04	0.89
Core: Nondurable	0.07	0.03	0.05	0.02	0.07	0.02	0.02	0.17	0.11	0.72

Note: As shown are the share of variance of inflation series π_{it} explained by each identified structural common shock. We employ the following three steps to compute such variance share. First, we obtain estimates of 20-quarter-ahead forecast error variance for each macroeconomic factor attributed to each of the identified structural shocks. Matrix FEV_{7x4} collects forecast-error variance of the 4 factors within C_t^* due to 7 structural shocks. Second, to compute such forecast-error variance for each inflation series, we multiply FEV_{7x4} by the squared loadings of each factor on inflation series, λ_i^2. We then compute variance share explained by each structural shock. Third, we multiply such share by the corresponding R^2 of each inflation series. The Table also reports the variance share explained by sector-specific shocks (1-R^2) in the rightmost column. The weighted average of statistics is obtained by using expenditure shares in year 2021 as weights. EnergyX excludes electricity fee and LPG price. CoreX and Core:ServiceX both exclude housing rent.

Figure 1: Variance Decomposition of Quarterly Inflation Series

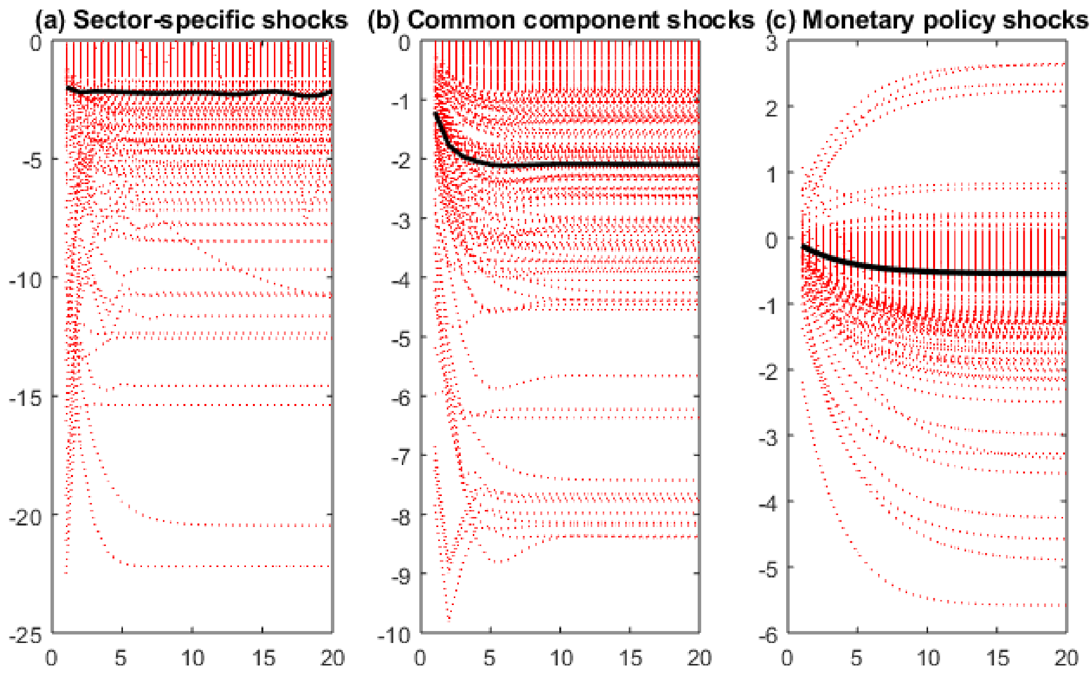


Note: Displayed are variance decomposition of 231 disaggregated inflation series into (1) sector-specific components, (2) components driven by global shocks and (3) components driven by domestic shocks. Please refer to Note in Figure 4 on how to compute contributions of each component on the variance of inflation series.

4.3 Impulse Response Functions

In this subsection, we explore the impact of shocks on inflation dynamics at the disaggregated level, and explores how it relates to inflation persistence. First, we differentiate between sector-specific and common components for each disaggregated price series by fitting these two components to an autoregressive process with 2 lags, and consider how the two components evolve according to shocks. As shown in Panel (a) and (b) of Figure 2, the impulse responses for disaggregated price series are in red, with their weighted average displayed as a solid black line. As in Boivin et al. (2009), we find that many prices fluctuate considerably in response to sector-specific shocks, but they respond more sluggishly to aggregate macroeconomic shocks. In particular, negative sector-specific shocks lead to a rather immediate drop in prices upon impact and its level is sustained for the medium term, implying no or limited inflation persistence. On the other hand, after a shock to the common component, prices keep falling in subsequent quarters, implying that prices are relatively sticky toward macroeconomic shocks. In Figure 2, we also show the responses of individual price series to a monetary policy shock in panel (c), which also displays price stickiness and takes time to reach full impact. The resuls here are consistent with our earlier results on inflation persistence as shown in Table 3.

Figure 2: IRFs of Disaggregated Prices to Common vs. Sector-specific Shocks



Note: The left and middle subfigures show the cumulative responses of disaggregated prices (in percent) to a sector-specific shock e_{it} of one standard deviation and to a shock to the common component $\lambda_i^{'} C_t^*$ of one standard deviation, respectively. The responses are based on estimated AR processes with 2 lags. The right figure shows cumulative responses of disaggregated prices to a monetary policy shock, identified from the FAVAR model using zero and sign restrictions. Please refer to Section 4.3 for details on the computation of impulse responses of individual price series. Black solid lines represent weighted-average responses of disaggregated price series using expenditure shares in year 2021 as weights.

Next, we examine disaggregated price responses to structural macroeconomic shocks to further shed light on heterogeneous price dynamics across sectors. To obtain impulse responses of disaggregated prices, we take the median responses of macroeconomic factors to each stock from 1,000 accepted draws, and link these responses to individual price series via Eq. (3). As shown in in Figure 3, we indeed find that the dynamic impact of each structural shock on CPI components vary widely across goods, and also across time horizons. Overall, the impact of macroeconomic shocks on disaggregated prices can be quite large, persistent, and textcolorredheterogeneous even in the long-run.[14] In terms of size, large price re-

[14]This holds even in the case of nominal shocks, be it a monetary policy or exchange rate shock, which goes against the assumption of money neutrality.

sponses are particularly concentrated in raw food and energy components, which drives large price dispersion via relative price changes across goods in Thailand. These findings are in line with Reis and Watson (2010) and Apaitan et al. (2020), whom shows that aggregate shocks can lead to large relative price responses that end up explaining a large portion of variability in headline inflation. Nevertheless, despite large relative price shocks in the case of Thailand, we find that there are limited spillovers to core inflation given its more muted response to macroeconomic shocks, potentially reflecting limited second-round effects on inflation expectations.

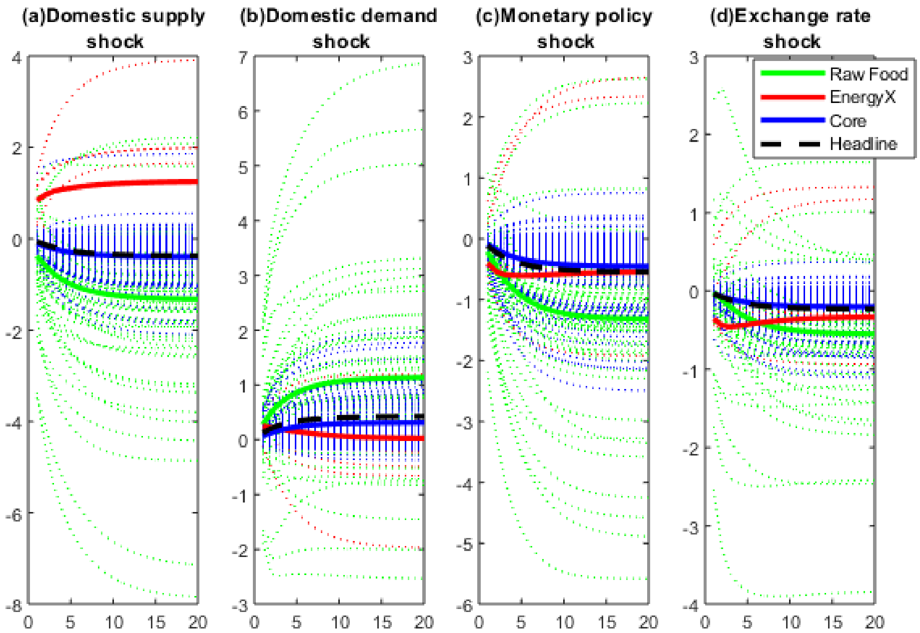
Examining Figure 3 in greater detail, global and domestic shocks affect food and energy components differently. The energy sector is highly responsive to global shocks whereas raw food items are more so influenced by domestic macroeconomic shocks. This implies that the transmission of global shocks to headline inflation, independently of being a global demand, supply or oil price shock, is mainly through its influence on domestic energy prices. We note that whereas a negative global supply shock leads to a rise in global inflation, Thailand's overall inflation in fact declines mainly in response to falling energy prices. Meanwhile, as expected, a positive world demand or adverse oil price shock that primarily raises world oil prices and global inflation, raises most of Thai individual prices as well as aggregated inflation. Comparing between all global shocks of similar size (one standard deviation), global demand shocks results in the largest price response toward overall inflation, in line with our earlier findings that highlight their large contributions towards explaining headline inflation variance. To give a sense of magnitude, a one-standard-deviation global demand shock leads to an increase in weighted-average prices as shown in the dashed black line by 0.96 percent after one year, whereas the impact of an oil price shock is 0.53 percent. This leads to an increase in retail oil prices of 5.12 and 4.52 percent respectively.

Turning to examine the impact of domestic shocks, we find that fresh food items are most responsive. This points out that while variations of fresh food prices are largely dominated by idiosyncratic shocks, they also do respond strongly to macroeconomic shocks as well. Depending on each type of domestic shock, we also find that items in the energy sector are highly sensitive to domestic supply shocks, and moderately responsive to exchange rate and monetary policy shocks, especially in the short run.[15] In particular, a domestic currency appreciation helps lower energy prices, with passthrough effects rather immediate, while other prices respond with lags. For a monetary policy tightening shock, energy-related prices also show an abrupt decline, which may underscore the existence of the exchange-

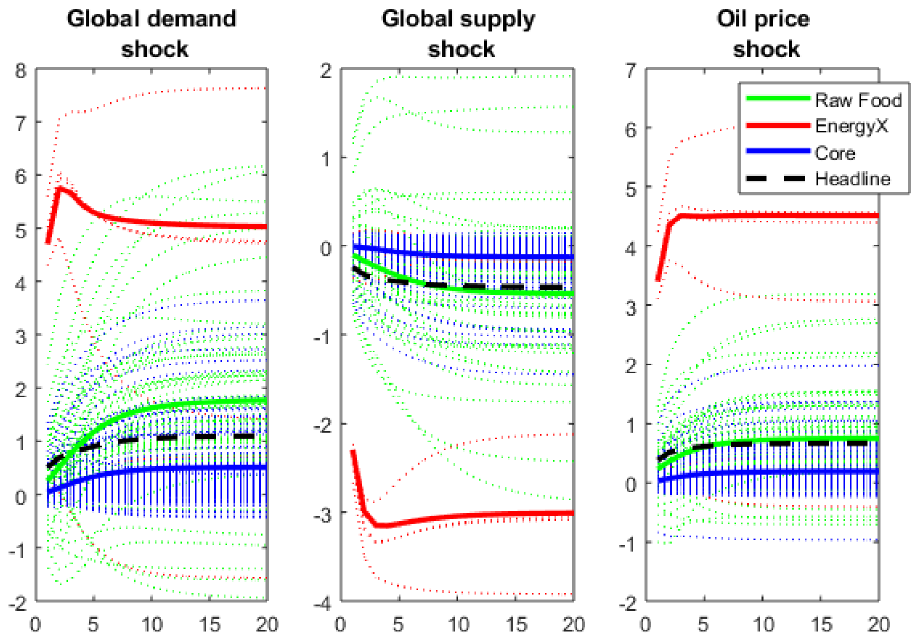
[15]Apaitan et al. (2021) document heterogeneity in exchange rate passthrough to Thai import prices where the passthrough is greatest for the petroleum sector.

Figure 3: IRFs of Disaggregated Price Series to Identified Common Shocks

(a) Domestic Shocks



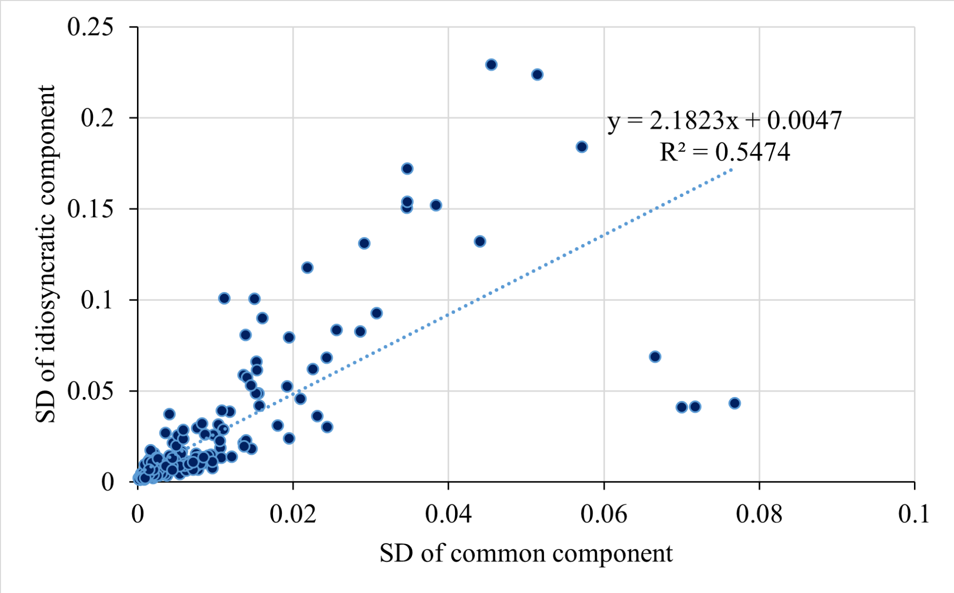
(b) Global Shocks



Note: Displayed are the estimated cumulative impulse responses of disaggregated price series (in percent) to an identified structural common shock of one standard deviation. Prices in core, raw food and energy components are shown in blue, green and red lines, respectively. Thick solid lines represent weighted average responses for each component, whereas dashed black lines show weighted average responses of all sectoral price series using expenditure shares in year 2021 as weights. EnergyX excludes electricity fee and LPG price.

rate channel of monetary policy transmission.

Figure 4: Volatility of Common and Sector-specific Components of Sectoral Inflation Rates

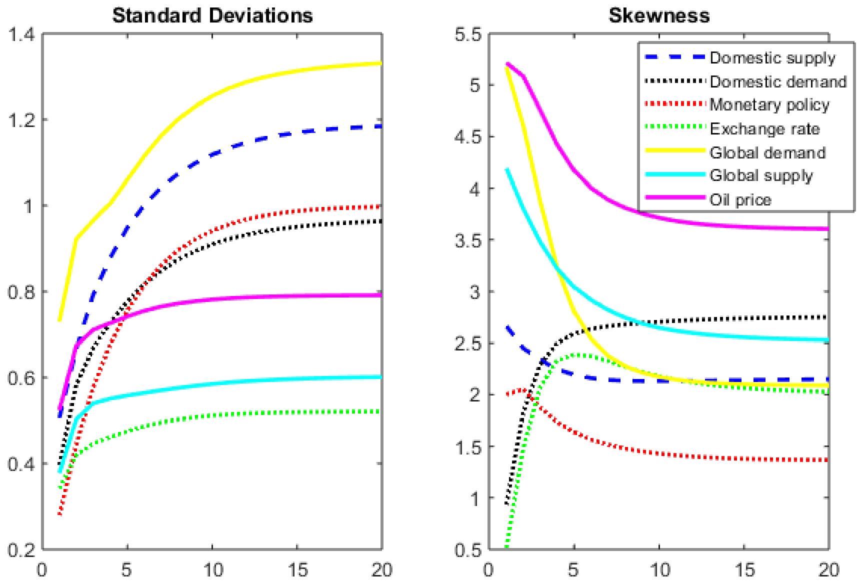


Note: Displayed are standard deviations (expressed in percent) of sector-specific components (e_{it}) and common components ($\lambda_i^{'} C_t^{*}$) of sectoral inflation rates π_{it}. A dashed blue line represents a cross-sectional regression line.

One key finding from our discussion above that is worth highlighting is that food and energy components that are typically volatile, are also largely influenced by macroeconomic shocks, whether it be domestic or global in nature. This is consistent with Boivin et al. (2009), whom argue that firms in industries with volatile idiosyncratic shocks also respond strongly to macroeconomic shocks. This may be the case if frequent price adjustments that create idiosyncratic volatility are also used as an opportunity to adjust to changes in the macroeconomic environment. Figure 4 plots the volatility of the common versus sector-specific components of 231 disaggregated inflation series, which overall displays a clear positive correlation across sectors.

Finally, we compute standard deviations and skewness measures based on individual impulse response functions to study how each identified structural shock impacts price distributions in each sector. The results are as shown in Figure 5. Several observations stand out. First, standard deviations of price responses tend to increase over time as prices become more flexible. Global demand shocks yield the highest degree of dispersion, followed by domestic supply and monetary policy shocks. Second, the impact of global shocks is highly skewed. Given that the distribution of price responses to global shocks is positive or right skewed, this suggests

Figure 5: Standard Deviations and Skewness of Disaggregated Price Responses to Identified Common Shocks



Note: Displayed are standard deviations and skewness of cumulative responses of disaggregaged prices to each of the 7 identified structural common shocks over 20 quarters. Each structural shock is assumed to result in an increase in overall inflation.

extreme responses to these type of shocks. This makes sense as items in the energy components typically responds strongly to these types of shocks. However, the responses of all global shocks, especially global demand shocks, becomes substantially less skewed over time, possibly because non-energy prices as affected by the same shock catch up somewhat.

4.4 Shock-dependent Inflation Persistence

The issue of inflation persistence is central to monetary policy considerations. To the extent that shocks have low persistence or short-lived effects on inflation, it may be safe to "look through" such shocks as inflation would revert back to target on its own after a short period of time. Our previous results suggest that common components of both aggregate and disaggregated inflation tend to be more persistent than their idiosyncratic counterparts. There is also evidence of considerable heterogeneity in the response of disaggregated prices to common macroeconomic shocks. In this section, we therefore examine inflation persistence conditional on identified structural shocks. This issue is of relevance insofar as monetary policy responses might be shock dependent. For example, Bems et al. (2022) argues that the impact of global shocks can be short-lived, hence monetary policy actions may not be warranted.

In Table 5, we report inflation persistence as conditional on each identified structural common shock. Based on the non-accumulated impulse responses of aggregate and disaggregated inflation series over a 40-quarter horizon, we calculate the 1^{st}-order and 4^{th}-order autocorrelations in the responses. Then, we show the weighted-average persistence of disaggregated price series by using their absolute contribution to one-year overall inflation responses to each structural shock as weights. We believe that this weighting scheme may better capture the influence of persistence at the disaggregated price level on overall inflation persistence.

According to our results, there exist heterogeneity in inflation persistence across different shocks. There are also differences between the persistence of aggregate and disaggregated inflation measures. For headline inflation, global shocks lead to lower inflation persistence (0.4 to 0.5) when compared to domestic shocks (0.65 to 0.89). For core inflation, both global and domestic shocks lead to high persistence, thus the lower persistence in headline inflation largely stems from the relatively low persistence that stems from the energy sector. Surprisingly, persistence in the raw food component is quite high.

Examining the differences in inflation persistence across different types of shocks, we show that monetary policy shocks generates high inflation persistence for aggregate and disaggregated inflation measures, consistent with the finding of Boivin et al. (2009) in the US. In particular, the 1^{st}-order autocorrelation coefficient for headline and core inflation are 0.77 and 0.81, respectively, and remains high across all CPI categories. Among different types of shocks, domestic supply shocks produce the strongest persistence in headline inflation, despite generating somewhat smaller inflation persistence at the disaggregated level. This finding lends some support to the the work of Altissimo et al. (2009), whom argues that heterogeneous propagation of a common shock across sectoral inflation rates can generate inflation persistence at the aggregate level.

Last, we find from Table 5 that the type of global shock matters for the degree of inflation persistence. In particular, global demand shocks produce more inflation persistence when compared to oil price shocks. Despite both mainly affecting Thai inflation through energy prices, global demand shocks make core and raw food inflation more persistent. This is rather intuitive, since firms are more eager to raise their product prices in response to rising global oil prices when domestic economic activity is also strong. Hence, given that the degree of persistence appears to be shock dependent, we highlight the importance of taking into account the underlying source of shocks when analyzing price dynamics and making monetary policy considerations.

Table 5: Inflation Persistence Conditional on Shock

		Domestic supply shock	Domestic demand shock	Domestic monetary policy shock	Exchange rate shock	Global demand shock	Global supply shock	Oil price shock
1st-order	*Aggregated Series*							
	Headline	0.89	0.65	0.77	0.80	0.50	0.43	0.43
	Core	0.81	0.78	0.81	0.83	0.83	0.76	0.68
	Disaggregated Series							
	Average (unweighted)	0.55	0.60	0.72	0.58	0.67	0.61	0.50
	Average (weighted)	0.59	0.68	0.76	0.58	0.65	0.57	0.50
	Median	0.64	0.63	0.80	0.62	0.79	0.62	0.54
	Categories (weighted-average)							
	All	0.63	0.69	0.77	0.63	0.59	0.48	0.44
	Raw Food	0.64	0.67	0.78	0.66	0.80	0.66	0.61
	Energy	0.46	0.53	0.68	0.47	0.27	0.30	0.27
	EnergyX	0.28	0.48	0.62	0.47	0.22	0.30	0.27
	Core	0.72	0.78	0.81	0.71	0.81	0.79	0.70
	Core: Food	0.79	0.81	0.80	0.75	0.86	0.85	0.74
	Core: Non-food	0.63	0.74	0.83	0.63	0.70	0.65	0.60
	CoreX	0.73	0.78	0.81	0.71	0.81	0.79	0.70
4th-order	*Aggregated Series*							
	Headline	0.40	0.24	0.31	0.34	0.19	0.13	0.09
	Core	0.36	0.32	0.35	0.37	0.42	0.43	0.24
	Disaggregated Series							
	Average (unweighted)	0.23	0.20	0.30	0.21	0.26	0.22	0.15
	Average (weighted)	0.25	0.26	0.33	0.21	0.24	0.19	0.12
	Median	0.27	0.21	0.34	0.24	0.30	0.21	0.19
	Categories (weighted-average)							
	All	0.26	0.27	0.33	0.24	0.24	0.15	0.10
	Raw Food	0.27	0.25	0.34	0.26	0.26	0.32	0.23
	Energy	0.17	0.18	0.26	0.13	0.13	-0.01	0.00
	EnergyX	0.10	0.19	0.22	0.12	0.12	-0.01	0.00
	Core	0.31	0.32	0.35	0.29	0.29	0.42	0.25
	Core: Food	0.33	0.34	0.34	0.32	0.32	0.49	0.27
	Core: Nonfood	0.27	0.29	0.37	0.25	0.25	0.27	0.18
	CoreX	0.31	0.32	0.35	0.30	0.30	0.43	0.25

Note: The Table shows autocorrelations of individual price responses to each identified structural common shock. The weighted average of statistics is obtained by using their (absolute) contributions to aggregate price responses to each shock after one year as weights. EnergyX excludes electricity fee. CoreX excludes housing rent.

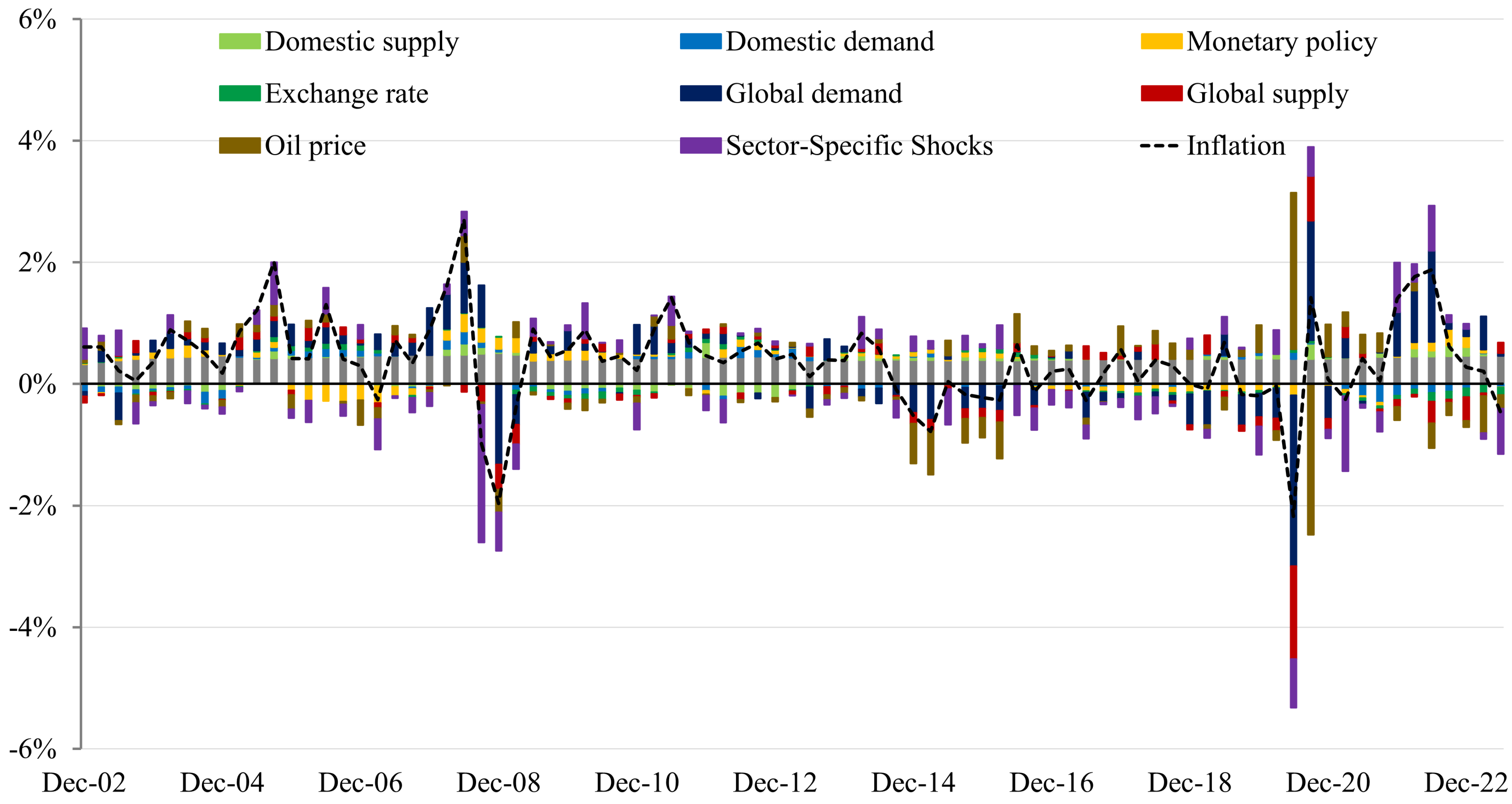
4.5 Historical Shock Decompositions

In this section, we perform a historical shock decomposition of headline inflation in order to explore the role of common and sector-specific shocks in driving overall inflation over the past two decades, where for this exercise, we also include the recent high inflation episode during the post COVID-19 pandemic. In doing so, we rely on a bottoms-up approach. First, we obtain historical shock decompositions of the seven common factors from the structural VAR model. They are computed as the average contributions of each shock to these factors from 1,000 accepted draws. We then use equations (3) to compute the contributions of these structural shocks to each of the disaggregated price series, where we take the residuals from each of the equations in (3) as sector-specific or idiosyncratic shocks. Finally, we aggregate these shock contributions up using the expenditure share weight of each corresponding item within the CPI basket to obtain the overall historical shock decomposition of headline inflation.[16]

Based on Figure 6, we can examine the drivers of Thai inflation during two crisis episodes - the global financial crisis (GFC) of 2008-09 and the recent COVID-19 pandemic period. As shown, global shocks have been predominant drivers of inflation during both episodes. In periods leading up to the GFC, positive global demand shocks raised inflation, possibly due to high demand from emerging market economies such as China and India. Adverse oil price shocks then added to high and volatile inflation during the second quarter of 2008 as quarterly inflation rates reached 2.7 percent. At the beginning of the GFC crisis, it was idiosyncratic shocks that first dragged Thai inflation down to -1.0 percent in Q3, mainly due to the role of government oil subsidies at that time which depressed retail oil prices. In subsequent periods, the global economic recession caused inflation to fall even further to -2.0 percent in Q4. Meanwhile, during the onset of the COVID-19 pandemic in 2020Q2, we find that both global demand and supply shocks mainly contributed to the abrupt decline in Thailand's inflation before rebounding in the third quarter. Oil price shocks appeared to have played a mitigating role that helped stabilize Thai inflation during these periods.

[16]The expenditure share weight is time-varying, non-adjusted and is based on the weight of that item in the previous quarter. Note that in the historical decomposition exercise, we do not re-adjust the expenditure weight to reflect the population distribution of categories, and so the weights of all 231 items do not sum up to 100. Despite excluded items and the use of actual expenditure weights, our aggregated inflation measure is still close to actual headline inflation.

Figure 6: Historical Shock Decomposition : Overall Inflation



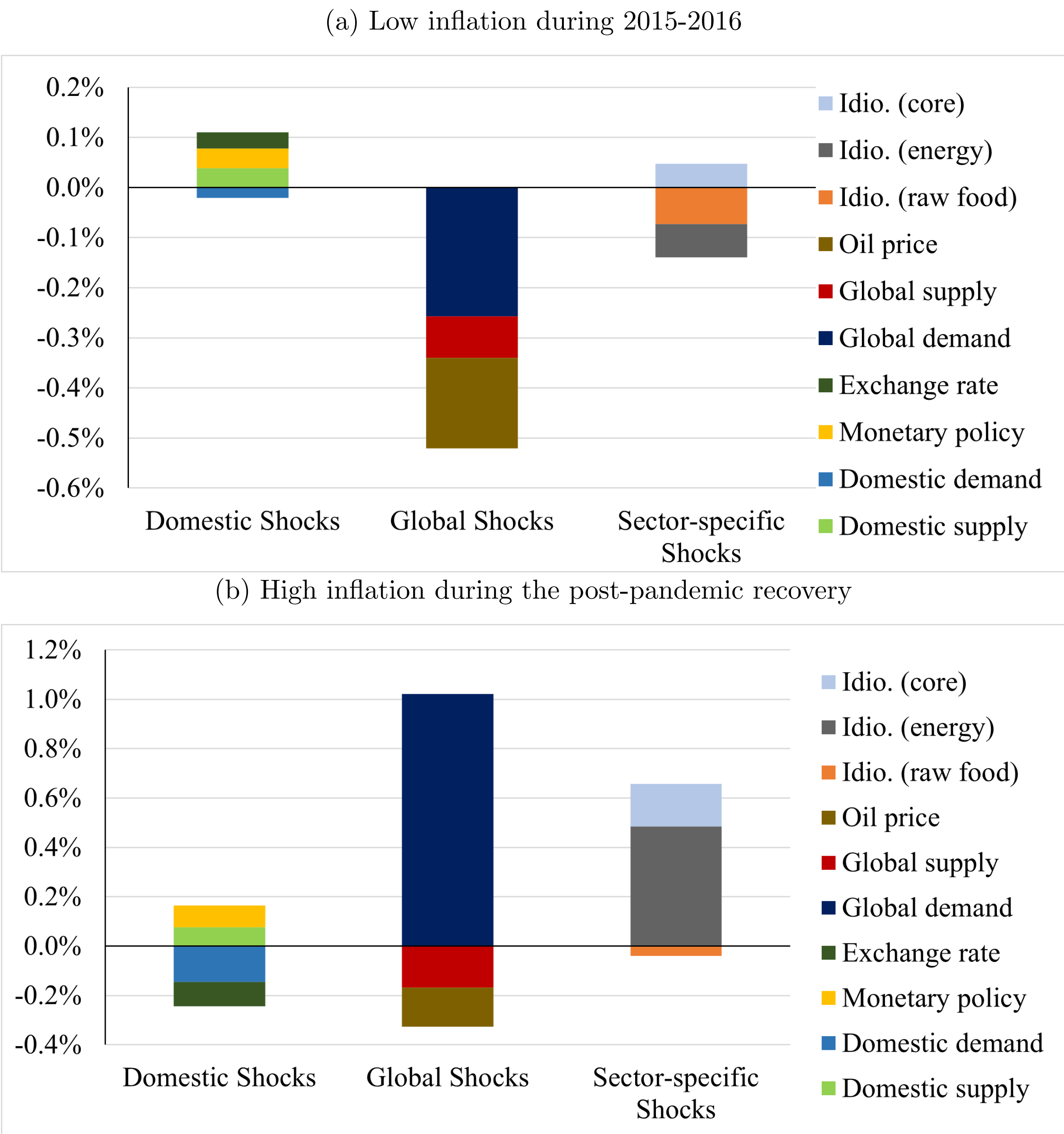
Note: Displayed are shock decomposition of Thailand's overall inflation during 2002Q4-2022Q2. We first obtain historical shock decompositions for each macroeconomic factor within the VAR model. Then, to obtain contributions of identified structural common shocks toward each sectoral price series, we rely on loadings of each factor on the disaggregated price series, λ_i. The unexplained component of each series is due to sector-specific shocks (purple bars), while in grey bars we capture historical mean of each disaggregated price series and the impact from structural shocks prior to the sample periods. Then we sum up shock contributions using expenditure share weights in the previous quarter, in order to obtain shock contributions toward overall inflation. A dashed line shows the summation of contributions from all shocks in each time period.

Our paper further documents two events over the past decade that are also worth mentioning. First is the low inflation period in 2015-16 that caused Thai inflation to deviate away from the central banks' inflation target for two consecutive years. The other one was the recent surge in inflation during the post COVID-19 pandemic, specifically in 2021Q4-2022Q2. According to Figure 7, which shows historical shock decompositions for both episodes, external shocks appear to be highly relevant. In particular, we find that the decline in inflation since 2015 can be mainly attributed to both global demand and oil shocks, with the latter being related to the shale oil revolution that increased global oil supply. Each of the two shocks on average contributed to the decline in headline inflation during that period by around 20 basis points. It can also be seen that sector-specific price shocks, mainly in the fresh food categories, was also responsible for low inflation during that time.

The increase in inflation during the post-pandemic recovery was once again a result of global shocks and, to a lesser extent, sector-specific shocks. Positive global demand shocks contributed significantly to the rise in Thai inflation, in line with the strong global economic recovery from the pandemic. Meanwhile, the Russia-Ukraine War that emerged during the beginning of 2022 led to only small adverse oil shocks in 2022Q1. However, relative price shocks emerged from the energy sector, partly due to the end of the electricity fee subsidy in Thailand. It can also be seen that the influence of demand-pull pressures for inflation in Thailand during this high inflation episode was negligible. Even in 2022Q2, we still do not observe inflation pressures stemming from domestic demand, despite the continued economic recovery. This finding is consistent with a flat Phillips curve for Thailand.

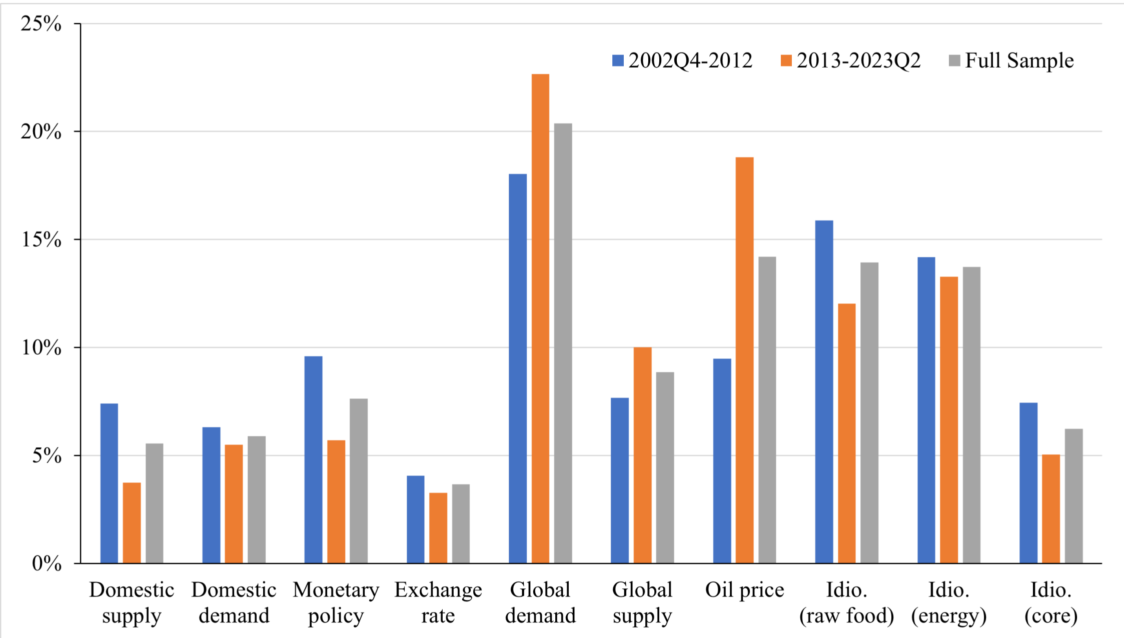
Finally, in Figure 8, we investigate whether the impact of each structural shock on inflation has changed over time. We compare shock contributions during 2003-2012 vs. 2013-2022, by computing averages from absolute shock contributions over these two subperiods. Our results show that during the past decade, there has been an increasing role for global shocks. These come at the expense of a diminished role for both domestic and sector-specific shocks. To get a sense of magnitude, all domestic shocks each contribute five percent or less in explaining overall inflation rate movements. On the other hand, oil price shocks play a much greater role, although global demand shocks remain the dominant driver of inflation dynamics during both periods. The greater importance of oil shocks means that as Thailand faces these common shocks, it will likely result in an inflation process that is more skewed as well as more volatile as these shocks are associated with less persistent inflation dynamics.

Figure 7: Historical Drivers of Thailand's Inflation Dynamics



Note: Displayed are average shock contributions to headline inflation, using results from Figure 6 during 2014Q3-2016Q4 (panel a) and 2021Q4-2022Q2 (panel b). We categorize shocks into 3 groups, domestic, global and sector-specific shocks as shown using 3 separate columns. For sector-specific shocks, we further categorize them into three groups.

Figure 8: Contributions of Shocks on Overall Inflation: Comparing Two Sub-periods



Note: Displayed are contributions of identified common shocks and sector-specific shocks towards explaining variations in Thailand's overall inflation. Based on historical shock decomposition in Figure 6, we compute for each shock its share in explaining overall inflation in absolute terms for each quarter. We then average such shares over the full sample and two sub-periods. For sector-specific shocks, we further categorize them into three groups.

5 Conclusion

This paper highlights the important role of global macroeconomic shocks in explaining the dynamics of disaggregated price series and overall headline inflation in Thailand. Based on an open economy FAVAR model, we find that global shocks, especially global demand and oil price shocks, drive the vast majority of variations in headline inflation, accounting for around 41% of its variance. Contrary to aggregate results, sector-specific shocks instead explain the majority of price variations in individual inflation series, accounting for over 80 percent of their price variations. This is with the exception of the energy sector where global shocks are prominent, implying that overall inflation dynamics in Thailand are heavily influenced by the characteristics of this sector.

Based on the dynamic responses of disaggregated prices to structural macroeconomic shocks, our findings show that the energy component is most reactive to global shocks - whether it be an oil shock, or a global shock from the demand or supply side. This again reiterates that global shocks mainly transmit to price dynamics at the aggregate level through the energy component. Based on differentiated price responses, it also implies that global shocks are responsible for large relative price movements and price dispersion in Thai inflation, where we also show that they generate highly skewed price responses. Nevertheless, while global shocks are a prominent driver of inflation dynamics through the energy component, they generate rather low levels of inflation persistence, implying that the optimal policy response may be to look-through such shocks, in particular oil price shocks that are most short-lived among the identified global shocks. On the other hand, domestically-oriented macroeconomic shocks, especially supply shocks, generate rather strong inflation persistence, thus warranting greater policy attention. Accordingly, our results on shock-dependent persistence underscores the importance of being able to disentangle underlying shocks towards determining the appropriate monetary policy response.

A key implication from our results for monetary policy pertains to the issue of inflation control. First, the large influence of global shocks means that Thai inflation is highly exposed to developments in the global economy, which could make control of inflation harder. To the extent that inflation variations attributed to globally-oriented shocks remain of moderate persistence, this makes the resulting inflation dynamics less worrisome. Developments of Thai inflation during the post-pandemic episode are consistent with our findings as Thai inflation managed to return to target in short periods of time, thus not warranting aggressive policy tightening. However, as highlighted by the Bank for International Settlements (2022), monetary policymakers must be aware of the conditions under which relative price shocks, and in particular salient ones, may generate broad-based or second round-effects through inflation expectations, which could in turn make inflation more entrenched. In addition, as global shocks affects domestic inflation mainly through variations in energy prices, they are by nature cost-push shocks, which expose monetary policymakers to frequent policy tradeoffs between stabilizing inflation and economic activity.

Finally, while aggregate inflation dynamics are heavily influenced by common global shocks, we find that idiosyncratic shocks still can explain a non-negligible portion of headline inflation. This raises policy challenges in terms of measuring underlying inflationary pressures, particularly in the face of large relative price shocks. Therefore, as emphasized in Borio et al. (2021), it is important to go beyond aggregate inflation analysis and dig deeper into disaggregated sectors to understand the underlying source of shocks. Towards addressing the challenge of conducting monetary policy in the face of large relative price shocks and noisy idiosyncratic price changes, policy flexibility and emphasis on the medium term horizon for the inflation target will be most critical.

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Appendix

5.1 Macroeconomic Series for Factor Estimation

Foreign economic activity and inflation: For the estimation of a foreign economic activity factor, we use real GDP (%QoQsa) in local currencies and industrial production index (%QoQsa) of Thailand's major trading partners. For a foreign inflation factor, CPI (%QoQsa) and GDP deflator (%QoQsa). All data are from Oxford Economics.

Thai economic activity: we use the following macroeconomic time-series to estimate Thai activity factor:

Gross Domestic Product

(1) Gross domestic product (GDP), CVM (reference year = 2002) (millions of baht, sa)

(2) Private final consumption expenditure, CVM (reference year = 2002) (millions of baht, sa)

(3) Gross private fixed capital formation, CVM (reference year = 2002) (millions of baht, sa)

(4) Exports of goods and services, CVM (reference year = 2002) (millions of baht, sa)

(5) Imports of goods and services, CVM (reference year = 2002) (millions of baht, sa)

(6) Manufacturing production index: total index (2016=100, sa)

Consumption and Investment

(7) Private consumption index (PCI): sales of motorcycles (units, sa)

(8) PCI: sales of benzene (million liter, sa)

(9) PCI: sales of diesel (million liter, sa)

(10) PCI: household electricity consumption (million kilowatt hour, sa)

(11) PCI: import of clothes, nominal (US dollar, sa)

(12) PCI: sales of passenger and commercial cars (units, sa)

(13) Private investment index (PII): construction area permitted (1000 sq. m, sa)

(14) PII: construction material sales index (2010=100, sa)

(15) PII: domestic machinery sales at 2010 prices (million baht, sa)

(16) PII: number of newly registered motor vehicles for investment purpose (units, sa)

Exports and Imports

(17) Export volume index: total index (2012=100, sa)

(18) Import volume index: total index (2012=100, sa)

(19) Import: consumer goods (2012=100, sa)

(20) Import: raw material (2012=100, sa)

(21) Import: capital goods (2012=100, sa)

Retail and Wholesale Trade

(22) Retail sales index (RSI): total index (2002=100, sa)

(23) RSI: non-durable goods (2002=100, sa)

(24) RSI: durable goods (2002=100, sa)

(25) RSI: sale of motor vehicles and automotive fuel (2002=100, sa)

(26) RSI: department Stores, supermarkets, and general stores (2002=100, sa)

(27) Wholesales index (WSI): total index (2002=100, sa)

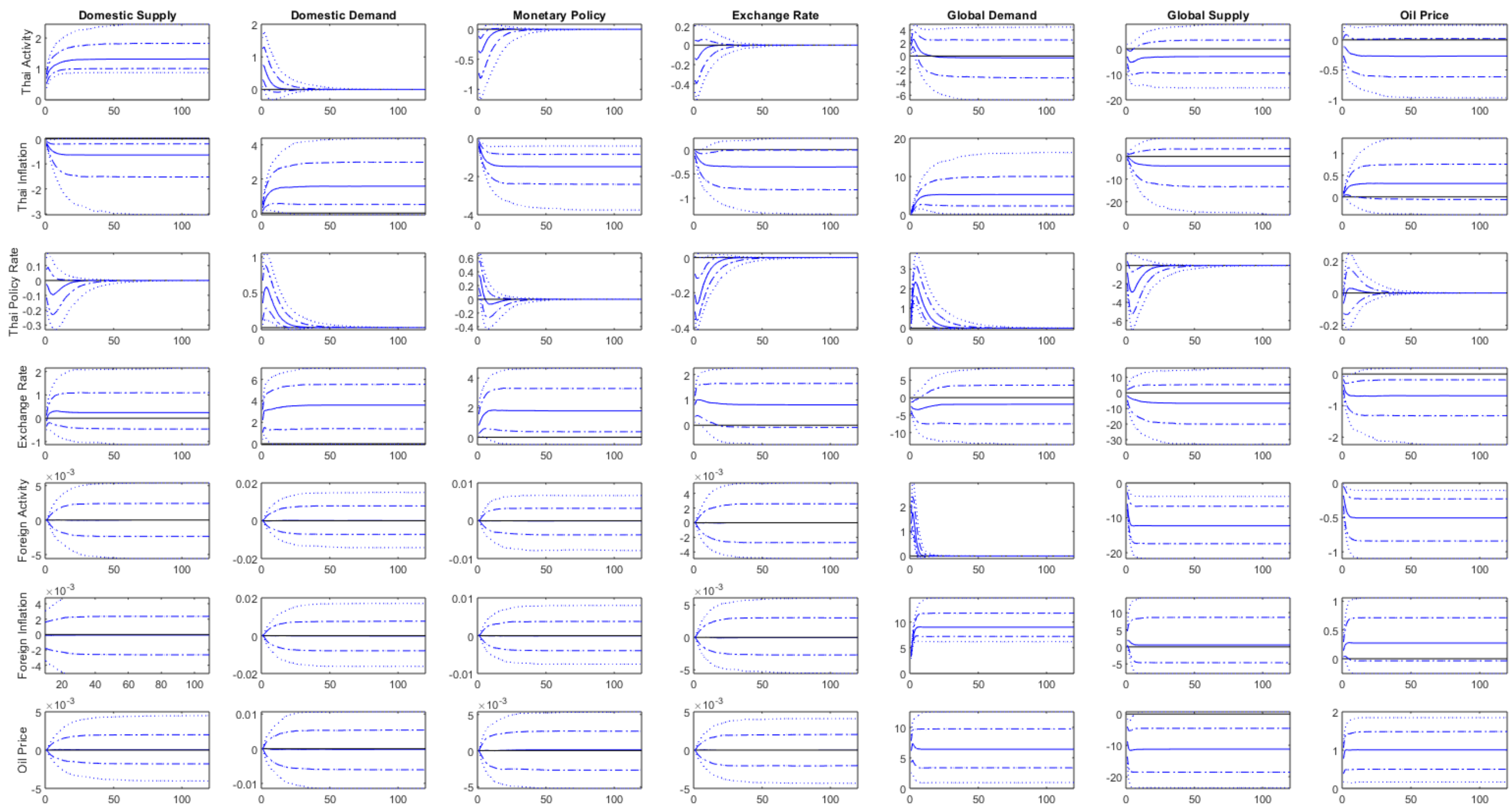
(28) WSI: non-durable goods (2002=100, sa)

(29) WSI: durable goods (2002=100, sa)

(30) WSI: intermediate goods (2002=100, sa)

We obtain real GDP and its components from the Office of the National Economic and Social Development Council (NESDC), whereas the manufacturing production index comes from the Office of Industrial Economics. The rest are from the Bank of Thailand. All series are seasonally-adjusted and transformed into quarter-on-quarter growth rate.

Figure 9: Impulse Response Functions from the SVAR Model



Note: Displayed are responses of factors in SVAR to each structural shock, which is identified using zero and sign restrictions. Responses of all factors, but the policy rate, are cumulative. From 1,000 draws that satisfy the restrictions, the blue solid lines show median responses of these factors, while dashed and dotted lines represent 68-percent and 90-percent confidence bands, respectively. We normalize the size of each shock such that the median cumulative response of the variable at the main diagonal after one year equal to one. For example, a domestic demand shock results in a median increase in a standardized Thai inflation factor by one standard deviation one year after a shock.