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## Decomposing Philippine Inflation into its supply and demand components (2001-2023)

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## **UP School of Economics**

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#### **Decomposing Philippine Inflation into its supply and demand components (2001-2023)**

by

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# Decomposing Philippine inflation into its supply and demand components (2001-2024)

JC Punongbayan \*

Final version as of September 30, 2024

## Abstract

Was the episode of high inflation in the Philippines in 2022 driven primarily by supply or demand factors? How did the relative contributions of supply and demand evolve over time? This study adopts the methodology proposed by Shapiro (2022) and Shapiro (2023) to disaggregate Philippine inflation into supply and demand components from 2001 to 2024. I find that supply factors were the more significant reason for the pandemic-era spike in inflation, consistent with recent studies. More generally, I demonstrate that this methodology is useful for inflation monitoring in an emerging market context, and also to inform monetary policy.

Keywords: inflation, supply and demand, Philippines

JEL codes: E31, E32, E52

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# 1 Introduction

After the COVID-19 pandemic, many countries saw a steep rise in inflation, with the Philippines being no exception. From 3% in January 2022, inflation rose to 8.7% by January 2023, the highest in 14 years (Figure 1). This is much higher than the 2-4% inflation target of the Philippine government, and also a lot higher than the previous spike in inflation in 2018 during the administration of former president Rodrigo Duterte.

The steady rise of headline inflation (and more importantly *core* inflation) prompted the Bangko Sentral ng Pilipinas (BSP), the Philippine central bank, to raise its policy rate steadily throughout 2022. From 2.0% on 3 January 2022, the target reverse repurchase rate went up to 5.5% by 30 December 2022 — a cumulative increase of 350 basis points.

Although policy rate hikes are a natural response to higher inflation, their appropriateness hinges on the respective role of supply and demand factors in inflation.

In the case of the Philippine inflation spike in 2022, there was some debate about the relative importance of supply and demand factors. On the supply side, many people attributed the global rise of inflation to the Russian invasion of Ukraine (which stoked prices of cereals and oil worldwide), as well as severe bottlenecks in supply chains worldwide (in the United States and other countries). These manifested in the Philippines in the form of, say, rising costs of agricultural inputs such as fertilizers. Late importation by President Ferdinand Marcos Jr.—concurrently serving as agriculture secretary at that time—also led to acute domestic shortages of agricultural commodities like sugar and onions. All of these led to the steady rise of food inflation, which accounted for nearly half of headline inflation. Meanwhile, on the demand side, some people reasonably posited that the rise of inflation was borne by “pent-up demand” from the reopening of the Philippine economy from the pandemic recession. This was manifested in the steep rise of inflation in, say, restaurant and hotel services.

The relative importance of supply and demand factors figured heavily in a debate between the Philippines’ top economic policymakers. On 6 October, Socioeconomic Planning Secretary Arsenio M. Balisacan warned against the idea of further policy rate hikes to combat inflation, saying that the BSP’s rate hikes have already been the “most aggressive” in the region and “not something to be proud of.” He added, “There’s really no urgency in creating another round of high interest rates. Higher interest rates will really put us too far away from our peers in the region.”<sup>1</sup> Days later, on 11 October, BSP Governor Eli Remolona said, “I wouldn’t say that we’re done with the tightening... I wouldn’t

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<sup>1</sup>CNN Philippines, 6 October 2023, <https://www.cnnphilippines.com/business/2023/10/6/balisacan-rejects-another-rate-hike.html>.

rule out 25 basis points [rate hike], for example.” He elaborated:

“I would say, it’s a serious concern whether supply side shocks would have a lasting impact. Normally, they don’t have a lasting impact, but once they get into expectations, once they get into wages, it becomes an issue for us. Of course, we only control the demand side. And for now we think tightening has relieved pressure from the demand side. So far we think it hasn’t really affected our growth prospects. We’re watching that very, very carefully.”<sup>2</sup> (Date: 11 October 2023.)

The BSP ended up delivering an off-cycle rate hike of 25 basis points on 26 October 2023, with the following reasoning:

“The Monetary Board recognized the need for this urgent monetary action to prevent supply-side price pressures from inducing additional second-round effects and further dislodging inflation expectations...second-round effects have broadened, including transportation fare increases and minimum wage adjustments. Inflation expectations have risen sharply, highlighting the risk of further second-round effects...”<sup>3</sup>

In short, the BSP has tended to justify policy rate hikes because of the “second-round” effects of inflation on inflation expectations. However, they also admit that they have limited impact in combatting supply-driven inflation in itself, and consistently called for “non-monetary interventions” (e.g., regarding agricultural productivity and supply chains).

Despite the centrality of supply and demand factors in understanding inflation and conducting monetary policy, the 2022 inflation episode showed that there is yet no systematic decomposition of Philippine inflation into its respective supply and demand contributors, where total inflation can be thought of as the sum of supply and demand contributors. To my knowledge, this is not being done by the government agencies most closely measuring and monitoring inflation, namely the Philippine Statistics Authority (PSA) and the BSP. In this paper, I demonstrate a simple and tractable way of monitoring Philippine inflation dynamics by decomposing inflation into its supply and demand components using output and price data. I am inspired by Shapiro (2022), who developed a “dynamic labeling” technique and first used it in the US context Shapiro (2023). I apply this technique in the context of Philippine data and uncover inflation dynamics in recent

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<sup>2</sup>GMA News Online, 11 October 2023, <https://www.gmanetwork.com/news/money/economy/884872/bsp-not-ruling-out-25-bps-rate-hike-in-november-meeting-remolona/story/>.

<sup>3</sup>BSP Monetary Policy Summary, 26 October 2023, <https://www.bsp.gov.ph/SitePages/MediaAndResearch/MediaDisp.aspx?ItemId=6891>.

decades. I provide robustness checks and suggest ways by which this methodology can be useful not just to researchers trying to understand past inflation, but also to policymakers (monetary or not) in search of tools to tame future inflation.

This paper contributes to a growing literature on the decomposition of inflation, especially in the aftermath of the pandemic, but as applied in an emerging market setting. This analysis also hopes to contribute to the toolkit of Philippine economic policymakers in, say, the BSP, who are at the forefront of inflation policymaking, as well as researchers in both the public and private sectors.

## 2 Review of literature

The decomposition of inflation into aggregate demand and aggregate supply components has been part of macroeconomic analysis since at least the late 1980s (Blanchard & Quah, 1988; Fackler & McMillin, 1998). Historical decompositions are used to analyze the impact of aggregate demand on the economy following structural shocks, which provide insights into the demand or supply-driven nature of inflation and real GDP growth over time.

The steep rise of US inflation in the aftermath of COVID-19 ushered in a new wave of interest among researchers focused on inflation decompositions (Sheremirov, 2022; Cascaldi-Garcia et al., 2023; Gordon & Clark, 2023). Most relevant to this paper, Shapiro (2022) and Shapiro (2023) proposed a novel decomposition of inflation in the US based on its supply and demand components. He used sign restrictions based on elementary supply and demand. Interestingly, Chang, Jansen, and Pagliacci (2023) also used sign restrictions in their own decomposition, but used parsimonious data (aggregate GDP and inflation). Apart from the US, there's also a similar burgeoning literature in the European Union (EU) (Eickmeier & Hofmann, 2022; Ascari et al., 2023). Gonçalves and Koester (2022) applied the Shapiro approach to understand inflation in the EU. Other papers that applied the method include Akarsu and Aktuğ (2024) in the case of Turkey.

Apart from the Shapiro method, inflation decomposition has caught the attention of other economists using other methods. Blanchard and Bernanke (2023), using a relatively simple framework, found that pandemic-era inflation was not so much due to tight labor market conditions, but rather to supply-side conditions (supply chain constraints and shocks to food and energy prices). Their method has since been applied in many settings, as summarized by Blanchard and Bernanke (2024). While other papers have likewise uncovered the greater role of supply factors (Giovanni et al., 2023), other papers argue a greater role for demand. Giannone and Primiceri (2024) noted that demand factors may be more important than supply, adding that the Shapiro method may underestimate

demand’s contribution by focusing on sectoral rather than aggregate demand. Understanding the true drivers of pandemic-era inflation continues to be a lively topic of debate among macroeconomists.

In the Philippines, a handful of papers have attempted to decompose inflation into its supply and demand components. Guo, Karam, and Vlcek (2019) used an exclusion approach and a model approach. In the exclusion approach, they broke down the CPI basket into its key components and measured inflation of core goods versus core services. They found a steep increase in core services in 2018, suggesting a strong role of demand-pull inflation. Their results have since been used in other macroeconomic models in the Philippines, including the BSP’s Policy Analysis Model for the Philippines (PAMPh) (Alarcon et al., 2020) and the Quarterly Projection Model (Karam et al., 2021; Abenoja et al., 2022; Debuque-Gonzales & Corpus, 2022). In the BSP’s Multi-Equation Model, short-run inflation dynamics are a function of oil and food prices, minimum wages, expected inflation, output gap, and T-bond and T-bill rates (Abenoja et al., 2022). Apart from this, various supply and demand factors—such as developments in markets for agricultural commodities and oil, domestic economic activity, external demand, and liquidity conditions—are surveilled regularly by the BSP’s Department of Economic Research in preparing analysis in support of the Monetary Board’s decision-making.

To date, there are few attempts to decompose inflation in the Philippines à la (Shapiro, 2023).<sup>4</sup> In its 2023 Annual Consultation Report on the Philippines, the ASEAN Macroeconomic Research Office (AMRO) decomposed inflation in this way, but used the output gap instead of actual quantities of goods and services (AMRO, 2023). In this paper I use the household final consumption expenditure (HFCE) data from the PSA’s National Accounts.

### 3 Model

Based on Shapiro (2022), year-on-year inflation can be understood as the sum of supply-driven inflation and demand-driven inflation. Specifically, if  $\pi_{t,t-4}$  is quarterly inflation (year-on-year), then it can be broken down as follows:

$$\pi_{t,t-4} = \sum_i \mathbb{I}_{i \in \text{supply}, t} \omega_{i,t} \pi_{i,t,t-4} + \sum_i \mathbb{I}_{i \in \text{demand}, t} \omega_{i,t} \pi_{i,t,t-4} \quad (1)$$

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<sup>4</sup>Reportedly, the BSP itself is exploring using the Shapiro (2023) methodology. Initial findings were supposed to be presented in the 2023 Philippine Economic Society Annual Meeting and Conference, but the presentation did not push through.

where  $\omega_{i,t}$  is the share of spending weight of component  $i$  in the CPI basket, and  $\pi_{i,t,t-4}$  is the year-on-year inflation of component  $i$ .<sup>5</sup> The first term on the right-hand side of Equation 1 is the supply-driven component of inflation, while the second term is the demand-driven component. They sum to the overall year-on-year inflation rate,  $\pi_{t,t-4}$ .

Crucially, each component of the CPI can be tagged as a supply- or demand-driven contributor to inflation, and this tag may change over time. For instance, inflation in a specific sector (e.g., food) may be demand-driven in period  $t$  but supply-driven in  $t + 1$ . Shapiro (2022) uses conventional supply and demand to guide this process of “dynamic labeling.” That is, whether or not a sector is a supply or demand contributor to overall inflation depends on the signs of error terms in a structural VAR model of supply and demand.

How does this dynamic labeling work? For a component  $i$  of the basket of goods, let there be typical supply and demand curves as follows:

$$q_i = \sigma^i p_i + \alpha^i \quad (2)$$

$$p_i = -\delta^i q_i + \beta^i \quad (3)$$

where  $q_i$  is quantity or consumption,  $p_i$  is the price level,  $\sigma^i$  is the supply curve’s slope,  $\delta^i$  is the demand curve’s slope, and  $\alpha^i, \beta^i$  are intercepts. A supply shock from  $t - 1$  to  $t$  constitutes a change in the intercept of Equation 2, while a demand shock constitutes a change in the intercept of Equation 3:

$$\begin{aligned} \epsilon_i^s &= \Delta \alpha^i = (q_{i,t} - \sigma^i p_{i,t}) - (q_{i,t-1} - \sigma^i p_{i,t-1}) \\ \epsilon_i^d &= \Delta \beta^i = (p_{i,t} + \delta^i q_{i,t}) - (p_{i,t-1} + \delta^i q_{i,t-1}). \end{aligned}$$

The above system can be converted to a typical structural VAR model:

$$A^i z_{i,t} = \sum_{j=1}^N A_j^i z_{i,t-j} + \epsilon_{i,t} \quad (4)$$

where  $A^i = \begin{pmatrix} 1 & -\sigma^i \\ \delta^i & 1 \end{pmatrix}$ ,  $z_i = \begin{pmatrix} q_i \\ p_i \end{pmatrix}$ , and  $\epsilon_i = \begin{pmatrix} \epsilon_i^s \\ \epsilon_i^d \end{pmatrix}$  are the structural supply and demand shocks, and  $j$  is the number of lags. The reduced form equation, obtained by pre-

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<sup>5</sup>Throughout I assume quarterly data.



multiplying the above equation by  $[A^i]^{-1}$ , is as follows:

$$z_{i,t} = [A^i]^{-1} \sum_{j=1}^N A_j^i z_{i,t-j} + v_{i,t} \quad (5)$$

where the reduced form residuals are  $v_{i,t} = \begin{pmatrix} v_{i,t}^q \\ v_{i,t}^p \end{pmatrix} = [A^i]^{-1} \epsilon_{i,t}$ . It follows that the structural shocks can be captured by  $\epsilon_{i,t} = A^i v_{i,t}$ , so that:

$$\epsilon_{i,t}^s = v_{i,t}^q - \sigma^i v_{i,t}^p \quad (6)$$

$$\epsilon_{i,t}^d = \delta^i v_{i,t}^q + v_{i,t}^p. \quad (7)$$

Insofar as restrictions are imposed on the signs of the slopes of the supply and demand equations—as embodied in  $A^i$ , and based on basic economic theory—this leads to restrictions as well on  $v_{i,t}$  and  $\epsilon_{i,t}$ . Hence, we have the following:

$$v_{i,t}^p > 0, v_{i,t}^q > 0 \rightarrow \epsilon_{i,t}^d > 0$$

$$v_{i,t}^p < 0, v_{i,t}^q < 0 \rightarrow \epsilon_{i,t}^d < 0$$

$$v_{i,t}^p < 0, v_{i,t}^q > 0 \rightarrow \epsilon_{i,t}^s > 0$$

$$v_{i,t}^p > 0, v_{i,t}^q < 0 \rightarrow \epsilon_{i,t}^s < 0.$$

So, using time-series data, if at time  $t$  the reduced form residuals from the price and quantity regressions are of the same sign, a demand shock must have happened. This makes intuitive sense: in microeconomics, a sudden increase in the demand curve, *ceteris paribus*, results in a higher equilibrium quantity and a higher equilibrium price, while a sudden decrease in the demand curve results in lower equilibrium quantity but a lower equilibrium price. Meanwhile, if at time  $t$  the reduced form residuals for price and quantity have opposing signs, there must be a supply shock. A sudden increase in the supply curve results in a higher equilibrium quantity and a lower equilibrium price, while a sudden decrease in the supply curve results in lower equilibrium quantity but a higher equilibrium price. Note that if one knows the implied demand or supply shock, respectively, one cannot say anything about the implied supply or demand shock (Calvert Jump & Kohler, 2022). Instead, if one detects that the residuals are of the same sign, one can only say that they experienced a *net* demand shock; if they have the opposite sign, they experienced a net supply shock.

## 4 Data and estimation

I use quarterly data from the Philippine Statistics Authority (PSA) for quantities and prices. For consumption data, I use quarterly, non-seasonally-adjusted data on household final consumption expenditure (HFCE) from the PSA's National Accounts from 2000 to 2023. I specifically look at its 12 components: food and non-alcoholic beverages; alcoholic beverages and tobacco; clothing and footwear; housing, water; electricity, gas, and other fuels; furnishings, household equipment, and other routine household maintenance; health; transport; communication; recreation and culture; education; restaurant and hotels; miscellaneous goods and services. The total number of categories, 12, is significantly smaller than in other studies; e.g., Shapiro (2023) used 136 categories. This is a limitation of the data collection of the PSA. Another limitation is that consumption data is collected in the Philippines only quarterly; in other countries this is done monthly.

As for the corresponding prices, I use the implicit price index data for HFCE as found in the National Accounts (base year 2018). The reason is as follows. First, although there are expected differences in overall inflation as computed using the CPI as well as the HFCE implicit price index, there is a very close correlation between the two (Figure 2);  $\rho = .9075$  from 2000 onward,  $\rho = .9415$  from 2010 onward. Second and more important, because quantity data is only available using the National Accounts, using the implicit price index allows us to perfectly match price data with the available quantity data. Third, using spending data from the National Accounts allows me to compute for the evolving share of spending categories to total HFCE spending (Figure 4); if I use the CPI, I am forced to fix the shares based on the current base year (2018).

Fourth, there are discrepancies in the way the CPI was computed for specific items in the basket over time. Specifically, it was only in 2018 that CPI data for two categories (financial services and personal care, and miscellaneous goods) were computed. In order to match the miscellaneous goods and services consumption category in the HFCE, one can get the average of financial services and personal care and miscellaneous goods and services. However, this presents another problem: there are discrete jumps in the CPI indices for financial services, which will also yield discrete jumps in the averaged CPI data (see Figure 3). For this reason, I stick with the implicit price index data as seen in the National Accounts.

I estimate Equation 4 by running VAR price and quantity regressions for each compo-

ment  $i$  of the CPI as follows:

$$q_{i,t} = \sum_{j=1}^4 \gamma_j^{qp} p_{i,t-j} + \sum_{j=1}^4 \gamma_j^{qq} q_{i,t-j} + c + v_{i,t}^q \quad (8)$$

$$p_{i,t} = \sum_{j=1}^4 \gamma_j^{pp} p_{i,t-j} + \sum_{j=1}^4 \gamma_j^{pq} q_{i,t-j} + c + v_{i,t}^p \quad (9)$$

where  $q_{i,t}$  is the log of consumption or quantity, while  $p_{i,t}$  is the log of the price index, and  $c$  is a constant accounting for factors other than supply and demand shocks in the short run. The above system is equivalent to a two-equation VAR with 4 lags (I will use other lags as well). I obtain the quantity and price residuals for period  $t$ ,  $v_{i,t}^q$  and  $v_{i,t}^p$ , and label them as demand or supply shocks as follows:

$$\mathbb{I}_{i \in \text{supply}, t} = \begin{cases} 1 & \text{if } v_{i,t}^p < 0, v_{i,t}^q > 0 \text{ or } v_{i,t}^p > 0, v_{i,t}^q < 0 \\ 0 & \text{otherwise} \end{cases}$$

$$\mathbb{I}_{i \in \text{demand}, t} = \begin{cases} 1 & \text{if } v_{i,t}^p > 0, v_{i,t}^q > 0 \text{ or } v_{i,t}^p < 0, v_{i,t}^q < 0 \\ 0 & \text{otherwise} \end{cases}.$$

I then tag the various inflation components as positive or negative contributors to supply or demand inflation, as follows:

$$\mathbb{I}_{i \in \text{supply}(+), t} = \begin{cases} 1 & \text{if } v_{i,t}^p < 0, v_{i,t}^q > 0 \\ 0 & \text{otherwise} \end{cases}$$

$$\mathbb{I}_{i \in \text{supply}(-), t} = \begin{cases} 1 & \text{if } v_{i,t}^p > 0, v_{i,t}^q < 0 \\ 0 & \text{otherwise} \end{cases}$$

$$\mathbb{I}_{i \in \text{demand}(+), t} = \begin{cases} 1 & \text{if } v_{i,t}^p > 0, v_{i,t}^q > 0 \\ 0 & \text{otherwise} \end{cases}$$

$$\mathbb{I}_{i \in \text{demand}(-), t} = \begin{cases} 1 & \text{if } v_{i,t}^p < 0, v_{i,t}^q < 0 \\ 0 & \text{otherwise.} \end{cases}$$

Using this tagging, the share of total spending experiencing a shock  $s$  in time  $t$  is given by:

$$\gamma_{s,t} = \sum_i \mathbb{I}_{i \in s, t} \omega_i \quad (10)$$

where  $s = demand(+), demand(-), supply(+), supply(-)$  and  $\omega_{i,t}$  is the weight of component  $i$  in the consumption basket at time  $t$ . Because consumption and price data are unavailable before 2000, I am constrained to decompose year-on-year inflation only starting in 2001. I do the decomposition until end-2003.

## 5 Results

Figure 5 shows the percentage-point contributions of supply and demand components to Philippine inflation. From here I can analyze specific events in recent economic history. For instance, the spike of inflation in 2008 (peaking at 9.8% in the second quarter) was generally attributed to a rise in global oil prices and the rice price crisis. As evidenced in the data, there was a steep rise in inflation's supply-driven component. Fast-forward to 2018, when inflation rose to a 9-year high, it was similarly blamed on supply-side factors as well, such as the rise of oil prices and rising rice prices (due primarily to a shortage of National Food Authority or NFA rice). Some amount of inflation was also blamed on the 2017 TRAIN Law, which introduced excise tax hikes on petroleum products and sugar-sweetened beverages, among others. Indeed, from Figure 5, it is evident that there was a spike in the contribution of supply components. Then in 2022, there was a similar spike in supply factors. But note that unlike previous episodes, it was not accompanied by a spike in demand-driven inflation. In fact, the gap between supply-side and demand-side inflation is at its highest since the start of the sample period.

Figure 6 shows the relative contributions of positive and negative supply and demand contributors. It allows us to understand more closely the trends in Figure 5. Note that the supply-driven inflation spike in the second quarter of 2008 was largely driven by a *negative* supply shock — thus corroborating the contribution of the oil and rice price increases. However, the subsequent decline of inflation was driven by a huge contribution of a negative *demand shock*. This presumably includes the effects of the global recession around that time. (Note that real GDP growth in the Philippines dropped from 6.5% in the fourth quarter of 2007 to only 0.9% in the third quarter of 2009.) Meanwhile, the inflation episode in third quarter of 2018 was also due to a large spike in the contribution of a negative supply shock; nearly 70% of inflation then was due to a negative supply shock. Interestingly, in quarter before that, about 91% of inflation was due to a positive demand shock — the highest contribution of a positive demand shock in the sample period. This was due to a rare simultaneous positive demand shock in all spending categories (except health, information and communication, and recreation). At this point I offer no reason for this. But such information is otherwise hidden if one merely looks at the increase in

inflation in 2018. This puts added value to the methodology as a way to unravel various forces that could explain inflation trends.

When the pandemic lockdowns struck in the first two quarters of 2020, there was no appreciable increase in the component of inflation corresponding to a negative demand shock. But this may be owing to the fact that consumption spending on food, the biggest component of the basket of goods, did not go down tremendously. Indeed, negative supply shocks figured more prominently in succeeding quarters, although erratically. Later, in 2022 up until early 2023, the contribution of negative supply shocks increased significantly. The analysis shows that much of recent inflation was largely driven by supply factors, not demand. This is not to say that pent-up demand and “revenge spending” was not a possible driver of inflation. There was a slight increase in the share of positive demand shocks in 2021 and late 2022, just as all COVID-19 restrictions and regulations (even masking requirements) were lifted. But in fact, the contribution of positive demand shocks has since gone down. Supply factors seem to have mattered more.

The findings contrast with AMRO (2023), which finds that about 60% of headline inflation in 2022 was supply-driven, while 22% was demand-driven. However, this reversed in 2023: 33% of inflation then was supply-driven, while 43% was demand-driven. Meanwhile, this paper’s findings agree with the findings of papers elsewhere, finding that much of the 2022 global inflation spike was supply-driven (Blanchard & Bernanke, 2024).

## 6 Robustness checks

Here I conduct various robustness checks of the analysis. First, as in Shapiro (2022), I consider possible measurement errors in the supply and demand categorization by looking at the *smoothed* residuals, instead of using the present or concurrent residual only. Specifically, I look at the rolling sum of past and present residuals and change the indicator functions as follows:

$$\mathbb{I}_{supply,t} = \begin{cases} 1 & \text{if } \sum_{j=0}^J v_{i,t-j}^p < 0, \sum_{j=0}^J v_{i,t-j}^q > 0 \text{ or } \sum_{j=0}^J v_{i,t-j}^p > 0, \sum_{j=0}^J v_{i,t-j}^q < 0 \\ 0 & \text{otherwise} \end{cases}$$

$$\mathbb{I}_{demand,t} = \begin{cases} 1 & \text{if } \sum_{j=0}^J v_{i,t-j}^p < 0, \sum_{j=0}^J v_{i,t-j}^q < 0 \text{ or } \sum_{j=0}^J v_{i,t-j}^p > 0, \sum_{j=0}^J v_{i,t-j}^q > 0 \\ 0 & \text{otherwise.} \end{cases}$$

I check for  $J = 1, 2, 3$ ; i.e., with just one, two, or three lagged residuals. Figures 7a and 7b show the trends.

Second, some residuals may be too small and I tag them not as “supply” or “demand” but as “ambiguous.” Specifically, I tag as ambiguous those observations that are within 0.05 standard deviations from zero. Figure 8 shows the trends. Note that even with the ambiguous category, the major trends for the demand and supply components hold.

Third, to allow for possible misspecification in the model, I tweak the number of lags in Equations 8 and 9. I assumed 4 lags in the original regressions. I test for lags  $J = 2, 6, 8$  (corresponding to 2 quarters, 1.5 years, or 2 years, respectively). Figures 9a and 9b show the inflation contributions using these alternative lags.

Finally, to fix possible misspecification, I allow the coefficients in Equations 8 and 9 ( $\gamma^{qp}, \gamma^{qq}, \gamma^{pp}, \gamma^{pq}$ ) to change. I run 40-period (40-quarter) rolling price and quantity regressions with the first window being 2000q1 to 2009q4, and the last window is 2018q3 to 2022q4. Figures 10a and 10b show the results.

Table 1 summarizes the cross-correlations for the various estimates of supply and demand contributions to inflation. All correlations are statistically significant at the 1% level, but the correlations are generally stronger for the supply contribution estimates. As well, the correlations are not as high as those found in Shapiro (2023). But this may be a function of the lack of more granular data in the Philippine case (i.e., the use of quarterly rather than monthly data). If so, this argues for collection of more frequent output (consumption) data, which is currently done only quarterly due to resource constraints.

## 7 Application

I explore the usefulness of the decomposition exercise by looking at how well they respond to supply and demand shocks (Shapiro, 2023; Akarsu & Aktuğ, 2024). For example: in response to oil price shocks, do the supply contributions increase as one would expect? Meanwhile, in response to monetary policy rate shocks, do the demand contributions decrease?

For this exercise, I use the local projection method (Jorda, 2005):

$$\pi_{i,t+h}^i = \beta_i^h OS_t + \gamma_i^h \sum_{k=1}^2 Z_t + \epsilon_t \quad (11)$$

$$\pi_{i,t+h}^i = \beta_i^h MPS_t + \gamma_i^h \sum_{k=1}^2 Z_t + \epsilon_t \quad (12)$$

where  $i \in \{demand, supply\}$ ,  $\pi_{t+h}^i$  is the cumulative growth in a component of inflation between  $t$  and  $t+h$ ,  $OS_{t-j}$  is the oil price shock at time  $t-j$ ,  $MPS_{t-j}$  is the monetary

policy (policy rate) shock, and  $Z_t$  is a vector of controls. For the oil price shocks, I use the data from Känzig (2021) based on OPEC announcements. For the monetary policy rate shocks, I use data from Bauer and Swanson (2023).<sup>6</sup> The vector  $Z_t$  includes controls, namely percent changes in the nominal exchange rate (to account for pass-through), the natural log of the global VIX index, and the lags of the dependent variables and shocks (I use two). I also look at the typical VAR model for comparison.

Figures 11 and 12 show the impulse response functions of the supply and demand contributors to inflation, in response to oil price and policy rate shocks, respectively. Figure 11 shows that, as one would expect, an increase in world oil prices results in a significant increase in the supply contribution to inflation manifesting about two and three quarters after the shock. However, this dissipates about one year after the shock. Meanwhile, the same oil price shock results in a much weaker effect on the demand contribution to inflation; in the VAR estimation there is no effect.

Figure 12, meanwhile, shows that a monetary policy shock in the US does not have any appreciable impact on the demand contribution to inflation. However, it does have a positive effect on the supply contribution in the first or second quarters after the shock. One likely reason is that a higher policy rate in the US usually results in a sudden depreciation of the peso vis-à-vis the US dollar, and this tends to increase the cost of imports and contribute to domestic inflation. It turns out, therefore, that in the Philippines, at least for the sample period, supply contributors to inflation tend to be more responsive to shocks, while demand contributors do not respond as much. It would be interesting, however, to look at the impacts of monetary policy shocks coming from the BSP itself (e.g., if this has a greater impact on demand-side inflation contributors). However, this requires a more careful study of how such a local series ought to be constructed. I leave this for future study.

## 8 Conclusion

Inspired by the method used by Shapiro (2022) and Shapiro (2023), which treated inflation as a decomposable macroeconomic variable, I estimated the supply-side and demand-side contributors to Philippine inflation. I find that much of the inflation episode in 2022 can be attributed to supply rather than demand factors. The results also explain well past inflation episodes, notably 2008 and 2018. The resulting series is robust when subjected to

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<sup>6</sup>I note that in the Philippines we do not have yet a good time series on monetary shocks coming from the Bangko Sentral ng Pilipinas. The use of data on US Federal Reserve shocks is justified, however, because as exemplified by the latest inflation episode the BSP's policy rate often mirrors movements by the Fed's policy rate. This is an area for future study (Gürkaynak et al., 2005; Baumeister & Hamilton, 2019).

various specifications of the VAR model. However, the correlations may be improved if there are granular and more frequent price and especially quantity data collected by the government. Finally, the estimates are useful in the sense that they respond to (oil price and monetary) shocks as what one would predict using macroeconomic theory.

This relatively simple method may help policymakers decompose the supply and demand contributors of inflation on a fairly regular basis. More importantly, it may help tailor-fit policies depending on which factor is predominant (e.g., greater reliance on supply interventions if supply-driven contributors to inflation become more significant). Extensions may include applying the methodology to other types of inflation data (e.g., core inflation) to the extent data will allow, as well as more frequent consumption and price data (however, this requires changes in the current data collection used by the PSA). Further inquiry into the nature of second-round inflation effects is also useful given how frequently it is cited in the BSP's monetary policy decisions. Finally, further use of impulse response functions offers policymakers a more nuanced and more complete understanding of inflation dynamics in the Philippines.



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Table 1: Pairwise correlation coefficients

## (a) Supply

	Original	Precision	Smoothed-1	Smoothed-2	Smoothed-3	VAR-2	VAR-6	VAR-8	Rolling
Original	1.0000								
Precision	0.9709*	1.0000							
Smoothed-1	0.8528*	0.8589*	1.0000						
Smoothed-2	0.6940*	0.6991*	0.7076*	1.0000					
Smoothed-3	0.7062*	0.7252*	0.6866*	0.7160*	1.0000				
VAR-2	0.9209*	0.9339*	0.8233*	0.6549*	0.6534*	1.0000			
VAR-6	0.9475*	0.9454*	0.8389*	0.7412*	0.7440*	0.8594*	1.0000		
VAR-8	0.9318*	0.9154*	0.8384*	0.7568*	0.7554*	0.8419*	0.9601*	1.0000	
Rolling	0.8479*	0.7996*	0.7846*	0.5968*	0.5691*	0.7429*	0.8342*	0.8141*	1.0000

## (b) Demand

	Original	Precision	Smoothed-1	Smoothed-2	Smoothed-3	VAR-2	VAR-6	VAR-8	Rolling
Original	1.0000								
Precision	0.9179*	1.0000							
Smoothed-1	0.6187*	0.5885*	1.0000						
Smoothed-2	0.4283*	0.4375*	0.5494*	1.0000					
Smoothed-3	0.4709*	0.4736*	0.5359*	0.7349*	1.0000				
VAR-2	0.8014*	0.7838*	0.6403*	0.5233*	0.5360*	1.0000			
VAR-6	0.8660*	0.8766*	0.6387*	0.5729*	0.5929*	0.7039*	1.0000		
VAR-8	0.8005*	0.8276*	0.6230*	0.6208*	0.6367*	0.6647*	0.9068*	1.0000	
Rolling	0.6830*	0.6813*	0.6292*	0.5344*	0.5138*	0.5945*	0.6987*	0.6774*	1.0000

Notes: This table shows the pairwise correlation of estimated percentage-point supply and demand contributions to inflation. \* $p < 0.01$ . Correlations start at 2010q1 (where all series are complete).

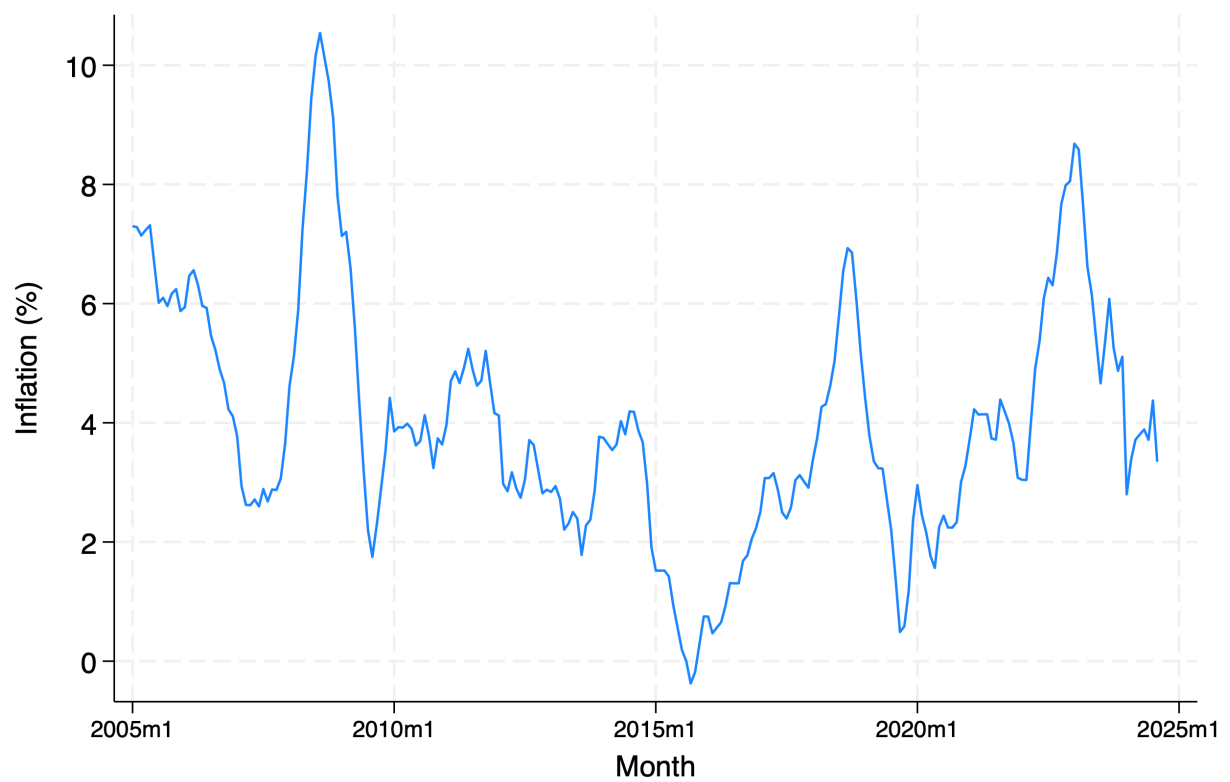


Figure 1: Headline CPI inflation in the Philippines, January 2005 to July 2024. Source: PSA.

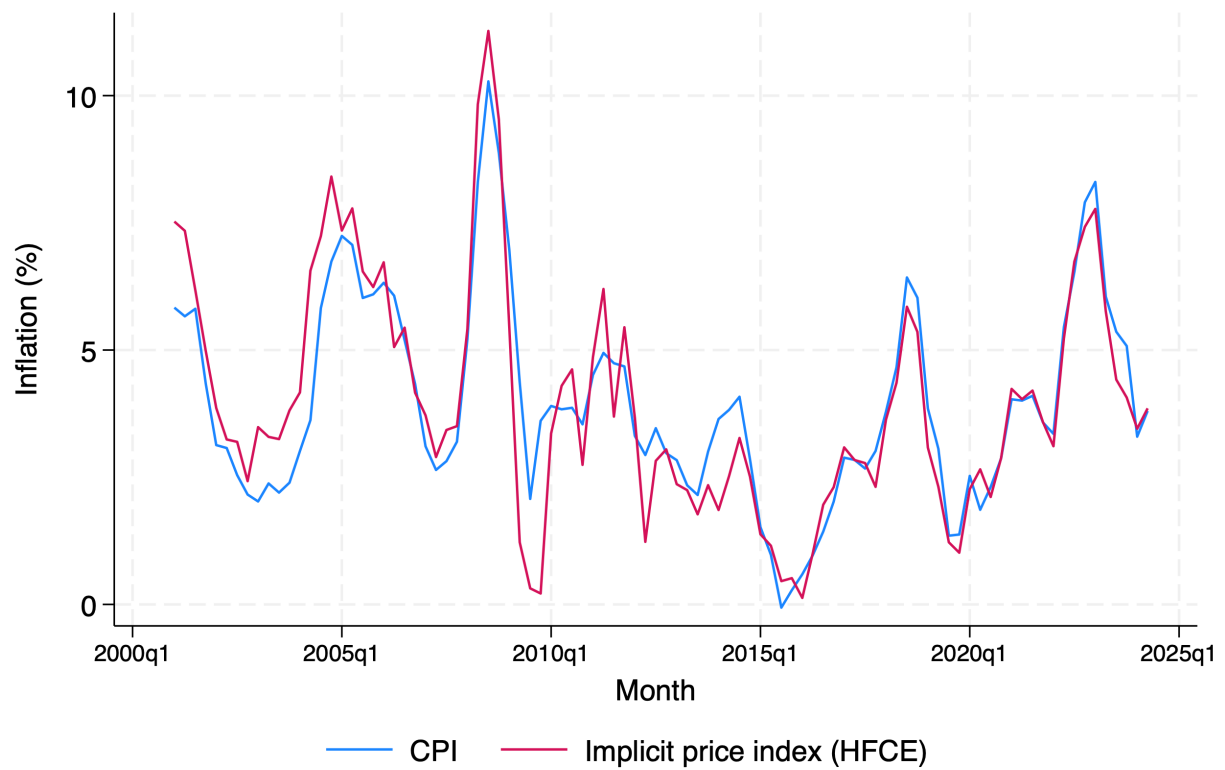


Figure 2: Quarterly inflation in the Philippines, CPI versus implicit price index for HFCE, 2000q1 to 2024q2 (base year 2018). Source: author's calculations.

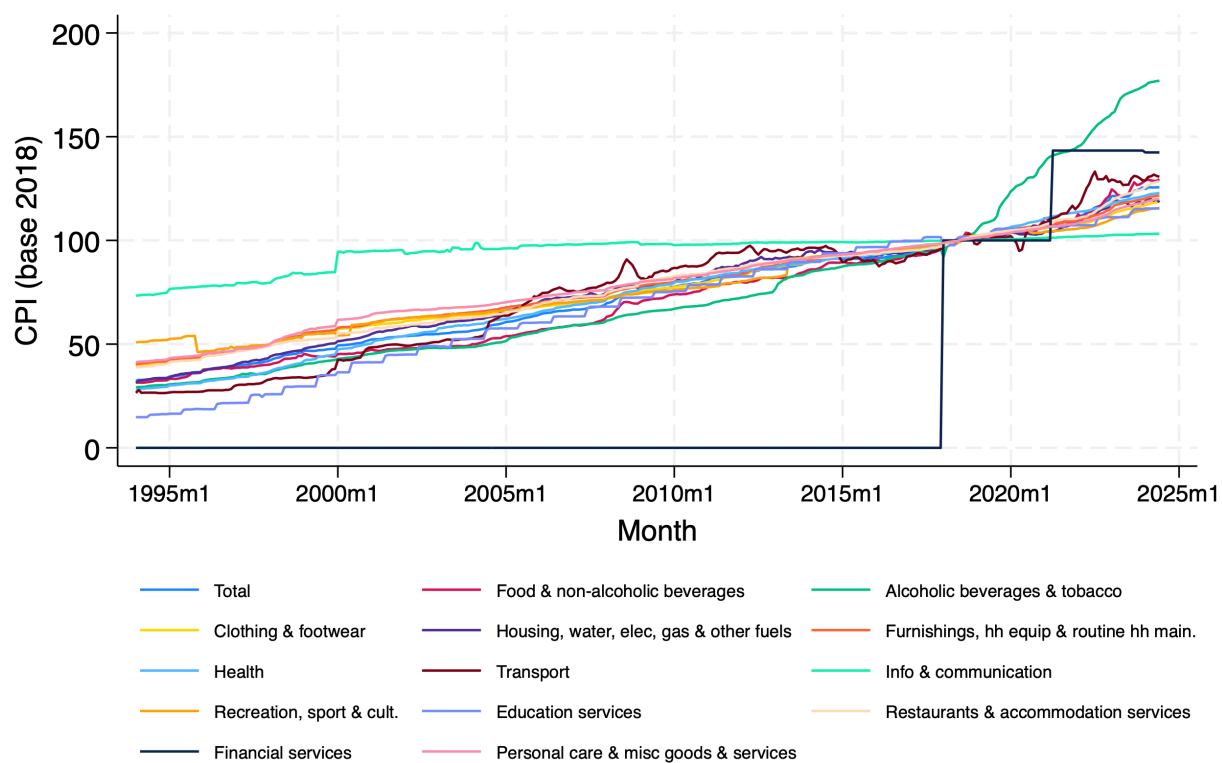


Figure 3: CPI in the Philippines, overall and components of the basket of goods, January 1994 to June 2004 (base year 2018). Source: PSA.

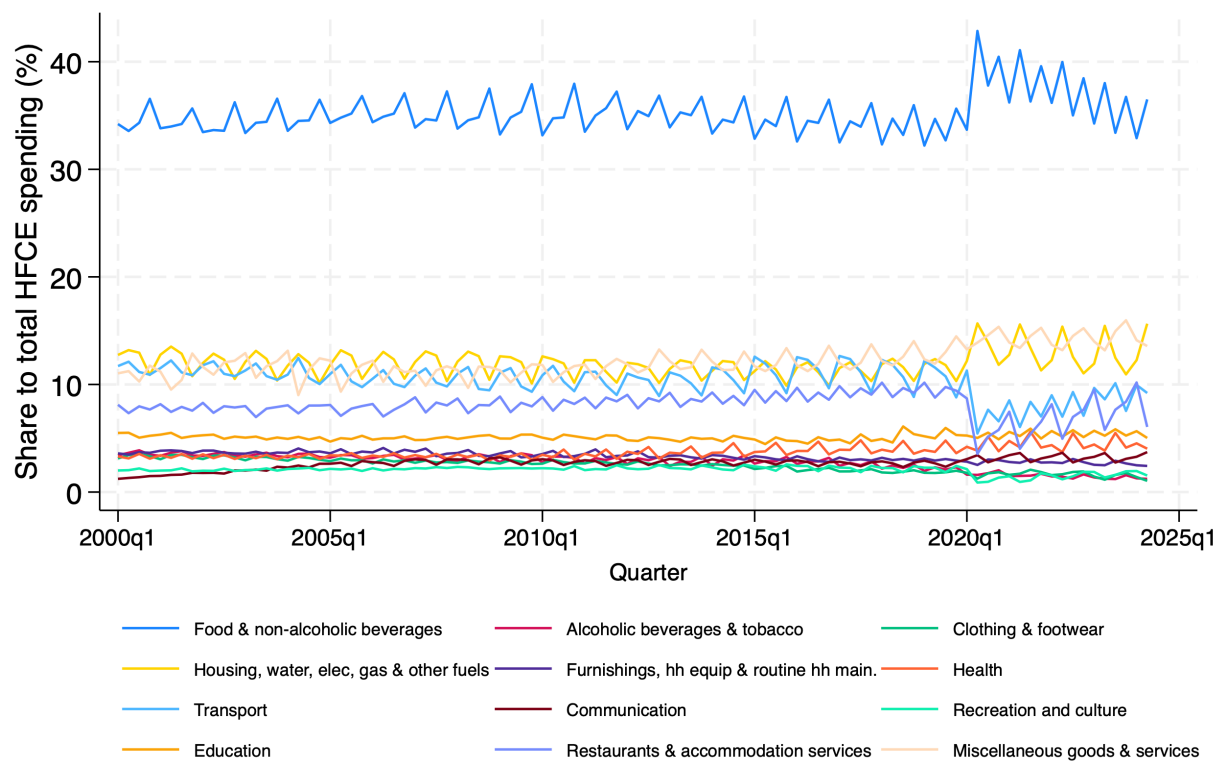


Figure 4: Percent share of spending categories to total HFCE spending, 2000q1 to 2024q2.  
Source: author's calculations.



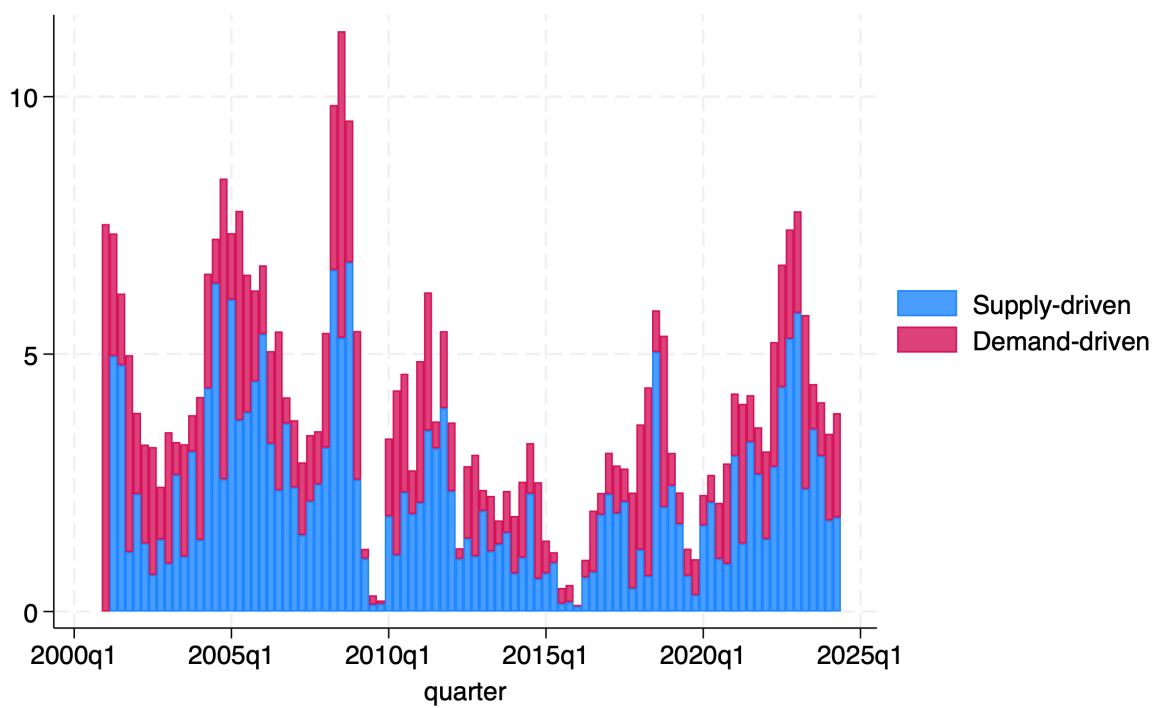


Figure 5: Breakdown of inflation into supply and demand, 2001q1 to 2024q2. Source: author's calculations.

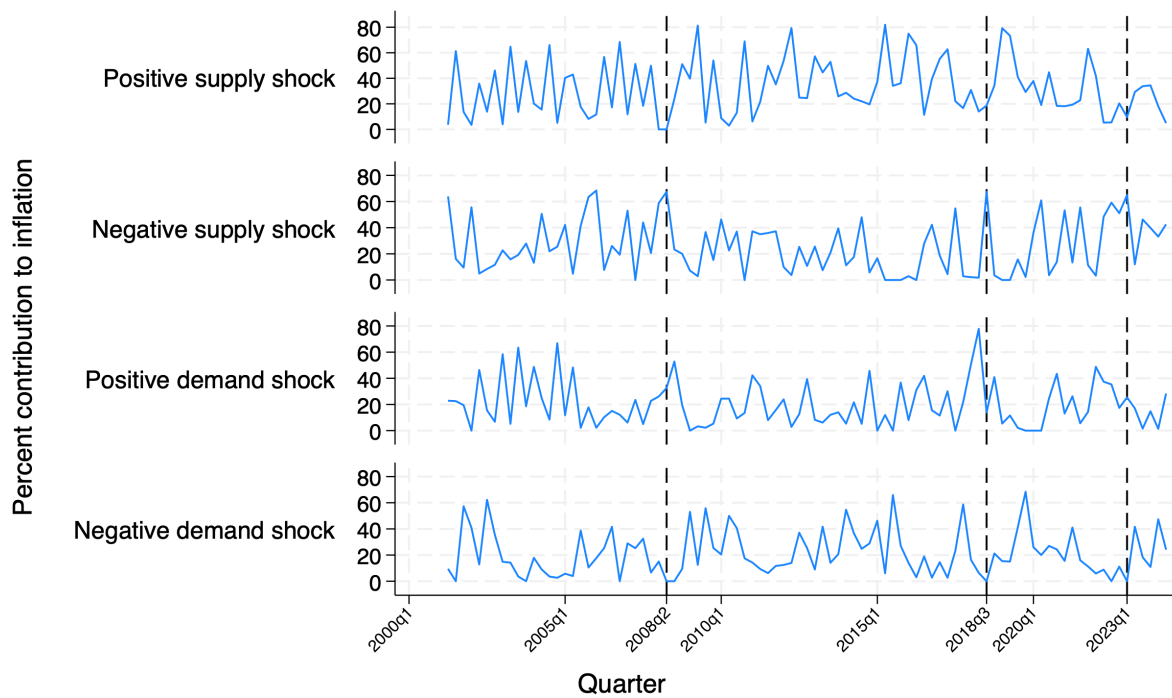
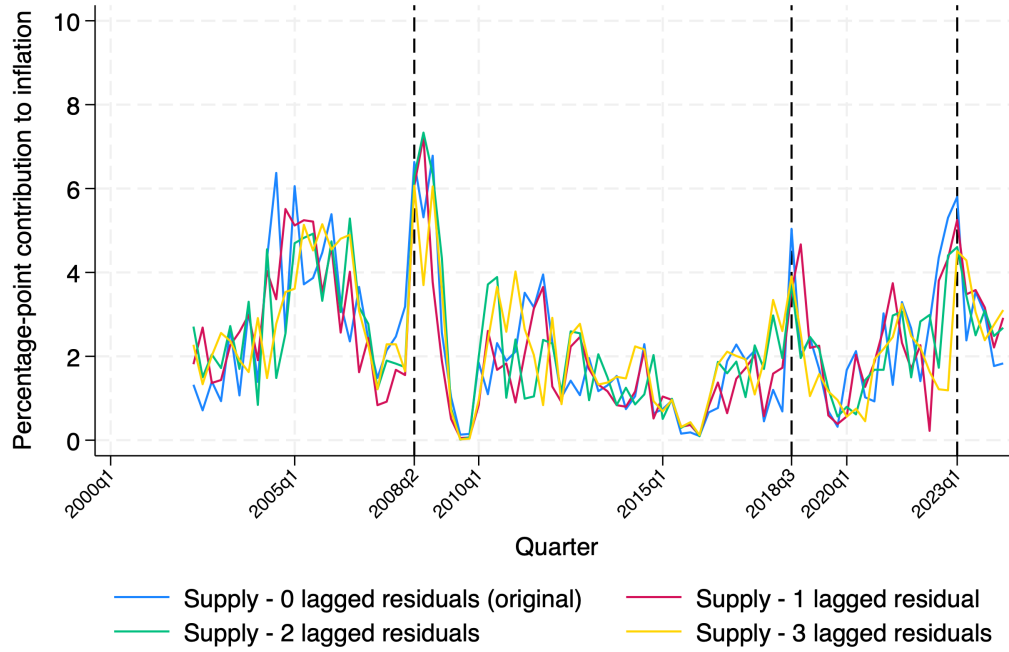
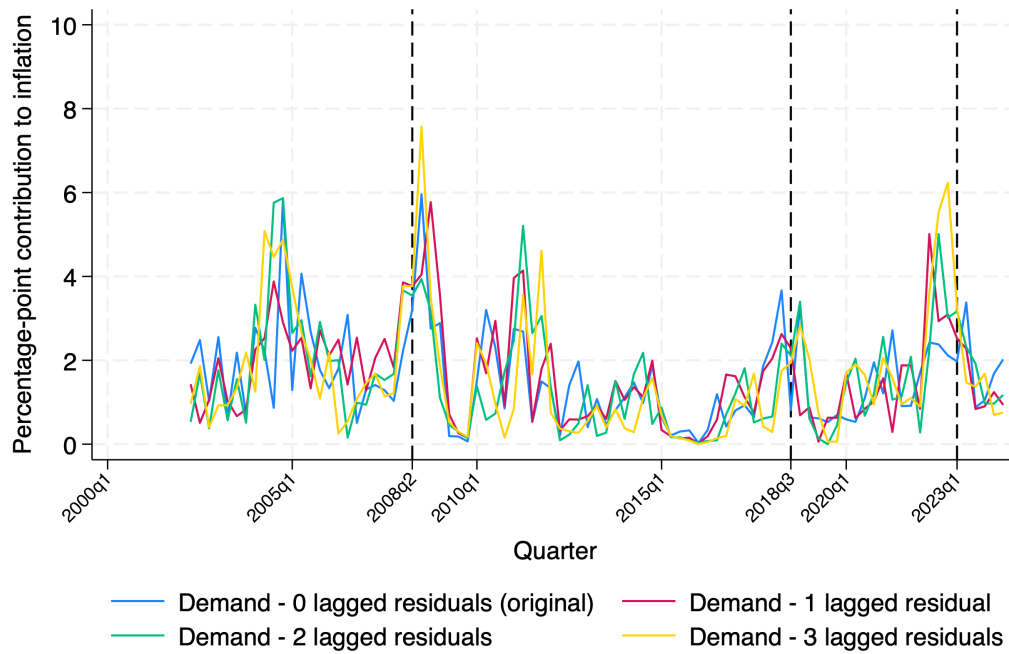


Figure 6: Percent contribution of supply and demand shocks to inflation in the Philippines (using implicit price index), 2002q2 to 2023q4. Source: author's calculations.



(a)



(b)

Figure 7: Supply and demand contributions to inflation in percentage points, using various lagged residuals. Source: author's calculations.

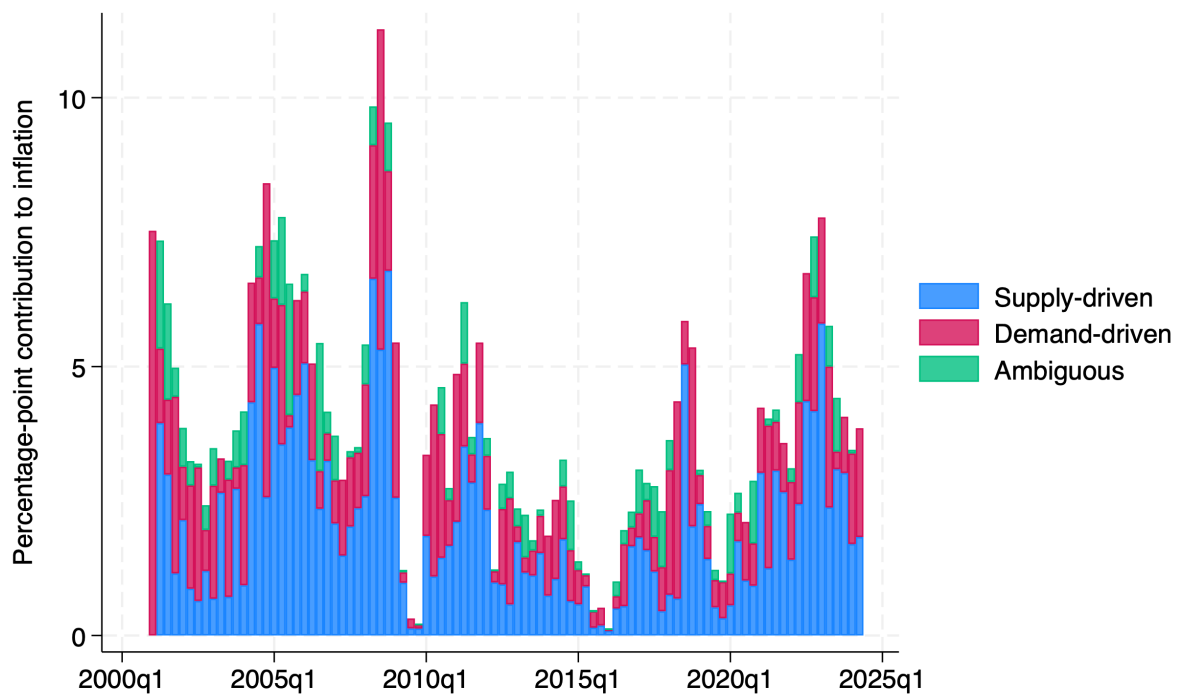
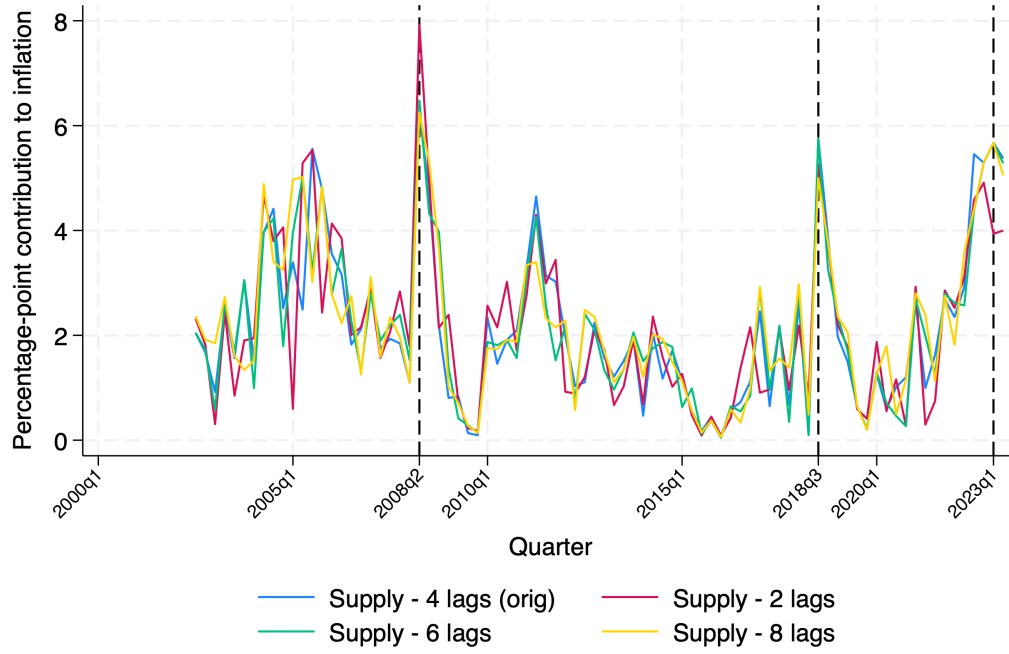
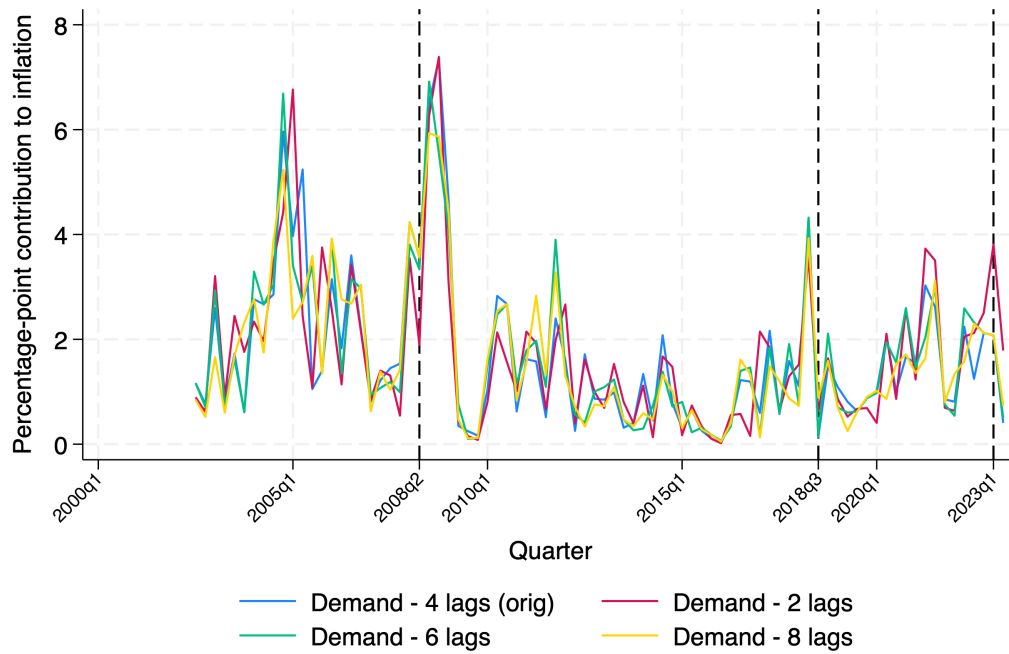


Figure 8: Breakdown of inflation with ambiguous category. Source: author's calculations. Note: "Ambiguous" is the tag for CPI inflation components whose reduced form residuals are less than 5% of that category's residual's standard deviation.

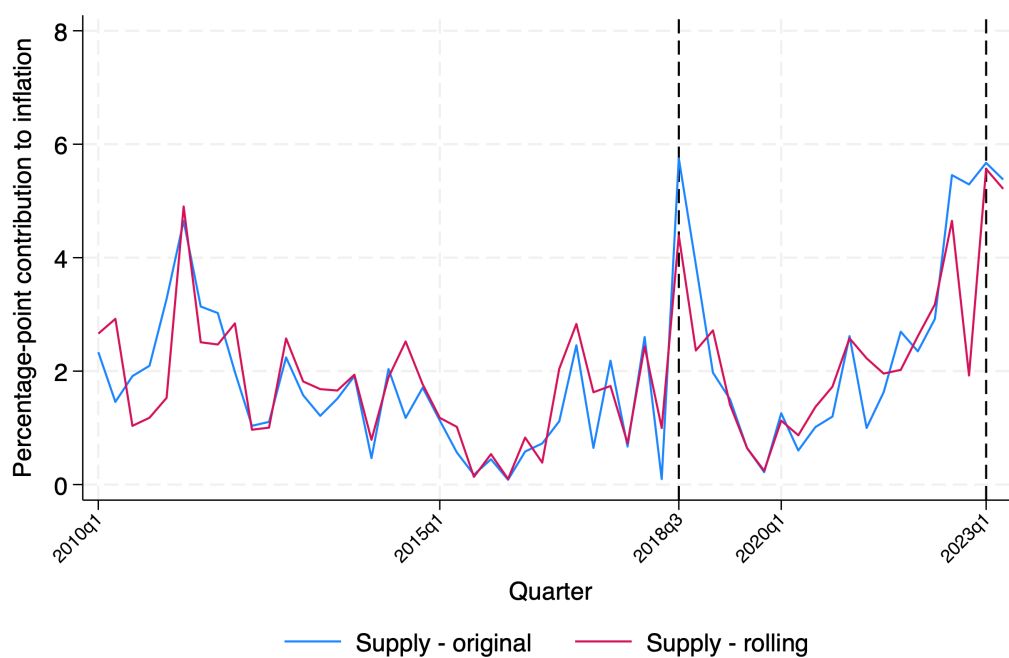


(a)

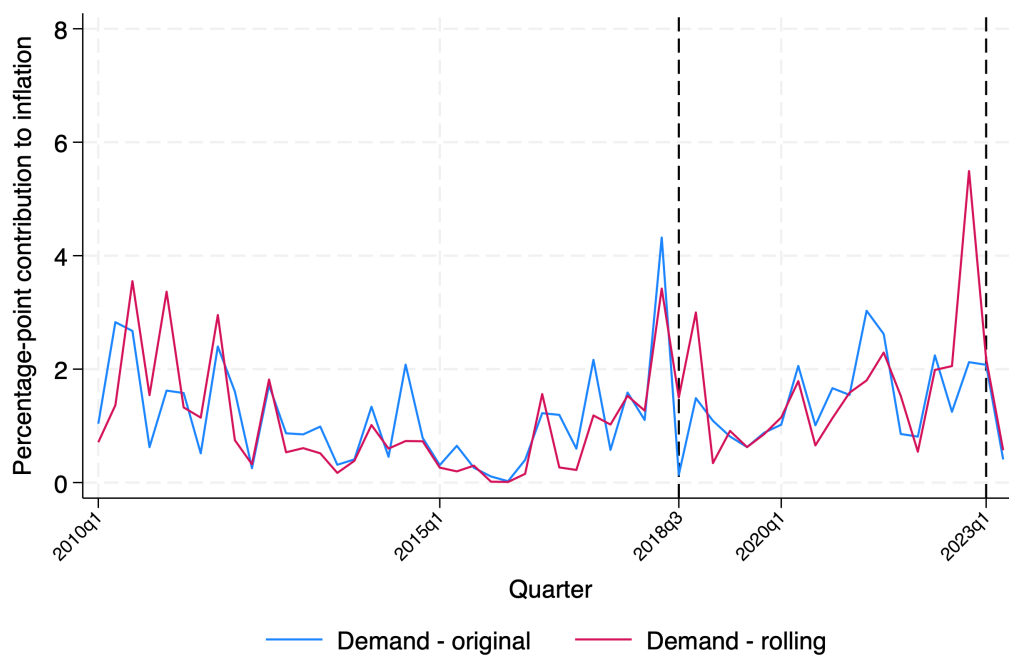


(b)

Figure 9: Supply and demand contributions to inflation in percentage points, using various lags in Equations 8 and 9. Source: author's computations.

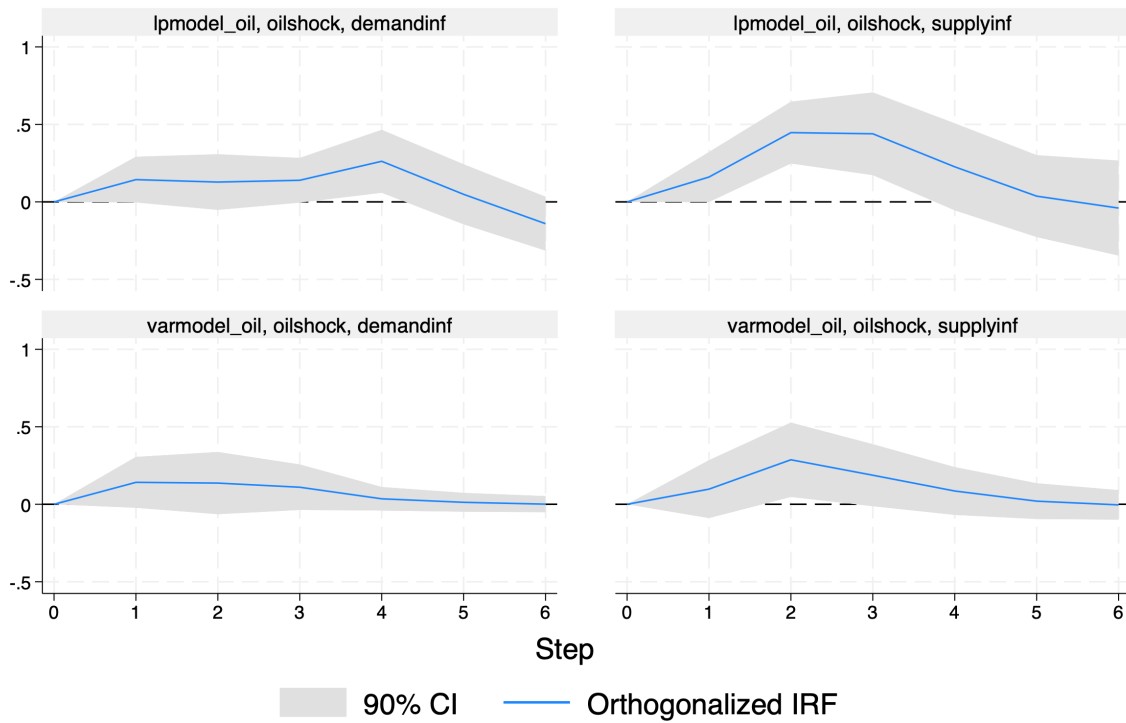


(a)



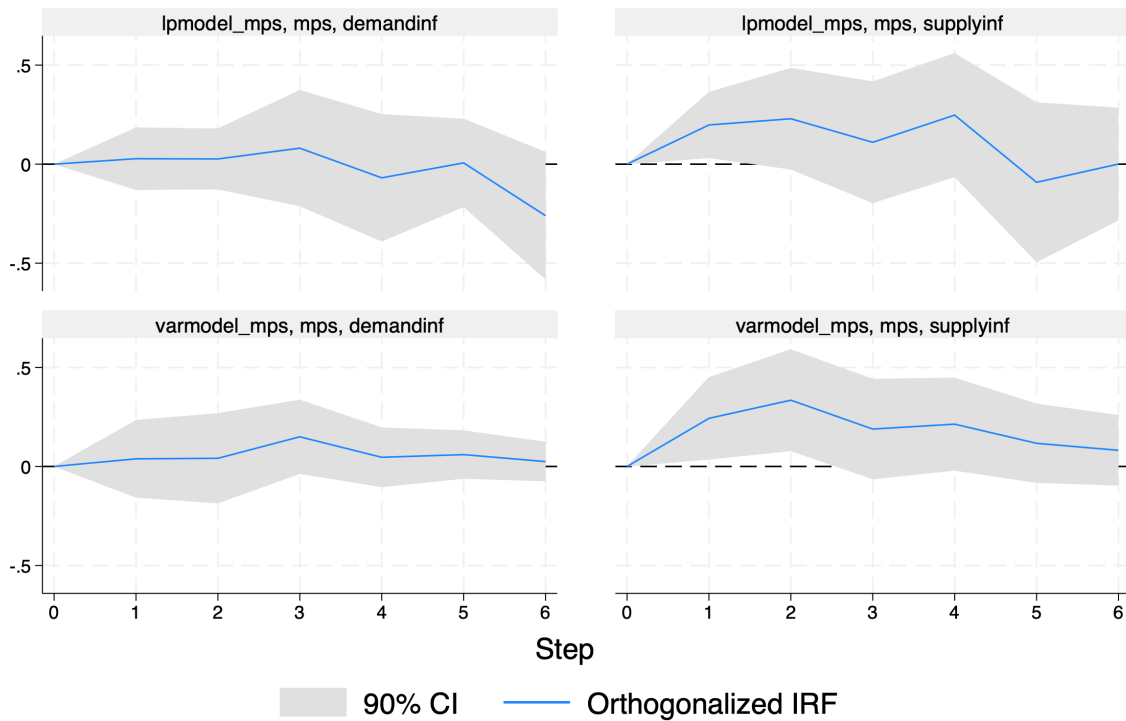
(b)

Figure 10: Supply and demand contributions to inflation in percentage points, using rolling regressions. Source: author's computations. Note: series start at 2010q1 because I used 40-period rolling window regressions.



Graphs by irfname, impulse variable, and response variable

Figure 11: Impulse response functions: response of supply and demand contributors to inflation, in response to oil price shocks. Top row shows results from local projection model; bottom row shows results from VAR model. Source: author's calculations.



Graphs by irfname, impulse variable, and response variable

Figure 12: Impulse response functions: response of supply and demand contributors to inflation, in response to monetary policy rate shocks. Top row shows results from local projection model; bottom row shows results from VAR model. Source: author's calculations.