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Asymmetric Exchange Rate Pass-Through to Producer Prices in Iran: The Role of Inflation Expectations

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Highlight

- **Exchange rate pass-through in Iran is nonlinear and state-dependent across inflation regimes.**
- **ERPT increases significantly in high-inflation expectations regimes.**
- **Inflation expectations act as a key amplification channel for producer price transmission.**
- **Manufacturing and agriculture are the most exchange-rate-sensitive sectors.**
- **Accurate ERPT modeling requires accounting for regime shifts, sectoral heterogeneity, and structural dynamic.**

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Abstract

This study investigates the nonlinear, state-dependent dynamics of exchange rate pass-through (ERPT) across Producer Price Index (PPI) sub-sectors in Iran, utilizing quarterly time-series data spanning from 2000Q2 to 2025Q4. Employing a threshold regression framework to capture asymmetric price transmission under varying macroeconomic conditions, the analysis distinguishes between low- and high-inflation expectations regimes. Empirical findings reveal a pronounced regime-dependent escalation in ERPT; at the aggregate level, pass-through elasticity surges from 0.525 in the low-inflation regime to 0.730 in the high-inflation regime, underscoring the pivotal role of inflation expectations in amplifying the transmission of exchange rate shocks into producer prices. This pattern persists robustly across more than two decades of structural economic evolution. Sectoral heterogeneity is particularly evident, with manufacturing and agriculture exhibiting the most significant increases (from 0.607 to 0.938 and 0.467 to 0.868, respectively), reflecting their enduring reliance on imported intermediate inputs. Similarly, the mining and oil & gas sectors demonstrate marked regime shifts consistent with nonlinear adjustment mechanisms in resource-based production. Collectively, these results confirm that ERPT in the Iranian economy is fundamentally nonlinear and state-dependent, with inflation expectations serving as a critical amplification channel. Consequently, the study emphasizes the necessity of accounting for regime shifts, long-run structural transformations, and seasonal dynamics to accurately model exchange rate transmission to producer prices.

1. Introduction

The relationship between exchange rates and domestic prices has long occupied a central position in international economics, particularly in the analysis

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of how retail and wholesale prices respond to exchange rate fluctuations. A fundamental issue in international macroeconomic theory concerns the extent to which changes in nominal exchange rates are transmitted to domestic prices, commonly referred to as exchange rate pass-through (ERPT) (Devereux et al., 2015). Both theoretical and empirical studies have sought to quantify the magnitude, speed, and determinants of this transmission process, given its critical implications for inflation dynamics and macroeconomic stability.

Understanding ERPT is especially important for monetary authorities operating under inflation-targeting frameworks, since exchange rate fluctuations directly affect the effectiveness of monetary policy in maintaining price stability. The literature identifies ERPT as one of the major determinants of inflation, alongside traditional monetary policy instruments such as interest rate adjustments (Campa & Goldberg, 2005; Ben Cheikh & Rault, 2015; Hofmann & Mizen, 2004; Golinelli & Rovelli, 2005). In addition, inflation expectations have been recognized as a key factor influencing the degree of pass-through (Castelnuovo & Surico, 2010; Feldkircher & Siklos, 2019). Empirical evidence suggests that well-anchored inflation expectations can reduce the impact of external shocks on domestic inflation by limiting the transmission of exchange rate fluctuations into domestic prices. Consequently, economies characterized by credible monetary policy frameworks and lower monetary expansion generally experience lower levels of ERPT (p, 2000; Choudhri & Hakura, 2006; De Mendonça & Tiberto, 2017; Gayaker et al., 2021). Nevertheless, despite the growing theoretical importance of inflation expectations in the ERPT framework, relatively limited empirical research has directly examined the relationship between inflation expectations and exchange rate pass-through, particularly in emerging and developing economies (Cuitino et al., 2022; Kabundi & Mlachila, 2019).

Iran provides a particularly relevant context for investigating ERPT because of its structural characteristics as an open and oil-dependent economy with substantial reliance on imported intermediate inputs in domestic production processes. During the past three decades, the Iranian economy has experienced considerable exchange rate volatility driven by external shocks, oil revenue fluctuations, sanctions, and macroeconomic instability. These developments have generated growing interest in understanding how exchange rate movements are transmitted to domestic prices. However, the empirical evidence for Iran remains inconclusive and, in some cases, contradictory. While some studies report a relatively complete degree of exchange rate pass-through in the Iranian economy (Mesbahi et al., 2018), others find that the transmission mechanism is incomplete and varies across sectors and inflationary conditions (Tayebi et al., 2014). Moreover, previous research identifies different macroeconomic and structural factors as key determinants of ERPT, indicating that the transmission process in Iran is likely nonlinear, asymmetric, and regime-dependent.

International evidence suggests that the inflationary environment significantly influences the degree of Exchange Rate Pass-Through (ERPT). For instance, many developed countries experienced a decline in the pass-through to consumer prices during the 1990s as a result of price stabilization policies (Taylor, 2000; Bailliu & Fujii, 2004; Takhtamanova, 2010). Nevertheless, the specific role of inflation expectations in shaping these transmission dynamics remains under-researched in the Iranian context. This study aims to address this gap by providing comprehensive empirical evidence on how inflation expectations modulate ERPT in Iran. To achieve this, the research employs a Threshold Vector Autoregression model to capture potential non-linearities, utilizing quarterly data spanning from 2000Q2 to 2025Q4. The analysis encompasses both the aggregate Producer Price Index (PPI) and its sectoral components, including agriculture, mining, manufacturing, oil, public services, and real estate.

2.1. Theoretical foundation

The transmission of exchange rate fluctuations to domestic prices remains one of the central issues in international macroeconomics. While early theoretical models primarily emphasized market structure, product substitutability, and pricing behavior under imperfect competition, more recent studies have expanded the analysis by incorporating firm-level heterogeneity and broader macroeconomic conditions into the exchange rate pass-through (ERPT) framework. Contemporary research suggests that the extent of ERPT depends not only on pricing strategies and competitive market structures but also on firms' currency denomination choices, production costs, market power, and the prevailing macroeconomic environment (Gopinath et al., 2010; Campa et al., 2008). In particular, Gopinath et al. (2010) show that product-level pricing decisions and the currency in which prices are invoiced play a critical role in determining how exchange rate fluctuations are transmitted to import and producer prices. Similarly, Goldberg and Hellerstein (2008) and Auer and Schoenle (2016) demonstrate that firm-specific characteristics, including pricing-to-market behavior, marginal cost structures, and market power, significantly influence the degree of exchange rate transmission to domestic prices.

In addition to microeconomic determinants, macroeconomic conditions have been identified as major factors shaping ERPT dynamics. Studies by Ricci et al. (2013) and Gopinath et al. (2010) indicate that aggregate demand conditions, inflation persistence, and monetary environments interact with firm-level pricing behavior in determining pass-through elasticity. Consequently, modern ERPT frameworks provide a more comprehensive explanation of exchange rate transmission compared with earlier models that focused primarily on industry concentration and product substitutability. These advances underscore the importance of integrating both microeconomic and macroeconomic determinants to explain the heterogeneous patterns of exchange rate transmission observed across countries and economic sectors.

Subsequent empirical literature has further strengthened the evidence for incomplete and nonlinear ERPT. The foundational work of Goldberg and Knetter (1997), which defines ERPT as the percentage change in import prices associated with a one-percent change in the bilateral exchange rate, established the conceptual basis for later empirical analyses. Building upon this framework, recent studies reveal that ERPT is generally incomplete in open economies due to factors such as pricing-to-market behavior, strategic price rigidities, and the currency composition of trade invoicing (Gopinath et al., 2010; Campa et al., 2008). Moreover, empirical findings suggest that the magnitude of exchange rate transmission varies systematically according to macroeconomic characteristics such as trade openness, exchange rate volatility, output gaps, and inflation dynamics (Di Giovanni et al., 2012). Economies with greater exposure to international trade and stronger competitive pressures often experience higher degrees of pass-through, whereas stable inflation environments and credible monetary policy frameworks tend to reduce the responsiveness of domestic prices to exchange rate fluctuations.

The literature also emphasizes the importance of import dependence in determining the extent of ERPT. According to McCarthy (2007), the transmission of exchange rate changes to consumer prices is strongly influenced by the share of imported goods in household consumption baskets. A higher import share increases the sensitivity of domestic inflation to exchange rate fluctuations, thereby strengthening the contribution of exchange rate movements to overall inflation dynamics. In parallel, Taylor (2000) argues that high-inflation environments amplify ERPT because firms operating under persistent inflation are more likely to adjust prices rapidly in response to exchange rate shocks. Under such conditions, exchange rate depreciation increases production costs and accelerates the transmission of imported inflation into domestic prices. Consistent with this argument, Mirdala (2014) and Aleem and Lahiani (2014) show that ERPT differs significantly across inflation regimes, implying that economic agents react differently to exchange rate fluctuations under low- and high-inflation environments.

Trade openness and exchange rate volatility also play an important role in shaping ERPT behavior. McCarthy (2007) finds a positive relationship between economic openness and exchange rate pass-through, suggesting that economies with greater integration into global markets experience faster and stronger transmission of exchange rate changes into domestic prices. At the same time, Taylor (2000) emphasizes that credible monetary policy and low inflation environments reduce the degree of pass-through, whereas high-inflation environments are associated with stronger ERPT effects. The literature further suggests that ERPT varies across business cycles. Goldfajn and Werlang (2000) argue that during recessionary periods firms tend to absorb exchange rate shocks through lower profit margins rather than fully transferring higher costs to consumers, thereby reducing pass-through elasticity. Conversely, Devereux and Engel (2000) contend that greater exchange rate volatility increases exporters' incentives to transmit exchange rate fluctuations into export prices, implying a positive relationship between exchange rate volatility and ERPT. In addition, Frankel (2005) identifies gross national product (GNP) as another determinant of ERPT and reports a negative relationship between economic output and the degree of pass-through.

As illustrated in Figure 1, exchange rate fluctuations exert direct effects on the prices of imported goods and intermediate inputs; however, the transmission of these cost increases to domestic consumer prices is typically incomplete and gradual rather than immediate and full. The extent and speed of exchange rate pass-through depend on several structural and macroeconomic factors, including market demand conditions, pricing behavior, adjustment costs, market competition, and the persistence of exchange rate shocks. Consequently, firms may absorb part of the increased costs in their profit margins, delaying the full adjustment of domestic prices following a currency depreciation. Currency depreciation also alters the composition of aggregate demand through multiple transmission channels. On the demand side, higher prices of imported goods encourage consumers and producers to substitute domestically produced goods for imported alternatives, thereby increasing domestic demand for local products and placing upward pressure on domestic prices. Simultaneously, depreciation improves the international competitiveness of domestic producers by lowering the relative price of exports in foreign markets. This improvement in export competitiveness increases foreign demand for tradable domestic goods, further intensifying inflationary pressures within the domestic economy. In addition, increased demand for domestically produced goods may stimulate production activity and raise firms' demand for labor inputs. Higher labor demand can subsequently generate upward pressure on wages and production costs, which may ultimately translate into additional increases in producer and consumer prices. Therefore, exchange rate depreciation affects domestic inflation not only through the direct cost channel associated with imported inputs, but also indirectly through demand-side adjustments, export expansion, wage dynamics, and cost-push inflationary mechanisms (Laflèche, 1997).

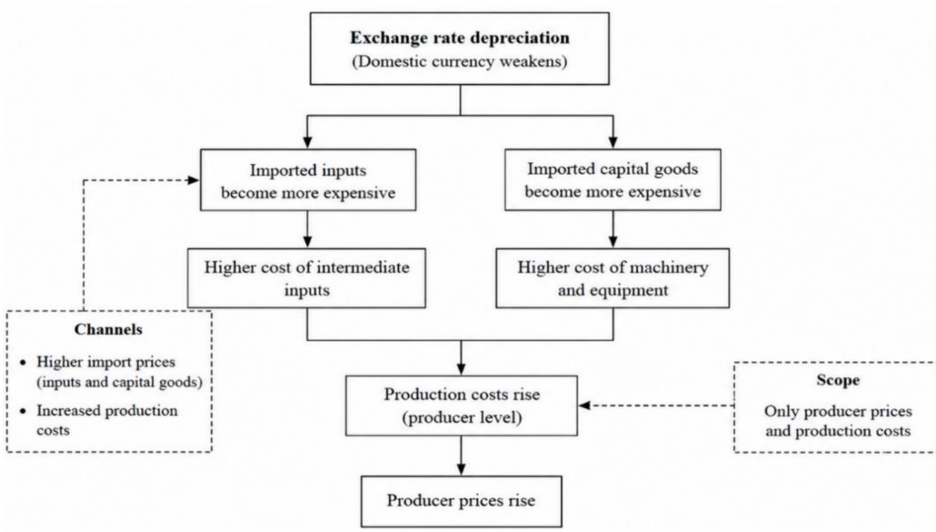


Figure 1: Pass-through from an exchange rate depreciation to producer prices
Source: *Research Findings*

2. Literature Review

Recent empirical literature has extensively investigated exchange rate pass-through (ERPT) and its relationship with monetary policy frameworks, inflation regimes, macroeconomic conditions, and external shocks in both developed and emerging economies. Muhammad Naqvi et al. (2025) examine ERPT in four Asian economies under inflation-targeting (IT) and non-IT regimes over the period 1990–2010 using a structural VAR framework with non-recursive contemporaneous restrictions. Their findings indicate that ERPT is largely insignificant in both groups of countries, while domestic inflation dynamics are driven primarily by global commodity price shocks rather than exchange rate depreciation. Similarly, Michael Anderl and Guglielmo Maria Caporale (2023), employing a smooth transition regression model for five inflation-targeting economies—namely the United Kingdom, Canada, Australia, New Zealand, and Sweden—demonstrate that ERPT to consumer and import prices is nonlinear and becomes stronger when inflation expectations rise, implying that well-anchored expectations can substantially reduce pass-through effects.

Evidence from emerging economies also confirms the nonlinear and asymmetric nature of ERPT. Bhat et al. (2025), using a backward-looking Phillips curve combined with a logistic smooth transition regression (LSTR) model for BRICS countries, report that ERPT coefficients are positive but incomplete, with considerable variation across inflation regimes and business cycles. Their results suggest that pass-through intensifies with higher inflation in Russia, India, and South Africa, varies according to output growth conditions, and remains largely insignificant in Brazil and China. Likewise, John Beirne et al. (2024), through a time-varying parameter SVAR model applied to nine emerging Asian economies during 1994–2021, find incomplete ERPT with stronger transmission to producer prices than consumer prices. They further show that long-run effects exceed short-run impacts and that ERPT is highly sensitive to external shocks, including oil price fluctuations, United States monetary policy, and financial market volatility.

A growing strand of the literature highlights asymmetric responses of domestic prices to exchange rate movements in developing economies. Fandamu et al. (2023) demonstrate that in Zambia consumer prices react more strongly to currency depreciation than to appreciation. Consistent with this finding, Obeng et al. (2022), using an EMD-NARDL framework for Ghana, report incomplete long-run pass-through under depreciation shocks and negligible transmission during periods of appreciation. Moreover, Muhammad Ali Nasir et al. (2020) show that ERPT in the Czech Republic is jointly influenced by inflation expectations, GDP growth, labor market conditions, oil prices, and monetary variables, underscoring the multidimensional determinants of pass-through dynamics. In a broader cross-country analysis covering 55 economies, Ha et al. (2020) find that monetary policy shocks generate stronger ERPT effects than other domestic disturbances, while global shocks produce heterogeneous impacts across countries. Their results further indicate that economies with flexible exchange rate regimes and credible inflation-targeting frameworks tend to experience lower degrees of exchange rate transmission.

The literature also emphasizes the critical role of monetary policy credibility and inflation stability in shaping ERPT. Alain Kabundi and Montfort Mlachila (2019) document a decline in ERPT in South Africa attributable to improved monetary policy credibility. Similarly, Sadat Hoseyni et al. (2018) find that ERPT in Iran's import price index is substantially higher under high-inflation regimes, while Ahmad Zubaidi Baharumshah et al. (2017) demonstrate that lower inflation uncertainty significantly reduces pass-through in Asian inflation-targeting economies. Earlier evidence for Iran provided by Kazerooni and Solaimani Alvang (2015) suggests that deviations in the real exchange rate significantly affect ERPT dynamics, with relatively limited short-run transmission that increases gradually over time, although remaining incomplete overall. Their findings also reveal a significant positive relationship between real exchange rate deviations and the consumer price index.

Overall, the existing literature consistently indicates that ERPT is generally incomplete, nonlinear, and asymmetric, while being strongly conditioned by inflation expectations, monetary policy credibility, macroeconomic environments, and global shocks. These findings provide a robust theoretical and empirical foundation for examining exchange rate pass-through across aggregate and sectoral producer price indices in economies such as Iran, where both domestic structural conditions and external disturbances play a central role in determining the magnitude and persistence of price transmission effects.

3. The Model

This study employs seasonal data for the Producer Price Index (PPI) and its eight major sectoral components, including Agriculture, Industry, Manufacturing, Mining, Oil and Gas, Public Sector, Real Estate, and Services, along with the free-market exchange rate, trade openness index, government expenditures, oil revenues, and gross domestic product (GDP) at constant 2015 prices for the period 2000Q2–2025Q4 in the Iranian economy. All required data were obtained from the official database of the Central Bank of the Islamic Republic of Iran. The empirical framework of the study is based on a threshold regression model designed to capture potential nonlinearities and structural asymmetries in exchange rate pass-through across different inflation regimes. The analysis begins with a standard multiple linear regression model consisting of T observations and m potential threshold regimes. For observations belonging to regime j=1, 2, …, m, the linear regression specification is defined as follows:

$$y_t = X_t'\beta + Z_t'\rho_j + \boldsymbol{\varepsilon_t} \tag{1}$$

An important feature of Equation (1) is the classification of regressors into two distinct groups: regime-invariant variables and regime-specific variables. To accurately identify the behavior of macroeconomic variables across different structural regimes and distinguish variables whose coefficients vary across regimes from those that remain stable, the Wald linear restriction test was employed to examine the equality of regression coefficients between regimes. Within this framework, the null hypothesis (H0) assumes structural symmetry and complete equality of a variable's coefficients across the two regimes. Accordingly, rejection of the null hypothesis at conventional significance levels (p<0.01), based on the Wald FFF-statistic, indicates that the effect of the corresponding variable on the dependent variable changes significantly across structural regimes, implying an asymmetric and regime-dependent behavior. Conversely, failure to reject the null hypothesis suggests that the variable maintains a stable effect regardless of regime shifts and can therefore be treated as regime-invariant.

In this study, different lag structures were evaluated, and by sequentially estimating alternative specifications and comparing the residual sum of squares, the first and fourth lags were selected as the optimal intervals for the variables. Moreover, based on the structural break procedure proposed by Jushan Bai and Pierre Perron (1998), one threshold value and two distinct regimes were identified. Accordingly, the research model is specified as follows:

$$\begin{aligned} \ln(y_t) = {} & B_0 + \beta_1 \ln(\mathrm{Open}_t) + \beta_2 \ln(\mathrm{Open}_{t-1}) + \beta_3 \ln(\mathrm{Open}_{t-4}) + \\ & \beta_4 \ln(\mathrm{GDP}_t) + \beta_5 \ln(\mathrm{GDP}_{t-1}) + \beta_6 \ln(\mathrm{GDP}_{t-4}) + \beta_7 \ln(\mathrm{Oil}_t) + \\ & \beta_8 \ln(\mathrm{Oil}_{t-1}) + \beta_9 \ln(\mathrm{Oil}_{t-4}) + \{\theta_1[\gamma_1 \ln(\mathrm{EX}_t).\, \mathrm{g}(\mathrm{Inf}_{\mathrm{EXP}_t}) + \\ & \gamma_2 \ln(\mathrm{EX}_{t-1}).\, \mathrm{g}(\mathrm{Inf}_{\mathrm{EXP}_t}) + \gamma_3 \ln(\mathrm{EX}_{t-2}).\, \mathrm{g}(\mathrm{Inf}_{\mathrm{EXP}_t}) + \\ & \gamma_4 \ln(\mathrm{G}_t).\, \mathrm{g}(\mathrm{Inf}_{\mathrm{EXP}_t}) + \gamma_5 \ln(\mathrm{G}_{t-1}).\, \mathrm{g}(\mathrm{Inf}_{\mathrm{EXP}_t}) + \end{aligned} \tag{2}$$

$\gamma_6 \ln(G_{t-2}).g(Inf_{EXP_t})] + \theta_2[\delta_1 \ln(EX_t).g(Inf_{EXP_t}) + \delta_2 \ln(EX_{t-1}).g(Inf_{EXP_t}) + \delta_3 \ln(EX_{t-2}).g(Inf_{EXP_t}) + \delta_4 \ln(G_t).g(Inf_{EXP_t}) + \delta_5 \ln(G_{t-1}).g(Inf_{EXP_t}) + \delta_6 \ln(G_{t-2}).g(Inf_{EXP_t})]\} + \varepsilon_t$

The $\theta_i, i = 1,2$ parameter determines which regime holds .If i=1, we are in the first regime, in which the value of $\theta_1 = 1$ and the value of $\theta_2 = 0$. Also, in the second regime i=2, the value of $\theta_1 = 0$ and $\theta_2 = 1$. As a result, the research model for the first and second regimes is specified as follows:

Regim 1 (3)

$$\ln(y_t) = B_0 + \beta_1 \ln(Open_t) + \beta_2 \ln(Open_{t-1}) + \beta_3 \ln(Open_{t-4}) + \beta_4 \ln(GDP_t) + \beta_5 \ln(GDP_{t-1}) + \beta_6 \ln(GDP_{t-4}) + \beta_7 \ln(Oil_t) + \beta_8 \ln(Oil_{t-1}) + \beta_9 \ln(Oil_{t-4}) + \gamma_1 \ln(EX_t).g(Inf_{EXP_t}) + \gamma_2 \ln(EX_{t-1}).g(Inf_{EXP_t}) + \gamma_3 \ln(EX_{t-2}).g(Inf_{EXP_t}) + \gamma_4 \ln(G_t).g(Inf_{EXP_t}) + \gamma_5 \ln(G_{t-1}).g(Inf_{EXP_t}) + \gamma_6 \ln(G_{t-2}).g(Inf_{EXP_t}) + \varepsilon_t$$

Regim 2 (4)

$$ln(y_t) = B_0 + \beta_1 ln(Open_t) + \beta_2 ln(Open_{t-1}) + \beta_3 ln(Open_{t-4}) + \beta_4 ln(GDP_t) + \beta_5 ln(GDP_{t-1}) + \beta_6 ln(GDP_{t-4}) + \beta_7 ln(Oil_t) + \beta_8 ln(Oil_{t-1}) + \beta_9 ln(Oil_{t-4}) + \delta_1 ln(EX_t).g(Inf_{EXP_t}) + \delta_2 ln(EX_{t-1}).g(Inf_{EXP_t}) + \delta_3 ln(EX_{t-2}).g(Inf_{EXP_t}) + \delta_4 ln(G_t).g(Inf_{EXP_t}) + \delta_5 ln(G_{t-1}).g(Inf_{EXP_t}) + \delta_6 ln(G_{t-2}).g(Inf_{EXP_t}) + \varepsilon_t$$

Table 1: Introduction of research variables

symbol	Notion	Operational definition
Y	Producer price index	Price index of producer goods and Services
Open	Degree of trade openness	The ratio of total exports and imports to GDP.
GDP	Gross domestic product	Gross domestic product at constant prices of 2015 in quarter t.
OIL_INCOME	Oil revenues	The amount of Iran's total oil revenues in quarter t.
EX	exchange rate	Quarterly average price of each EX in terms of Rials in the market of Iran.
G	government expenditure	Total central government expenditure in Iran.
$\mathbf{Inf_{EXP}}$	Inflationary expectations	The inflation rate of the total consumer index in the previous quarter.

Source: *Research Findings*

The dependent variable in this study is represented by both the aggregate Producer Price Index (PPI) and its sectoral components, enabling a comprehensive analysis of exchange rate pass-through across different segments of the economy.

Specifically, the overall PPI is disaggregated into nine categories: total PPI, Agriculture, Industry, Manufacturing, Mining, Oil and Gas, Public Sector, Real Estate, and Services. Examining these sectoral indices alongside the aggregate measure allows the study to capture the heterogeneity of price responses across economic sectors and provides a more detailed understanding of how exchange rate fluctuations are transmitted through various components of producer prices.

4. Empirical Results

The seasonal unit root test based on the HEGY methodology indicates that all examined macroeconomic and sectoral variables—including PPI, GDP, exchange rate (EX), expected inflation, trade openness (OPEN), oil income, and sectoral output indicators—exhibit a unit root at the zero frequency. This result implies that none of the series are stationary in levels, confirming that they are integrated of order one, I(1), in their non-seasonal component (Table 2). In contrast, the results for seasonal frequencies provide strong evidence against the presence of seasonal unit roots in most variables. The null hypothesis of seasonal non-stationarity is rejected in the majority of cases, suggesting that seasonal fluctuations are transitory and mean-reverting rather than driven by stochastic seasonal processes. Overall, the evidence supports a data-generating process characterized by a common stochastic trend accompanied by stationary or deterministic seasonal dynamics. This structure is consistent with the presence of long-run equilibrium relationships among the variables. Accordingly, and given the non-stationarity of the series in levels, the next step of the empirical analysis involves testing for cointegration relationships among the variables to examine whether a stable long-run equilibrium exists despite short-run dynamics and stochastic trends.

Table 2: HEGY Unit Root Test Results

Variable	Unit Root at Freq. 0	Seasonal Unit Roots	Test Statistic (Freq. 0)	Critical value (5%)	Conclusion
PPI	Yes	Rejected	-2.555	-2.812	I(1)
Agriculture	Yes	Rejected	-2.587	-2.812	I(1)
Oil & Gas	Yes	Rejected	-0.036	-2.812	I(1)
Mining	Yes	Rejected	-0.882	-2.812	I(1)
Industry	Yes	Rejected	-2.274	-2.812	I(1)
Manufacturing	Yes	Rejected	-2.270	-2.812	I(1)
Public	Yes	Rejected		-2.812	I(1)
Real Estate	Yes	Rejected		-2.812	I(1)
Service	Yes	Rejected		-2.812	I(1)
GDP	Yes	Rejected	-2.399	-2.812	I(1)
EX	Yes	Rejected	-2.687	-2.812	I(1)
EXPECT_INF	Yes	Rejected	-0.375	-2.812	I(1)
G	Yes	Rejected	-0.009	-2.812	I(1)
OPEN	Yes	Rejected	-1.893	-2.812	I(1)

Note: The HEGY test shows that all variables are non-stationary at zero frequency with significant seasonal unit roots, indicating stochastic trends. Overall, all series are integrated of order one (I(1)), satisfying the prerequisite for cointegration analysis.
Source: *Research Findings*

In this study, the Phillips–Ouliaris cointegration test (Phillips & Ouliaris, 1988) is employed to examine the existence of long-run equilibrium relationships among macroeconomic variables across different economic sectors. The results strongly indicate rejection of the null hypothesis of no cointegration for all sectors, including aggregate PPI, agriculture, oil and gas, mining, industry, manufacturing, public sector, real estate, and services, at the 5% significance level (Table 3). This confirms the presence of stable long-run equilibrium relationships among the variables, implying that the series share common stochastic trends and converge toward a long-run equilibrium path. The relatively stronger significance observed in sectors such as oil and gas and manufacturing suggest tighter integration of these sectors with macroeconomic fundamentals. Overall, the Phillips–Ouliaris test provides robust evidence of widespread cointegration across sectors, indicating that short-run shocks are transitory and adjustments toward long-run equilibrium are persistent and stable.

Table 3: Phillips–Ouliaris Cointegration Test Results

Dependent Variable	Tau-statistic	Prob. (tau)	Z-statistic	Prob	Conclusion
PPI	-8.6369	0.0000	-40.6158	0.0301	Cointegration confirmed
Agriculture	-8.7487	0.0000	-38.2516	0.0473	Cointegration confirmed
Oil & Gas	-8.0454	0.0000	-78.2271	0.0000	Cointegration confirmed
Mining	-5.6027	0.0078	-47.7419	0.0067	Cointegration confirmed
Industry	-6.3980	0.0019	-57.9957	0.0016	Cointegration confirmed
Manufacturing	-7.4771	0.0000	-71.4562	0.0000	Cointegration confirmed
Public	-6.6159	0.0003	-60.7528	0.0003	Cointegration confirmed
Real Estate	-5.4445	0.0121	-45.7224	0.0104	Cointegration confirmed
Service	-6.9329	0.0001	-64.7242	0.0001	Cointegration confirmed

Note: The Phillips–Ouliaris test results indicate the presence of a long-run equilibrium relationship among the variables in all sectors, as both tau and Z statistics are statistically significant at conventional levels ($p < 0.05$), confirming cointegration.
Source: *Research Findings*

Table 4. Results of the Wald Test: Equality of Regression Coefficients of Variables across Two Regimes

Producer Price Index & Sub-sector	Regressor	F-statistic	df	Probability	Conclusion
PPI	EX	18.4860	(1,86)	0.0000	Regime-Specific
	G	3.5800	(1,86)	0.0620	Regime-Invariant

	Open	199.2382	(1,86)	0.0000	Regime-Specific
	GDP	10.8579	(1,86)	0.0015	Regime-Specific
	OIL_INCOME	68.0567	(1,86)	0.0000	Regime-Specific
	EX	4.7553	(1,86)	0.0320	Regime-Specific
	G	1.3604	(1,86)	0.2468	Regime-Invariant
Agriculture	Open	25.9577	(1,86)	0.0000	Regime-Specific
	GDP	1.9008	(1,86)	0.1716	Regime-Invariant
	OIL_INCOME	88.0023	(1,86)	0.0000	Regime-Specific
	EX	4.4157	(1,86)	0.0387	Regime-Specific
	G	10.9573	(1,86)	0.0014	Regime-Specific
Oil & Gas	Open	3.7172	(1,86)	0.0574	Regime-Invariant
	GDP	40.0957	(1,86)	0.0000	Regime-Specific
	OIL_INCOME	425.0883	(1,86)	0.0000	Regime-Specific
	EX	4.3600	(1,86)	0.0403	Regime-Specific
	G	8.4182	(1,86)	0.0049	Regime-Specific
Industry	Open	11.2897	(1,86)	0.0012	Regime-Specific
	GDP	35.7494	(1,86)	0.0000	Regime-Specific
	OIL_INCOME	19.7381	(1,86)	0.0000	Regime-Specific
	EX	29.0076	(1,86)	0.0000	Regime-Specific
	G	22.0878	(1,86)	0.0000	Regime-Specific
Manufacturing	Open	172.6178	(1,86)	0.0000	Regime-Specific
	GDP	29.7993	(1,86)	0.0000	Regime-Specific
	OIL_INCOME	59.3935	(1,86)	0.0000	Regime-Specific
Mining	EX	19.4025	(1,86)	0.0000	Regime-Specific
	G	4.0758	(1,86)	0.0466	Regime-Specific

	Open	0.4167	(1,86)	0.5203	Regime-Invariant
	GDP	0.0255	(1,86)	0.8734	Regime-Invariant
	OIL_INCOME	12.5883	(1,86)	0.0006	Regime-Specific
	EX	8.8840	(1,86)	0.0038	Regime-Specific
	G	1.6728	(1,86)	0.1995	Regime-Invariant
Public	Open	62.2400	(1,86)	0.0000	Regime-Specific
	GDP	0.0000	(1,86)	0.9983	Regime-Invariant
	OIL_INCOME	17.7380	(1,86)	0.0001	Regime-Specific
	EX	18.5593	(1,86)	0.0000	Regime-Specific
	G	0.6164	(1,86)	0.4347	Regime-Invariant
Real Estate	Open	74.6728	(1,86)	0.0000	Regime-Specific
	GDP	0.0280	(1,86)	0.8674	Regime-Invariant
	OIL_INCOME	41.5437	(1,86)	0.0000	Regime-Specific
	EX	8.3961	(1,86)	0.0048	Regime-Specific
	G	0.1957	(1,86)	0.6594	Regime-Invariant
Service	Open	99.6372	(1,86)	0.0000	Regime-Specific
	GDP	0.0789	(1,86)	0.7796	Regime-Invariant
	OIL_INCOME	38.4289	(1,86)	0.0000	Regime-Specific

Note: The Wald test assesses parameter equality across regimes; $p < 0.05$ indicates regime-specific effects, while $p \geq 0.05$ implies regime invariance

Source: *Research Findings*

In this study, inflation expectations, proxied by the lagged inflation rate, function as the threshold variable to investigate structural heterogeneity in the transmission mechanism. A Wald test for coefficient equality across regimes was employed to differentiate between regime-specific and regime-invariant dynamics. The rejection of the null hypothesis of parameter stability (H_0), evidenced by F-statistics significant at conventional levels ($p < 0.05$), reveals statistically significant asymmetries in how explanatory variables respond across different regimes; conversely, a failure to reject H_0 implies parameter constancy and structural invariance. As detailed in Table 4, exchange rate fluctuations (EX) and oil revenue shocks (OIL_INCOME) exhibit robust, pervasive regime-dependent effects across all sectors, confirming that external macroeconomic shocks are transmitted to producer prices in a fundamentally nonlinear and state-contingent manner. In contrast, gross domestic product (GDP) demonstrates regime-invariant behavior in several non-manufacturing sectors—including agriculture, mining, real estate, services, and the public sector—where the Wald test fails to reject coefficient equality, suggesting a structurally stable growth–price nexus. Notably, the manufacturing and industrial sectors emerge as the most structurally sensitive; for these sectors, the null hypothesis of parameter stability is decisively rejected for all regressors ($p < 0.01$). This indicates that regime shifts driven by inflation expectations fundamentally alter the underlying transmission channels of macroeconomic variables, thereby reinforcing the presence of strong nonlinearities and state-dependent adjustments within the production-price system.

The results reported in Table 5 present the estimated dynamics of key macroeconomic variables across different production sub-sectors using a threshold-based regression framework. Overall, the findings indicate strong heterogeneity in the responses of sub-sectoral producer price indices (PPI) to fiscal, external, and demand-side shocks, highlighting the importance of sector-specific transmission mechanisms in the economy. The presence of lagged effects in most variables further confirms the dynamic nature of price adjustments across production structures.

For the aggregate Producer Price Index (PPI), government expenditure (G) exhibits a statistically significant and persistent positive effect in both contemporaneous and lagged forms. The positive coefficient at the current and first lag suggests that fiscal expansion exerts immediate inflationary pressure on producer prices, while the negative coefficient at the fourth lag indicates partial correction over time. This pattern reflects a delayed adjustment process in the transmission of fiscal policy to production costs and pricing behavior.

In the agricultural sub-sector, GDP plays a dominant role in explaining price dynamics. The results show that lagged GDP exerts a strong and statistically significant positive effect, suggesting that agricultural prices are highly sensitive to macroeconomic demand conditions. Interestingly, the current GDP effect is negative but insignificant, indicating that agricultural markets respond with a lag rather than instantaneously. Government expenditure also shows a consistently positive and significant impact across all lags, implying that public spending policies indirectly increase agricultural producer prices through demand-side channels.

The oil and gas sector demonstrates a distinct pattern driven primarily by trade openness. The coefficient of openness is positive and significant in the contemporaneous term, but becomes strongly negative at longer lags. This indicates that while increased openness may initially stimulate price levels in this sector, over time it leads to downward pressure, possibly due to increased competition and integration into global energy markets. The insignificance of the first lag further suggests short-run volatility and adjustment delays.

In the mining sector, both openness and GDP are important determinants of price behavior. Openness has a positive short-run effect but becomes negative in the long run, implying that external exposure initially raises input costs but ultimately enhances efficiency and reduces price levels. GDP, on the other hand, has a strong positive contemporaneous and lagged effect, indicating that mining prices are highly pro-cyclical and strongly tied to overall economic activity. This confirms the resource-dependent nature of the sector.

For the public sector-related PPI, GDP exerts mixed but significant effects across lags. The negative contemporaneous coefficient combined with positive lagged coefficients suggests an initial cost-containment effect followed by delayed inflationary transmission. This dynamic may reflect institutional rigidities and adjustment lags in public pricing mechanisms. The results further suggest that fiscal and economic shocks are not immediately reflected in public sector prices but are transmitted gradually.

The real estate sector shows strong sensitivity to both GDP and government expenditure. GDP has a negative contemporaneous effect but positive and significant lagged effects, indicating delayed demand transmission into property-related prices. Government expenditure, however, remains consistently positive and highly significant across all lags, suggesting that public investment and fiscal expansion play a central role in driving real estate price inflation.

Table 5. Regime-Invariant Variables in Threshold Regression Models

Producer Price Index & Sub-sector	Regressor	Coefficient	Std. Error	t-Statistic
PPI	G	0.0638***	0.0080	7.9860
	G(-1)	0.1235***	0.0136	9.0712
	G(-4)	-0.0520***	0.0189	-2.7475
Agriculture	GDP	-0.2185	0.1391	-1.5709
	GDP(-1)	0.3894***	0.0586	6.6434
	GDP(-4)	0.2279*	0.1278	1.7833
	G	0.0280**	0.0127	2.2081
	G(-1)	0.1263***	0.0128	9.8489
	G(-4)	0.1276***	0.0136	9.4052
Oil & Gas	OPEN	0.2963***	0.0728	4.0728
	OPEN(-1)	0.0834	0.0945	0.8822
	OPEN(-4)	-0.5422***	0.0641	-8.4570
Mining	OPEN	0.0718**	0.0305	2.3538
	OPEN(-1)	0.1311***	0.0298	4.4060
	OPEN(-4)	-0.0390	0.0255	-1.5265
	GDP	1.3728***	0.2063	6.6549
	GDP(-1)	0.4823***	0.1011	4.7693
	GDP(-4)	-0.6977***	0.2535	-2.7523
Public	GDP	-0.2297***	0.0817	-2.8129
	GDP(-1)	0.5463***	0.0349	15.6385
	GDP(-4)	0.3689***	0.0961	3.8391
Real Estate	GDP	-0.8356***	0.1869	-4.4711
	GDP(-1)	0.4876***	0.0737	6.6140
	GDP(-4)	1.0579***	0.1730	6.1160
	G	0.1416***	0.0104	13.6696

	G(-1)	0.2225***	0.0089	25.1051
	G(-4)	0.0244	0.0229	1.0666
Service	GDP	-0.0302	0.1131	-0.2674
	GDP(-1)	0.3836***	0.0459	8.3604
	GDP(-4)	0.1118	0.0899	1.2437
	G	0.0867***	0.0090	9.5799
	G(-1)	0.1680***	0.0080	21.0291
	G(-4)	0.1026***	0.0124	8.2643

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Regime-invariant variables are variables whose coefficients remain unchanged across low- and high-inflation expectation regimes in the discrete threshold regression models.
Source: *Research Findings*

In the service sub-sector, government expenditure (G) demonstrates a statistically significant and persistent positive impact on producer prices, with significant coefficients observed at the current, first, and fourth lags. This pattern indicates that fiscal expansion generates immediate and sustained inflationary pressure within this sector. Furthermore, lagged GDP exerts a strong and statistically significant positive influence, highlighting the high sensitivity of service prices to macroeconomic demand conditions; however, the effects of current and fourth-lag GDP remain statistically insignificant. These findings suggest that while fiscal policy and past economic activity are key drivers of price dynamics in services, contemporaneous economic fluctuations have a less direct impact, underscoring the role of accumulated demand and policy lags in shaping sector-specific inflation.

Overall, the findings suggest that macroeconomic policies exert asymmetric and time-varying effects across different production sectors. The presence of lagged responses indicates that policy impacts are not instantaneous and vary depending on sectoral characteristics, market structure, and degree of openness. These results are consistent with threshold dynamics, where economic relationships shift depending on underlying structural conditions. In conclusion, the empirical evidence supports the hypothesis that producer price formation is highly heterogeneous across sectors and is shaped by a combination of fiscal, external, and demand-side factors. The results emphasize the necessity of sector-specific policy design, particularly in economies where structural differences across industries are pronounced. Policymakers should therefore account for these asymmetric effects when designing inflation control and growth stabilization strategies.

The empirical results in Table 6 highlight a pronounced regime-dependent exchange rate pass-through (ERPT) across inflation expectation regimes. The exchange rate (EX), together with macroeconomic variables such as trade openness (OPEN), oil income (OIL_INCOME), GDP, and government expenditure (G), exhibits highly nonlinear effects across contemporaneous and lagged structures (Lag 1 and Lag 4). The evidence suggests that ERPT intensifies under high-inflation expectations, while other macro variables act as either amplifiers or dampeners depending on the regime and time horizon.

At the aggregate PPI level, ERPT is clearly evident through the positive and significant coefficients of EX across both regimes. In the low-inflation regime, the contemporaneous exchange rate effect is positive (0.155***), with a weak but positive lag structure at Lag 4 (0.370***), while Lag 1 is relatively muted. In the high-inflation regime, ERPT becomes more persistent, with a stronger Lag 1 effect (0.420***) and continued significance at Lag 4 (0.178***), indicating delayed but amplified transmission. OPEN shifts from a contractionary effect in the low regime (-0.402***) to a mixed and partially inflationary impact in the high regime, reinforcing imported inflation channels. OIL_INCOME remains consistently inflationary in both regimes, with stable short- and long-run effects, while GDP shows a structural break: negative or weak effects under low inflation but strongly positive contemporaneously (0.925***) under high inflation, turning negative at Lag 4 (-0.761***). Government spending (G) is not included at PPI level but appears as a stabilizing omitted macro driver in aggregate dynamics.

In the agriculture sector, ERPT is present but relatively moderate compared to industrial sectors. EX shows weak contemporaneous effects in the low regime (0.213) but strengthens in Lag 1 (0.467**) before fading at Lag 4 (0.076). Under high inflation, EX becomes more consistently transmitted across all lags, especially Lag 1 (0.497***) and Lag 4 (0.239***), confirming stronger ERPT persistence. GDP plays a dominant role: it is negative or insignificant contemporaneously but becomes strongly positive at Lag 1 (0.3894***) and weaker at Lag 4. OPEN exerts persistent negative pressure across both regimes, reflecting import competition in agriculture. OIL_INCOME remains weak in the low regime but becomes consistently positive and significant under high inflation, reinforcing cost-side pressures. G is absent in this sector, implying limited fiscal transmission channels.

The oil and gas sector demonstrates the strongest ERPT mechanism among all sectors. EX shows high sensitivity in both regimes, but the high-inflation regime exhibits substantially larger contemporaneous and lagged coefficients (0.484*** at level, 0.519*** at Lag 4). In contrast, the low regime shows mixed dynamics with negative Lag 1 (-0.341***) and positive Lag 4 effects. OIL_INCOME strongly reinforces ERPT, particularly in the high regime where coefficients rise sharply (0.262*** at level, 0.196*** at Lag 1), indicating dollar-linked revenue pass-through. GDP switches from negative contemporaneous effects (-0.717***) to extremely strong positive inflationary effects (2.515***) under high inflation, while reversing sign at Lag 4. G becomes destabilizing in the high regime (-0.202***), suggesting contractionary fiscal responses under inflationary pressure. OPEN is not included, indicating sectoral insulation from trade openness channels.

In the industrial sector, ERPT operates through multiple channels and lags. EX is positive in both regimes, but the high-inflation regime shows stronger persistence, particularly at Lag 1 (0.491***) and Lag 4 (0.120***). OIL_INCOME is consistently positive and significant, with stronger lagged effects under high inflation, indicating imported input cost transmission. OPEN shifts from contractionary (-0.485***) in the low regime to inflationary (+0.267***) in the high regime, reinforcing ERPT amplification through trade channels. GDP is strongly regime-dependent, turning from negative (-0.813***) to positive (1.064***) at level, while Lag 4 remains negative in high inflation, indicating delayed correction.

G is consistently positive and significant across both regimes, suggesting fiscal spending amplifies inflationary transmission and supports ERPT persistence.

The manufacturing sector shows highly persistent and lag-driven ERPT. EX is strongly positive in both regimes, but Lag 1 and Lag 4 effects intensify under high inflation (0.460*** and 0.300*** respectively), indicating delayed cost pass-through. OIL_INCOME consistently raises prices in both regimes, with stronger lagged transmission in the high regime. OPEN shifts from contractionary (-0.825***) to inflationary (0.385***), highlighting a structural break in import sensitivity. GDP moves from negative contemporaneous effects (-1.063***) to positive under high inflation (0.508***), while Lag 4 remains negative, suggesting overshooting effects. G is inflationary in the low regime but turns slightly contractionary at level in the high regime, indicating fiscal tightening under inflationary stress.

In the mining sector, ERPT is present but structurally heterogeneous. EX is positive across both regimes, but Lag 1 is stronger in the low regime (0.337***) while diminishing in the high regime, suggesting partial pass-through delay effects. OIL_INCOME is consistently positive but becomes more volatile under high inflation, with Lag 4 turning strongly negative (-0.121***), indicating adjustment effects in commodity-linked revenues. G exhibits a regime switch from contractionary (-0.051***) in the low regime to strongly expansionary (0.197***) in the high regime, reinforcing inflationary pressures. OPEN is positive in both regimes but loses significance at Lag 4 under high inflation, while GDP is not included, indicating a dominance of external rather than domestic demand channels.

The public sector shows moderated but still significant ERPT. EX is positive in both regimes, with stronger contemporaneous effects in the low regime (0.393***) and more lagged persistence in the high regime (0.349*** at Lag 1). OIL_INCOME remains inflationary across all lags, but its magnitude declines under high inflation, suggesting partial fiscal absorption. OPEN is consistently negative and significant, indicating import discipline effects on prices. G is strongly inflationary in both regimes, particularly at Lag 1, reinforcing demand-side pressures. GDP is absent, suggesting fiscal and external channels dominate ERPT rather than production-side dynamics.

The real estate sector exhibits strong ERPT, particularly under high inflation expectations. EX shows persistent and rising pass-through across all lags, with stronger Lag 1 and Lag 4 effects in the high regime, indicating delayed asset revaluation. OIL_INCOME is weak or insignificant in the low regime but becomes positive and significant under high inflation, reflecting liquidity-driven asset inflation. OPEN remains strongly negative in the low regime but turns inflationary in contemporaneous high-regime dynamics, indicating capital inflow sensitivity. GDP is strongly negative at level in the low regime but reverses sign under high inflation, reinforcing speculative demand effects. G is not included, suggesting limited fiscal transmission in this sector.

Overall, the results confirm a strong, heterogeneous, and regime-dependent ERPT mechanism across sectors. Exchange rate effects are systematically amplified under high-inflation expectations, with significant lagged transmission in most sectors. OPEN, OIL_INCOME, GDP, and G act as key transmission modifiers: OPEN strengthens import-driven inflation, OIL_INCOME reinforces cost-push dynamics, GDP exhibits structural regime reversals, and G amplifies demand-side inflation in several sectors. The interaction of these variables with EX confirms that ERPT is not only strong but also dynamically conditioned by macroeconomic expectations, making inflation stabilization essential for weakening exchange rate-driven inflation persistence.

Table 6. Regime-Specific Coefficients across Inflation Regimes

Dependent Variable	Threshold	Regime	Regressor	Level	Lag 1	Lag 4
PPI	21.75	Low	EX	0.155***	0.186	0.370***
		High	EX	0.132***	0.420***	0.178***
		Low	OPEN	-0.402***	-0.056	-0.384***
		High	OPEN	0.086***	-0.340***	-0.425***
		Low	OIL_INCOME	0.046***	0.089***	0.060***
		High	OIL_INCOME	0.041***	0.041***	0.024***
		Low	GDP	-0.664***	-0.100	0.551***
		High	GDP	0.925***	-0.093***	-0.761***
Agriculture	21.70	Low	EX	0.213	0.467**	0.076
		High	EX	0.132**	0.497***	0.239***
		Low	OPEN	-0.655***	-0.263***	-0.112*
		High	OPEN	-0.101***	-0.310***	-0.335***
		Low	OIL_INCOME	0.043***	-0.007	-0.002
		High	OIL_INCOME	0.040***	0.053***	0.035***
Oil & Gas	25.17	Low	EX	0.171**	-0.341***	0.350***

		High	EX	0.484***	-0.257***	0.519***
		Low	OIL_INCOME	0.054***	-0.074***	-0.022*
		High	OIL_INCOME	0.262***	0.196***	0.052***
		Low	GDP	-0.717***	0.678***	2.027***
		High	GDP	2.515***	-0.142	-1.583***
		Low	G	0.027	0.343***	0.124**
		High	G	-0.202***	-0.094***	-0.193
		Low	EX	0.271***	0.079	0.153**
		High	EX	0.053**	0.491***	0.120***
		Low	OIL_INCOME	0.032***	-0.049***	0.005
		High	OIL_INCOME	0.017***	0.019***	0.016***
		Low	OPEN	-0.485***	0.207***	0.065
Industry	23.55	High	OPEN	0.267***	-0.399***	-0.513***
		Low	GDP	-0.813***	0.614***	1.216***
		High	GDP	1.064***	-0.302***	-0.830***
		Low	G	0.088***	0.179***	0.030***
		High	G	0.110***	0.283***	-0.036*
		Low	EX	0.314***	0.293**	0.057
		High	EX	0.178***	0.460***	0.300***
Manufacturing	23.55	Low	OIL_INCOME	0.062***	-0.007	0.036***
		High	OIL_INCOME	0.033***	0.049***	0.015***

		Low	OPEN	-0.825***	0.249***	-0.079
		High	OPEN	0.385***	-0.407***	-0.581***
		Low	GDP	-1.063***	0.665***	1.148***
		High	GDP	0.508***	-0.319***	-0.606***
		Low	G	0.136***	0.178***	-0.001
		High	G	-0.073***	0.024	0.004
		Low	EX	0.234***	0.337***	-0.379***
		High	EX	0.509***	0.143	0.070***
		Low	OIL_INCOME	0.051***	-0.065***	-0.019*
Mining	24.54	High	OIL_INCOME	0.060***	-0.008**	-0.121***
		Low	G	-0.051***	0.305***	0.294***
		High	G	0.197***	0.237***	-0.200***
		Low	EX	0.393***	-0.219***	0.268***
		High	EX	0.099***	0.349***	0.102***
		Low	OIL_INCOME	0.055***	-0.026***	-0.038***
Public	25.17	High	OIL_INCOME	0.024***	0.015***	0.035***
		Low	OPEN	-0.591***	-0.061*	-0.392***
		High	OPEN	-0.212***	-0.116***	-0.211***
		Low	G	0.077***	0.285***	0.210***

		High	G	0.168***	0.153***	0.000
		Low	EX	0.148***	0.125*	0.299***
		High	EX	0.147***	0.304***	0.254***
		Low	OIL_INCOME	0.048***	0.005	-0.006
Real Estate	30.44	High	OIL_INCOME	-0.005	0.051***	0.111***
		Low	OPEN	-0.505***	-0.247***	-0.186***
		High	OPEN	0.188***	-0.281***	-0.631***
		Low	EX	0.096***	0.141***	0.324***
		High	EX	-0.029	0.466***	0.187***
		Low	OIL_INCOME	0.029***	-0.002	-0.007
Service	28.10	High	OIL_INCOME	0.033***	0.009	0.0003
		Low	OPEN	-0.284***	-0.179***	-0.210***
		High	OPEN	-0.217**	-0.132***	-0.331***

Notes: *** p<0.01, ** p<0.05, * p<0.10. The table reports the estimated coefficients under low- and high-inflation expectation regimes obtained from discrete threshold regression models.
***Source**: Research Findings*

Finally, the service sector exhibits strong Exchange Rate Pass-Through (ERPT), particularly under high inflation expectations. In the low-inflation regime, the effects are strongest at Lag 1 and Lag 4, whereas in the high-inflation regime, positive pass-through is observed primarily at Lag 1 and Lag 4. Notably, under high inflation expectations, the highest ERPT in the service sector is associated with the fourth lag, suggesting a delayed but substantial transmission of exchange rate shocks to producer prices. However, it is important to note that the overall ERPT effect in this specific high-inflation context does not reach statistical significance, indicating that while the magnitude of the pass-through is elevated at longer lags, the relationship may be influenced by other stabilizing factors or noise in the data, warranting cautious interpretation of the immediate policy implications.

Table 7. Regime-Dependent Exchange Rate Pass-Through under Low & High Inflation Expectations Regimes

Producer Price Index & Sub-sector	Low inflation regime	High inflation regime
PPI	0.525	0.730
Agriculture	0.543	0.868
Industry	0.424	0.664
Manufacturing	0.607	0.938
Mining	0.232	0.579
Oil & Gas	0.180	0.748
Public	0.232	0.579
Real Estate	0.447	0. 705
Service	0.424	0.653

Note: Values represent cumulative exchange rate pass-through coefficients derived from threshold regression models across inflation regimes.

Source: *Research Findings*

The analysis of Exchange Rate Pass-Through (ERPT) across Producer Price Index (PPI) sub-sectors reveals a general pattern of higher pass-through elasticity under the high inflation expectation regime. At the aggregate level, PPI ERPT increases substantially from 0.525 in the low-inflation regime to 0.730 in the high-inflation regime, confirming that inflationary expectations amplify the transmission of exchange rate shocks into producer prices (Table 7). This strengthening effect is observed in most sub-sectors, particularly agriculture, manufacturing, mining, oil & gas, industry, and real estate, where ERPT coefficients rise markedly in the high regime, reflecting greater price sensitivity and reduced nominal rigidity under inflationary pressures. Among these, manufacturing exhibits the highest degree of pass-through in both regimes (increasing from 0.607 to 0.938), suggesting strong integration with imported intermediate inputs and a high dependence on foreign currency pricing. Agriculture also demonstrates a pronounced increase (from 0.543 to 0.868), indicating that food production costs are highly exposed to exchange rate fluctuations, especially in inflationary environments. The oil & gas and mining sectors show relatively lower pass-through in the low regime but substantial increases under high inflation, implying nonlinear adjustment behavior consistent with threshold effects in pricing strategies. Contrary to the initial impression of a decline, the service sector actually shows a significant increase in ERPT from 0.424 to 0.653, indicating that production costs in this sector are also affected by exchange rate shocks, particularly in inflationary environments. This finding challenges the notion of complete insulation for services and suggests that even non-tradable sectors are vulnerable to external monetary pressures when inflation expectations are high. Overall, the findings confirm significant heterogeneity in ERPT across sectors and regimes, supporting the hypothesis of nonlinear and state-dependent price transmission mechanisms in the economy.

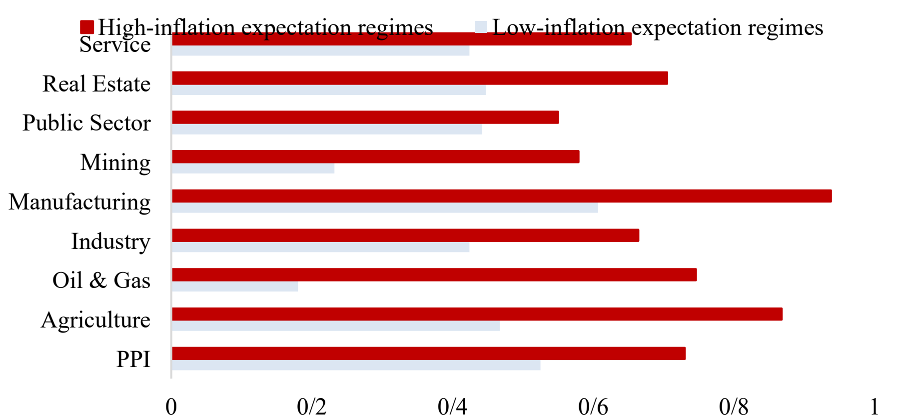
Figure 2: Comparison of exchange rate pass-through between groups in the inflation regimes

Source: *Research Findings*

5. Concluding Remarks

The empirical evidence of this study reveals a pronounced nonlinear and state-dependent exchange rate pass-through (ERPT) mechanism across PPI sub-sectors in the Iranian economy. A key finding is that ERPT is systematically stronger under high inflation expectation regimes, suggesting that inflationary expectations and expectation formation mechanisms play a central role in amplifying the transmission of exchange rate shocks into producer prices. At the aggregate level, the increase in ERPT from 0.525 in the low-inflation regime to 0.730 in the high-inflation regime indicates that Iran's production structure is highly sensitive to macroeconomic instability, particularly when inflation expectations become unanchored.

At the sectoral level, the Iranian economy exhibits substantial heterogeneity in ERPT, reflecting structural differences in import dependence, pricing behavior, and



exposure to international markets. Manufacturing and agriculture emerge as the most vulnerable sectors, exhibiting strong and persistent pass-through effects, consistent with their reliance on imported intermediate inputs, machinery, fertilizers, and feedstock. The oil & gas, mining, and industrial sectors also demonstrate significant amplification of ERPT under high inflation regimes, indicating that resource-based and tradable sectors in Iran are highly exposed to exchange rate volatility, particularly during periods of macroeconomic stress. In contrast, the services sector shows a weaker and even declining pass-through under high inflation conditions, reflecting a greater degree of domestic price formation, partial regulation, and lower integration with global input markets.

From a macroeconomic policy perspective, these findings carry important implications for Iran, where exchange rate fluctuations have historically been a key driver of inflation dynamics due to structural dependencies and external constraints. The results suggest that stabilizing inflation expectations is as important as stabilizing the nominal exchange rate itself. In the Iranian context—characterized by sanctions, oil revenue volatility, and fiscal imbalances that frequently destabilize expectations—credible, consistent, and rule-based monetary policy becomes essential. Strengthening the independence and policy credibility of the Central Bank, alongside enhancing transparency in monetary operations, can significantly reduce expectation-driven amplification of ERPT.

Moreover, exchange rate management in Iran should move beyond short-term stabilization toward a more predictable and rule-based framework. Persistent administrative interventions and the coexistence of multiple exchange rate regimes tend to increase uncertainty and intensify pass-through effects by distorting price signals. A more unified and transparent exchange rate regime, even if implemented gradually, could reduce arbitrage incentives and improve price stability across production chains. At the same time, effective coordination between fiscal and monetary authorities is crucial, as fiscal dominance has historically weakened monetary transmission mechanisms in Iran.

On the structural side, the findings highlight the urgent need to reduce import dependence in key production sectors. Iran's manufacturing and agricultural sectors are particularly exposed to foreign exchange shocks due to their reliance on imported inputs and intermediate goods. Policies aimed at strengthening domestic supply chains, supporting local production of strategic inputs, and promoting technology transfer can substantially mitigate ERPT intensity over the medium to long term. Investment in domestic industrial capacity, particularly in upstream manufacturing and agro-industrial linkages, would reduce vulnerability to exchange rate shocks.

In addition, the results suggest that inflation expectations in Iran are not merely adaptive but highly sensitive to exchange rate movements, thereby generating a feedback loop between currency depreciation and inflation acceleration. Breaking this loop requires enhancing policy credibility and addressing structural sources of macroeconomic volatility, including fiscal deficits financed through monetary expansion. The development of inflation-indexed financial instruments and more effective communication strategies by policymakers may also contribute to better anchoring of expectations.

Finally, the pronounced sectoral heterogeneity in ERPT implies that uniform policy responses are likely to be inefficient in the Iranian context. Instead, targeted and sector-specific policy interventions are recommended. For manufacturing and agriculture, priority should be given to input substitution policies, incentives for domestic production, and strategic import management. For energy-related sectors, improving export revenue stability and enhancing contract predictability can help reduce volatility spillovers. In contrast, the services sector may benefit more from productivity-enhancing reforms and digital transformation policies rather than exchange rate protection measures.

Overall, the study concludes that in the Iranian economy, exchange rate pass-through is fundamentally a regime-dependent phenomenon shaped by inflation expectations, structural import dependence, and macroeconomic credibility. Therefore, achieving sustainable inflation control in Iran requires a comprehensive policy framework that simultaneously addresses exchange rate stability, inflation expectation management, and structural production vulnerabilities.

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