HOW DOES INFLATION IN ADVANCED ECONOMIES AFFECT EMERGING MARKET BOND YIELDS?

EMPIRICAL EVIDENCE FROM TWO CHANNELS

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Sei-Wan Kim (swan@ewha.ac.kr) is a professor of economics at the Ewha Womans University, Seoul. Donghyun Park (dpark@adb.org) is an economic advisor and Shua Tian (stian@adb.org) is a senior economist at the Economic Research and Development Impact Department, Asian Development Bank.

ASIAN DEVELOPMENT BANK

6 ADB Avenue, Mandaluyong City, 1550 Metro Manila, Philippines
Tel +63 2 8632 4444; Fax +63 2 8636 2444
www.adb.org

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ABSTRACT

Increasing oil and food prices and persistent supply chain disruptions in 2022 contributed to inflation in advanced economies that had not been seen in decades. This pushed up interest rates, which in turn led to higher yields in global bond markets. This study examines two distinct channels that transmit advanced economy inflation to emerging market bond yields by employing a novel multivariable smooth transition autoregressive–vector autoregressive (STAR-VAR) model. Our empirical analysis yields two new key findings. First, advanced economy inflation has a significant effect on regime changes between expansion and contraction in emerging market bond yields. Second, the short-run effect of advanced economy inflation on the bond yields of emerging markets is asymmetric between the expansion and contraction regimes. The effect is mostly positive in both regimes but stronger in a bond yield's contraction regime. This suggests that the response of emerging market bond yields to advanced economy inflation does not necessarily follow a simple Fisher equation relationship.

Keywords: bond yields, inflation, advanced economy, emerging market, regime change, smooth transition autoregressive model

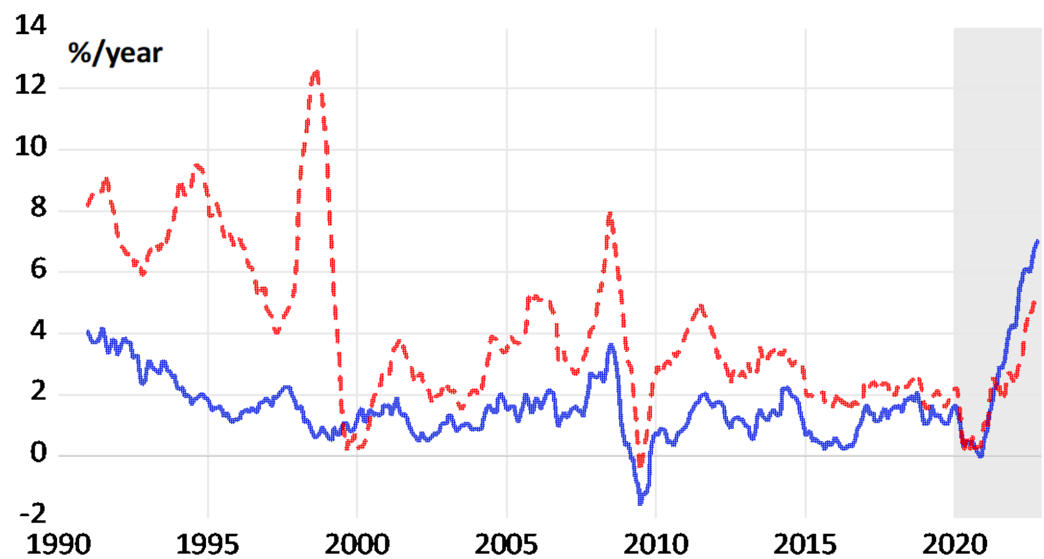
JEL codes: F14, C40, C51

1. Introduction

This study helps to fill a gap in the literature by empirically examining whether and how advanced economy inflation affects emerging market bond yields. Specifically, we investigate how inflation in the United States (US), Japan, and Germany is associated with yields on local currency bonds in seven Asia and the Pacific economies for which bond market data are available: the People's Republic of China (PRC); Hong Kong, China; Indonesia; the Republic of Korea; Malaysia; the Philippines; and Thailand.

Since the coronavirus disease (COVID-19) pandemic, advanced economies have been experiencing record-high inflation (**Figure 1**). This has prompted central banks to hike policy rates, which then pushes up short-term interest rates. In addition, high inflation causes long-term interest rates to rise reflecting changes in expected future interest rates, inflation, and inflation risk premiums (Duffee 2018; Joyce et al. 2010). Inflation implies greater uncertainty about economic growth and higher risk aversion, which also pushes up bond yields (Bekaert and Engstrom 2010).

Figure 1: Average Inflation Rate in Major Advanced Economies and Average Inflation Rate in Developing Asian Economies, January 1990–October 2022



Notes: The solid line represents the United States, Japan, and Germany. The dotted line represents the People's Republic of China; Hong Kong, China; Indonesia; the Republic of Korea; Malaysia; the Philippines; and Thailand. The gray region indicates the coronavirus disease (COVID-19) pandemic period from March 2020 onward.

Source: International Monetary Fund.

Inflation causes the entire yield curve to shift up in advanced economies. Furthermore, there are growing concerns that advanced economy inflation may transmit to emerging markets and affect their interest rate term structure. The interest rate term structure reflects market expectations of future interest rates, future inflation, inflation risk premium, and term risk premium. Therefore, higher inflation in advanced economies may influence interest rates in emerging markets through different channels. First, high inflation leads to monetary tightening in advanced economies, which can spill over to international bond markets, especially through the exchange rate channel as emerging market central banks try to stabilize currencies and capital flows (Albagli et al. 2019). Second, advanced economy inflation may imply inflationary pressure in emerging markets, potentially driven by either inflationary factors common to both emerging and advanced economies, such as global oil and food prices, or imported inflationary pressure through global value chains. Higher inflation can also trigger domestic monetary tightening in emerging markets that pushes up interest rates. Third, high inflation pushes up bond yields in advanced economies, which can spill over into and influence bond markets in emerging economies (Belke et al. 2018). Fourth, high inflation in advanced economies may be associated with a bleak economic outlook and higher risk aversion in global financial markets, which can affect bond yields in emerging markets (Bekaert and Engstrom 2010).

The literature has documented the role of inflation in the domestic interest rate term structure (e.g., Bekaert and Engstrom 2010, Duffee 2018, Joyce et al. 2010) and the spillover of advanced economy bond yields and monetary policy to emerging markets (e.g., Albagli et al. 2019, and Belke et al. 2018). However, there is no direct evidence for the link between advanced economy inflation and emerging market bond yields.

This study empirically contributes to the existing literature by incorporating two distinct features of endogenous regime changes in a smooth transition autoregressive–vector autoregressive (STAR-VAR) model. The STAR-VAR methodology enables the identification of the boom-and-bust cycles of individual bond markets based on advanced economy inflation, in contrast to previous studies that determine bond yield cycles through ad hoc definitions of bond market characteristics (Candelon et al. 2008, Edwards et al. 2003, Yu et al. 2010). Another important advantage of using the STAR-VAR model is that we can capture the potentially asymmetric effects of advanced economy inflation on emerging market bond yields. These effects can differ depending on the bond yield regime. For more appropriate regime changing characteristics, Kim et al. (2019) used a STAR model that incorporates endogenous changes of stock market regimes. They found significant differences in the degree of financial market integration between expansionary and contractionary stock market regimes across Asia and the Pacific.

Our study builds on the existing literature by employing the new STAR-VAR framework and incorporating endogenous bond market regime changes. Our empirical evidence uncovers two novel characteristics of the association between advanced economy inflation and emerging market bond yields. First, for most emerging Asian markets and for different maturities, advanced economy inflation triggers a shift in the bond market regime. Second, advanced economy inflation has an asymmetric effect on emerging market bond yields depending on whether the bond market regime of an emerging market is expansionary or contractionary. In particular, the cumulative net effect is stronger in the contractionary regimes of most emerging Asian markets.

The remainder of this paper is organized as follows. Section 2 introduces the empirical model and data. Section 3 reports and interprets the STAR-VAR estimation results together with the benchmark simple VAR estimation results. Section 4 presents our conclusions.

2. Empirical Model and Data

2.1. Smooth Transition Autoregressive Model

Given the significant evidence of inflation among linearly independent developed economies such as the US, Japan, and Germany, the most appropriate model is that where the endogenous variables adjust toward equilibrium and can be characterized by a slow regime switch triggered by the inflation of advanced economies. [1] Here, the regime

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[1] This indicates that advanced economy inflation in the United States, Japan, and Germany provides an independent shock to emerging market bond yields There are two types of nonlinear regime-switching models, depending upon the speed of transition between regimes: the threshold autoregressive model developed by (Tsay 1989) and the smooth transition autoregressive model developed by Luukkonen,

is determined by advanced economy inflation size and its sign of the deviation from the equilibrium relationship. In the empirical analysis, we thus fully account for nonlinearity and regime changes among endogenous variables.

In a linear time-series framework, this type of behavior is captured by a VAR model (Engle and Granger 1987, Hatanaka 1996, Johansen 1995).[2] Escribano and Mira (2002) extend the linear VAR to a general nonlinear VAR by employing the near epoch dependence (NED) concept suggested by Gallant and White (1988) and Wooldridge and White (1988). In particular, they find that the nonlinear VAR can be theoretically constructed by incorporating a smooth transition autoregressive model (STARM) from among many possible nonlinear parameterizations (Escribano and Mira 2002).[3]

In preliminary nonlinearity tests for Asian bond market yields, we find strong evidence in favor of smooth transition dynamics rather than a linear VAR. We therefore incorporate nonlinearity into the VAR, following recent developments in nonlinear models. Specifically, we incorporate a smooth transition mechanism into the VAR to allow for a nonlinear regime change; thus, the STAR-VAR,[4] which can be considered to be a special case of the smooth transition autoregressive model. Granger and Swanson (1996) provide a general discussion on this issue, while Escribano (1987) and Escribano and Pfann (1998) provide an early empirical example of STARM.

We now explain the specifications of the STAR-VAR model based on the PRC's 1-year maturity government bond yield ($yld1_t^{PRC}$) with five other endogenous variables: the PRC's real gross domestic product (GDP) growth ($growth_t^{PRC}$), inflation ($infla_t^{PRC}$), exchange rate (ex_t^{PRC}), the yield gap between 10-year and 1-year maturity bonds ($Yieldgap_t^{PRC}$), and the US inflation rate ($Infla_t^{US}$). A simple VAR model and a STAR-VAR

Saikkonen and Teräsvirta (1988), Teräsvirta and Anderson (1992), and Teräsvirta (1994). While the former specifies a sudden transition between regimes with a discrete jump, the latter allows a smooth transition between regimes.

[2] See also Johansen (1995) and Hatanaka (1996).

[3] For details of the proof, see section 5 in Escribano and Mira (2002).

[4] Refer to Granger and Swanson (1996) for a more general discussion and to Escribano (1987) and Escribano and Pfann (1998) for an early empirical example of nonlinear error-correcting mechanisms.

model of the PRC's 1-year maturity government bond yield ($yld1_t^1$) are compared in a general form in equations (1) and (2) as follows:

$$yld1_t^{PRC} = \phi_0 + \sum_{i=1}^{p} \phi_i^1 yld1_{t-i}^{PRC} + \sum_{i=1}^{p} \phi_i^2 growth_{t-i}^{PRC} + \sum_{i=1}^{p} \phi_i^3 infla_{t-i}^{PRC} + \sum_{i=1}^{p} \phi_i^4 ex_{t-i}^{PRC} + \sum_{i=1}^{p} \phi_i^5 Infla_{t-i}^{US} + \sum_{i=1}^{p} \phi_i^6 Yieldgap_{t-i}^{PRC} + \varepsilon_t^1 \quad (1)$$

and

$$yld1_t^{PRC} = \left[\phi_0 + \sum_{i=1}^{p} \phi_i^1 yld1_{t-i}^{PRC} + \sum_{i=1}^{p} \phi_i^2 growth_{t-i}^{PRC} + \sum_{i=1}^{p} \phi_i^3 infla_{t-i}^{PRC} + \sum_{i=1}^{p} \phi_i^4 ex_{t-i}^{PRC} + \sum_{i=1}^{p} \phi_i^5 Infla_{t-i}^{US} + \sum_{i=1}^{p} \phi_i^6 Yieldgap_{t-i}^{PRC}\right] + \left[\rho_0 + \sum_{i=1}^{p} \rho_i^1 yld1_{t-i}^{PRC} + \sum_{i=1}^{p} \rho_i^2 growth_{t-i}^{PRC} + \sum_{i=1}^{p} \rho_i^3 infla_{t-i}^{PRC} + \sum_{i=1}^{p} \rho_i^4 ex_{t-i}^{PRC} + \sum_{i=1}^{p} \rho_i^5 Infla_{t-i}^{US} + \sum_{i=1}^{p} \phi_i^6 Yieldgap_{t-i}^{PRC}\right] \cdot F(inf_{t-d}^{US}) + \varepsilon_t^1, \quad (2)$$

where $yld1_{t-i}^{PRC}$ is the PRC's 1-year maturity government bond yield, $growth_{t-i}^{PRC}$ is the PRC's real GDP growth rate, $infla_{t-i}^{PRC}$ is the PRC's inflation rate, ex_{t-i}^{PRC} is the PRC's exchange rate, $Yieldgap_{t-i}^{PRC}$ is the yield gap between 10-year and 1-year maturity bonds, and $Infla_{t-i}^{US}$ is the US inflation rate. Finally, $F(inf_{t-d}^{US})$ is the transition function.

These STAR-VAR models are specified for six emerging bond markets—the PRC; Hong Kong, China; Indonesia; the Republic of Korea; Malaysia; Thailand; and the Philippines—and four bond maturities of 1, 3, 5, and 10 years. In addition, the inflation rates of three advanced economies—the US, Japan, and Germany—are incorporated one by one. This indicates that 84 estimations are implemented based on the simple VAR in equation (1) and the STAR-VAR in equation (2).

According to the specification of the STAR-VAR model, inf_{t-d}^{US} is the common transition variable triggering regime change. Among quite a few candidates for the common transition variable, we employed three developed economies' inflation sequentially, as the focus of this study is to understand the impact of advanced economies' inflation on emerging market bond yields. Moreover, the inflation of advanced economies is the most significant variable that has a stable long-term equilibrium relationship.

For the STAR-VAR specification, two types of the transition function specification, $F(\Delta y^c_{t-d})$, are available: the logistic smooth transition VAR model (LSTAR-VAR) and the exponential smooth transition VAR model (ESTAR-VAR). The LSTAR-VAR is useful in describing a stochastic process characterized by an alternative set of dynamics of either the large or small values of the transition function.

In the LSTAR-VAR, the transition function is given by the following logistic function:[5]

$$F(\Delta y^c_{t-d}) = [1 + \exp\{-\gamma(\Delta y^c_{t-d} - c)\}]^{-1}, \gamma > 0. \qquad (3.1)$$

By contrast, the ESTAR-VAR is more appropriate for generating another dynamics of both large and small magnitudes of the transition variable. In the ESTAR-VAR model, the transition function is given by the following:[6]

$$F(\Delta y^c_{t-d}) = 1 - \exp\{-\gamma(\Delta y^c_{t-d} - c)^2\}, \gamma > 0. \qquad (3.2)$$

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[5] The logistic function, $F(\Delta y^c_{t-d})$, takes a value between 0 and 1, depending on the degree and direction by which Δy^c_{t-d} deviates from c, the switching value of the transition variable. The estimated value of c defines a transition between the two regimes: $0 < F(\Delta y^c_{t-d}) < 0.5$ (lower regime) for $\Delta y^c_{t-d} < c$; and 0.5 < $F(\Delta y^c_{t-d})$ < 1 (upper regime) for $\Delta y^c_{t-d} > c$. When $\Delta y^c_{t-d} = c$, $F(\Delta y^c_{t-d})$ = 0.5 so that the current dynamics of Δy (or the growth rate) are halfway between the upper and the lower regimes; especially, when Δy^c_{t-d} takes a large value (i.e., $\Delta y^c_{t-d} \gg c$), $\exp\{-\gamma(\Delta y^c_{t-d} - c)\}$ is close to 0. As a result, the value of $F(\Delta y^c_{t-d})$ approaches one, and the dynamics of Δy are generated by both ϕ^i_j and ρ^i_j in equation (1). In addition, for a small value of Δy^c_{t-d} (i.e., $\Delta y^c_{t-d} \ll c$), $\exp\{-\gamma(\Delta y^c_{t-d} - c)\}$ is close to a big number. Then the value of the transition function $F(\Delta y^c_{t-d})$ approaches 0, and the dynamics of Δy_t are generated by only the ϕ^i_j parameter in equation (1).

[6] For a large or a small value of Δy^c_{t-d}, the value of $exp\{-\gamma(\Delta y^c_{t-d} - c)^2\}$ approaches 0, and the value of the transition function approaches 1. The dynamics of Δy_t are generated by both ϕ^i_j and ρ^i_j in equation (2). When the value of Δy^c_{t-d} is close to c, the value of $exp\{-\gamma(\Delta y^c_{t-d} - c)^2\}$ approaches 1, and the value of the transition function approaches 0. In these cases, the dynamics of Δy_t are generated only by the ϕ^i_j parameters in equation (2).

Here, the adjustment parameter γ in both models represents the speed of transition between the two regimes: the greater the value of γ, the faster the transition between the regimes. At the limit, as the value of γ approaches infinity, the model degenerates into the conventional threshold autoregressive model (Tsay 1989) or the Markov regime switching model. Alternatively, if γ approaches 0 so that the value of the transition function, $F(\Delta y^c_{t-d})$, approaches 0, then the model degenerates into a linear VAR model, with ρ^i_j parameters that are unidentifiable in model (2).

2.2. Data

We employed monthly government bond yield data from the Asian Development Bank (ADB) for seven emerging Asian markets: the PRC; Hong Kong, China; Indonesia; the Republic of Korea; Malaysia; the Philippines, and Thailand. There are four different maturities bonds: 1 year, 3 years, 5 years, and 10 years. The Consumer Price Index (CPI) of each emerging economy was also retrieved from the ADB data archive. The CPI for the three advanced economies (the US, Japan, and Germany) were also employed from the International Monetary Fund data archive. In line with data availability, we chose the data range January 1, 1990–February 28, 2022 for all economies except Malaysia (whose data start from October 1999). Each CPI was transformed into its logarithmic value for inflation, and the monthly changes in each variable were obtained as the log differences.[7] The real GDP growth rate and exchange rate for the seven emerging markets were also retrieved from the ADB data archive. **Table 1** presents the summary statistics for the data employed in this study.

There is a common misunderstanding that inflation among advanced economies is highly correlated and therefore generates a common factor. According to preliminary empirical tests, however, inflation in advanced economies is neither highly correlated nor generates common principal components during the review period. This means that the inflation rates of the three advanced economies–the US, Japan, and Germany–are not highly correlated. Also no single advanced economy's inflation or a linear combination of

[7] For each time-series, a Dicky-Fuller test was conducted to confirm the non-stationarity of the data; the results are not reported in the paper due to space limitations, but are available upon request.

two developed economies' inflation rates dominate the explanation power. It further indicates that the three advanced economies' inflation rates should be considered separately in empirical work.

Table 1: Summary Statistics

	Economy	Mean (%)	Standard Deviation (%)	Data Range
1-Year Bond Yield	PRC	2.5913	0.7052	2005.11–2021.12
	Hong Kong, China	1.9568	2.1741	1998.03–2021.12
	Indonesia	6.8553	2.2250	2003.05–2021.12
	Republic of Korea	3.5542	2.0414	1999.03–2021.12
	Malaysia	2.2247	0.5764	2019.06–2021.12
	Philippines	5.7452	3.8498	1998.07–2021.12
	Thailand	2.3928	1.1185	2000.01–2021.12
3-Year Bond Yield	PRC	2.9259	0.6045	2005.11–2021.12
	Hong Kong, China	2.3650	2.1608	1998.03–2021.12
	Indonesia	7.7890	2.2309	2002.12–2021.12
	Republic of Korea	3.7988	1.9835	1998.10–2021.12
	Malaysia	3.2509	0.4550	1999.10–2021.12
	Philippines	9.4347	1.1548	2020.07–2021.12
	Thailand	2.9852	1.2200	2000.01–2021.12
5-Year Bond Yield	PRC	3.1386	0.5329	2005.11–2021.12
	Hong Kong, China	2.7191	2.1637	1998.03–2021.12
	Indonesia	8.3785	2.5336	2002.12–2021.12
	Republic of Korea	4.0207	2.0587	1999.03–2021.12
	Malaysia	3.5731	0.5497	1999.10–2021.12
	Philippines	8.4609	4.7509	1998.07–2021.12
	Thailand	3.6633	1.3648	2000.01–2021.12
10-Year Bond Yield	PRC	3.4759	0.4634	2005.11–2021.12
	Hong Kong, China	3.2474	2.1787	1998.03–2021.12
	Indonesia	8.7504	2.3496	2003.07–2021.12
	Republic of Korea	3.9501	1.6257	2001.01–2021.12
	Malaysia	4.0603	0.6730	1999.10–2021.12
	Philippines	8.3027	4.7567	1998.07–2021.12
	Thailand	3.2599	5.9132	1990.01–2021.12
Real GDP Growth	PRC	9.2795	3.0476	1992.01–2021.10
	Hong Kong, China	3.3714	3.9714	1990.01–2021.10
	Indonesia	4.3881	4.2311	1994.01–2021.10
	Republic of Korea	4.9619	3.6940	1990.01–2021.10
	Malaysia	4.3188	3.8562	2001.01–2021.10
	Philippines	4.1757	3.6174	1990.01–2021.10
	Thailand	3.2476	4.3862	1994.01–2021.10

	Economy	Mean (%)	Standard Deviation (%)	Data Range
Exchange Rate	PRC	7.1505	1.0635	1990.01–2021.12
	Hong Kong, China	7.7704	0.0295	1990.01–2021.12
	Indonesia	9057.4390	3996.2520	1991.11–2021.12
	Republic of Korea	1054.9950	184.2806	1990.01–2021.12
	Malaysia	3.4436	0.5805	1990.01–2021.12
	Philippines	43.4733	9.5846	1991.11–2021.12
	Thailand	12.5646	4.9409	2006.06–2021.12
Inflation	PRC	0.3173	0.9129	1990.02–2021.04
	Hong Kong, China	0.2522	0.7772	1990.02–2021.04
	Indonesia	0.6898	1.2354	1990.02–2021.05
	Republic of Korea	0.2710	0.4478	1990.02–2021.05
	Malaysia	0.2108	0.4412	1990.02–2021.03
	Philippines	0.4520	0.5807	1990.02–2021.03
	Thailand	0.2309	0.5213	1990.02–2021.04
	United States	0.1980	0.3267	1990.02–2021.04
	Japan	0.0335	0.3399	1990.02–2021.04
	Germany	0.1479	0.3513	1990.02–2021.04

GDP = gross domestic product, PRC = People's Republic of China.

Source: Asian Bonds Online.

3. Estimation Results

3.1. Simple Linear VAR Estimation Results

In the first part of our empirical work, we estimated simple linear VAR models for seven emerging markets in Asia and four different government bond maturities. These simple VAR empirical results provide the benchmarks for our nonlinear STAR-VAR estimation in the next section.

By following standard VAR specifications, the simple linear VAR model of the PRC's 1-year maturity government bond yield ($yld1_t^{PRC}$) is provided in a general form by equation (4) as follows:

$$yld1_t^{PRC} = [\phi_0 + \sum_{i=1}^{p} \phi_i^1 yld1_{t-i}^{PRC} + \sum_{i=1}^{p} \phi_i^2 growth_{t-i}^{PRC} + \sum_{i=1}^{p} \phi_i^3 infla_{t-i}^{PRC} + \sum_{i=1}^{p} \phi_i^4 ex_{t-i}^{PRC}$$

$$+\sum_{i=1}^{p} \phi_i^5 Infla_{t-i}^{US} + \sum_{i=1}^{p} \phi_i^6 Yieldgap_{t-i}^{PRC}] + \varepsilon_t^1, \quad (4)$$

where $yld1_{t-i}^{PRC}$ is the PRC's 1-year maturity government bond yield, $growth_{t-i}^{PRC}$ is real GDP growth, $infla_{t-i}^{PRC}$ is inflation, ex_{t-i}^{PRC} is the exchange rate, $Yieldgap_{t-i}^{PRC}$ is the yield gap between 10-year and 1-year maturity bonds, and $Infla_{t-i}^{US}$ is the US inflation rate.

Because the empirical results of linear VAR estimations are too voluminous, it is not feasible to interpret the entire empirical results in a single form for seven emerging bond markets, three advanced economies, and four different maturities of bonds.[8] Therefore we summarized the empirical results in terms of the cumulative net effect. This basically assesses the effect of the Granger-causing variable (i.e., an advanced economy's inflation such as $Infla_{t}^{US}$) on the Granger-caused variable (i.e., an emerging market's bond yield like $yld1_{t}^{PRC}$) over lagged periods.

Gauging the cumulative net effect of three advanced economies' inflation on emerging markets bond yields was implemented in two steps. In the first step, we tested whether an advanced economy's inflation has a significant Granger causation on an emerging market's bond yields. For example, whether US inflation ($Infla_{t}^{US}$) has a Granger causation on the PRC's 1-year bond yield ($yld1_{t}^{PRC}$) can be tested by the null hypothesis of $H_0\colon \phi_1^5 = \phi_2^5 = \phi_3^5 = \phi_4^5 = 0$ in the linear VAR estimation equation of

$$yld1_t^{PRC} = [\phi_0 + \sum_{i=1}^{p} \phi_i^1 yld1_{t-i}^{PRC} + \sum_{i=1}^{p} \phi_i^2 growth_{t-i}^{PRC} + \sum_{i=1}^{p} \phi_i^3 infla_{t-i}^{PRC} + \\ + \sum_{i=1}^{p} \phi_i^4 ex_{t-i}^{PRC} + \sum_{i=1}^{p} \phi_i^5 Infla_{t-i}^{US} + \sum_{i=1}^{p} \phi_i^6 Yieldgap_{t-i}^{PRC}] + \varepsilon_t^1.$$

Given that the null hypothesis is not significantly accepted or that Granger causality is accepted, we moved to the second step of the cumulative net effect estimation. In the second step, we tested the null hypothesis of the null hypothesis $H_0\colon \phi_1^5 + \phi_2^5 + \phi_3^5 + \phi_4^5 = 0$. For the cases where the null hypothesis was not accepted, we assessed the cumulative net effect by adding up the coefficients of the Granger causing variable ($Infla_t^{US}$) $\sum_{i=1}^{4} \phi_i^5$. The cumulative net effect of US inflation ($Infla_t^{US}$) on the PRC's 1-year bond yield ($yld1_t^{PRC}$) was estimated by adding up the coefficients in equation (4).

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[8] There are 84 separate equations of estimation in each of simple VAR model and nonlinear STAR-VAR model empirical results.

Table 2: Estimation of Linear VAR—Effect of Inflation in the US, Japan, and Germany on 1-Year, 3-Year, 5-Year, and 10-Year Government Bonds in the PRC, 1999–2021

	1-Year Government Bond Yield (yld1)	**3-Year Government Bond Yield** (yld3)	**5-Year Government Bond Yield** (yld5)	**10-Year Government Bond Yield** (yld10)
$\phi^{US}{}_1$	0.0496 (0.4966)	0.1241* (0.0516)	0.0293 (0.3314)	0.0387* (0.0745)
$\phi^{US}{}_2$	–0.0363 (0.5978)	–0.0908* (0.0736)	–0.0694 (0.1198)	–0.0669* (0.0534)
$\phi^{US}{}_3$	0.0486 (0.4675)	0.0666 (0.2138)	0.0370 (0.2883)	0.0340 (0.2754)
$\phi^{US}{}_4$	0.1301** (0.0399)	0.0056 (0.9067)	–0.0087 (0.6731)	–0.0077 (0.6375)
$\phi^{JP}{}_1$	0.0389 (0.5575)	0.0899* (0.0893)	0.1075* (0.056)	0.0511 (0.2635)
$\phi^{JP}{}_2$	0.0265 (0.6549)	–0.0596 (0.1823)	–0.1871** (0.0152)	–0.0883 (0.1719)
$\phi^{JP}{}_3$	0.1251** (0.0243)	0.0668 (0.1889)	0.1147 (0.1196)	0.0798 (0.2951)
$\phi^{JP}{}_4$	0.0312 (0.5549)	–0.0369 (0.3946)	–0.0757 (0.1247)	–0.0719 (0.2182)
$\phi^{GR}{}_1$	0.0091 (0.8657)	0.0519 (0.2222)	0.0629 (0.1057)	0.0660** (0.0377)
$\phi^{GR}{}_2$	–0.0903* (0.0916)	–0.0382 (0.3439)	–0.1028** (0.0282)	–0.0965** (0.0266)
$\phi^{GR}{}_3$	0.0291 (0.5947)	–0.0328 (0.4645)	0.0277 (0.5938)	0.0274 (0.4999)
$\phi^{GR}{}_4$	0.1331** (0.0284)	0.0693 (0.1387)	0.0184 (0.6714)	0.0278 (0.4132)

PRC = People's Republic of China, US = United States, VAR = vector autoregression.

Notes: The values in parentheses below the regression coefficients are the heteroskedasticity robust t-statistics-based p-values. *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively. The full results for all parameter estimates are not presented due to space limitations, but are available upon request.

Source: Authors' calculations.

In simple linear VAR estimation results for the PRC's 1-year maturity bond in **Table 2**, we demonstrate a numerical example of the cumulative net effect of US inflation as follows. In the first step of Granger causality, a null hypothesis of $H_0: \phi_1^{US} = \phi_2^{US} = \phi_3^{US} = \phi_4^{US} = 0$ was not accepted at the 10% significance level. In the second step, another null hypothesis of $H_0: \phi_1^{US} + \phi_2^{US} + \phi_3^{US} + \phi_4^{US} = 0$ was tested and not accepted at the 5% significance level. Finally, we added up the US inflation coefficients and the US inflation cumulative net effect over 4 months, which was estimated as 0.1920. Likewise, we carried out estimations of cumulative net effects of the inflation of three advanced economies on seven emerging markets and four different maturity bond yields. We report the simple linear VAR estimation cumulative net effects in **Table 3**.

The major empirical results for the cumulative net effects are summarized as follows. For the 1-year bond yield of the PRC, the inflation rate of all three advanced economies had a significant effect (or Granger cause). Japan's inflation demonstrated a significant impact on Hong Kong, China's bond yields for 1-year, 3-year, and 5-year maturities. US inflation also demonstrated a significant effect on all the maturities bond yields of Indonesia. In the Republic of Korea's bond market, US inflation had a significant effect on 1-year and 10-year bond yields. The Philippines' bonds yields were affected relatively more by Japan's inflation, with a significant effect from Japanese inflation on the Philippines' 1-year, 5-year, and 10-year bond yields. In addition, Japan's inflation demonstrated a significant effect on Thailand's 3-year, 5-year, and 10-year bond yields.

To summarize our linear VAR empirical results, it is evident that the three advanced economies' inflations have a significant impact on emerging Asian bond yields. However, their effects on the seven different emerging markets and four different maturity bond yields were diverse and did not present a clear pattern.

To visualize the cumulative net effect results in the linear VAR models, **Figure 2** shows the impact of the three advanced economies' inflation on seven emerging markets' bond yields. For example, in panel (1), Japan's inflation has a greater cumulative net effect on the 1-year bond yield in the PRC (represented by thicker arrows from Japan's inflation circle to the PRC's 1-year bond yield circle). Instead we find Germany's inflation (thinner arrow) to the PRC's 1-year bond yield circle indicating a relatively weaker effect.

Table 3. The Effect of Inflation in the United States, Japan, and Germany on Emerging Asian Bond Yields—Cumulative Net Effect in Simple Linear VAR

1) People's Republic of China

	1-Year Government Bond Yield (yld1)	3-Year Government Bond Yield (yld3)	5-Year Government Bond Yield (yld5)	10-Year Government Bond Yield (yld10)
United States	0.1301	0.0333	---	–0.0282
Japan	0.1251	0.0899	–0.0796	---
Germany	0.0428	---	–0.1028	–0.0305

2) Hong Kong, China

	1-Year Government Bond Yield (yld1)	3-Year Government Bond Yield (yld3)	5-Year Government Bond Yield (yld5)	10-Year Government Bond Yield (yld10)
United States	---	---	---	---
Japan	–0.1709	---	0.0306	0.0546
Germany	–0.1379	---	---	---

3) Indonesia

	1-Year Government Bond Yield (yld1)	3-Year Government Bond Yield (yld3)	5-Year Government Bond Yield (yld5)	10-Year Government Bond Yield (yld10)
United States	0.7388	0.7716	0.1737	0.1933
Japan	0.2199	0.4900	0.2902	0.3408
Germany	0.2955	0.3235	---	0.2115

4) Republic of Korea

	1-Year Government Bond Yield (yld1)	3-Year Government Bond Yield (yld3)	5-Year Government Bond Yield (yld5)	10-Year Government Bond Yield (yld10)
United States	0.1783	---	---	–0.0472
Japan	---	–0.1185	---	---
Germany	0.1696	---	---	---

5) Malaysia

	1-Year Government Bond Yield (yld1)	3-Year Government Bond Yield (yld3)	5-Year Government Bond Yield (yld5)	10-Year Government Bond Yield (yld10)
United States	---	---	0.0337	---
Japan	---	---	---	---
Germany	---	---	---	---

6) Philippines

	1-Year Government Bond Yield (yld1)	3-Year Government Bond Yield (yld3)	5-Year Government Bond Yield (yld5)	10-Year Government Bond Yield (yld10)
United States	0.5223	---	---	---
Japan	–0.3749	---	–0.177	–0.1307
Germany	---	---	---	---

7) Thailand

	1-Year Government Bond Yield (yld1)	3-Year Government Bond Yield (yld3)	5-Year Government Bond Yield (yld5)	10-Year Government Bond Yield (yld10)
United States	–0.151	0.0631	---	---
Japan	---	–0.1286	0.1705	0.2330
Germany	---	---	–0.0926	---

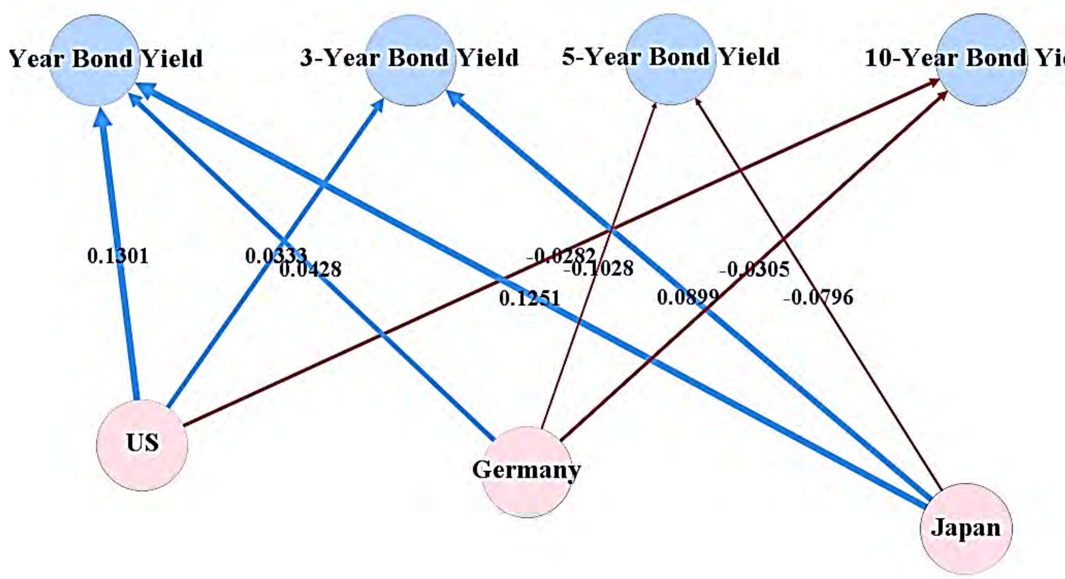
VAR = vector autoregression.

Note: --- indicates significant Granger causality is not found at 10% level.

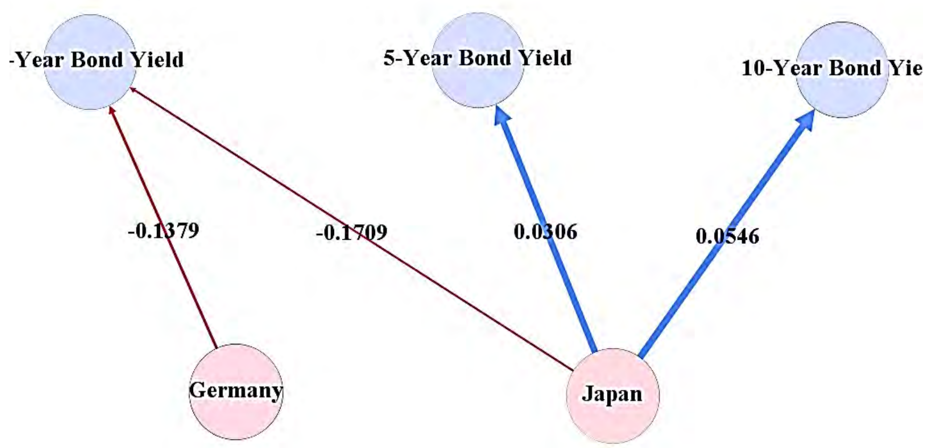
Source: Authors' calculations.

Figure 2: The Effect of Inflation in the United States, Japan, and Germany on Emerging Asian Bond Yields—Cumulative Net Effect in Simple Linear VAR

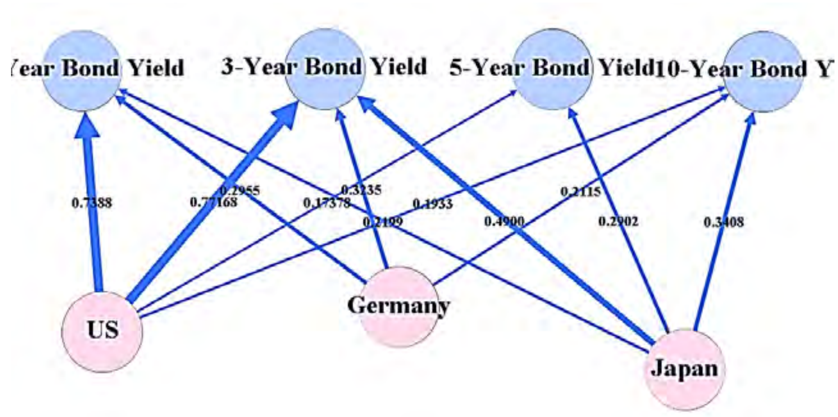
1) People's Republic of China



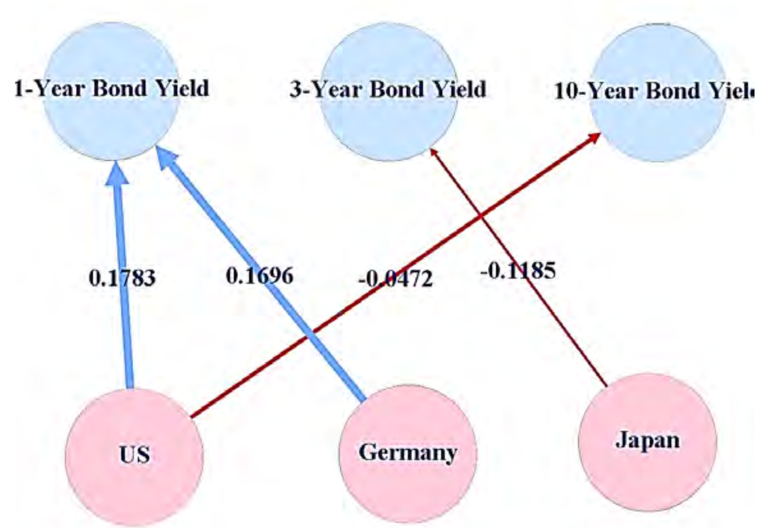
2) Hong Kong, China



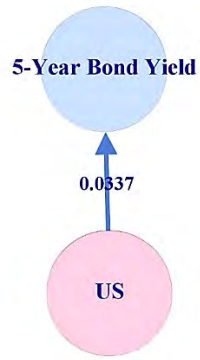
3) Indonesia



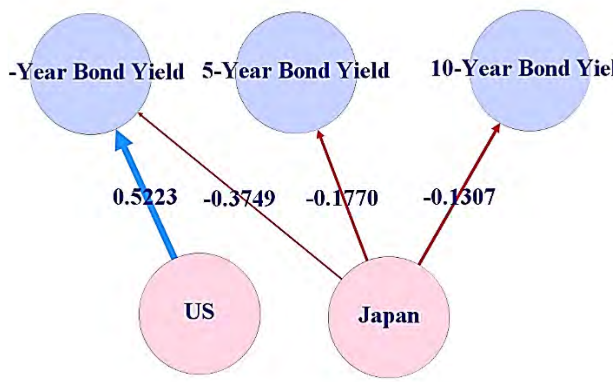
4) Republic of Korea



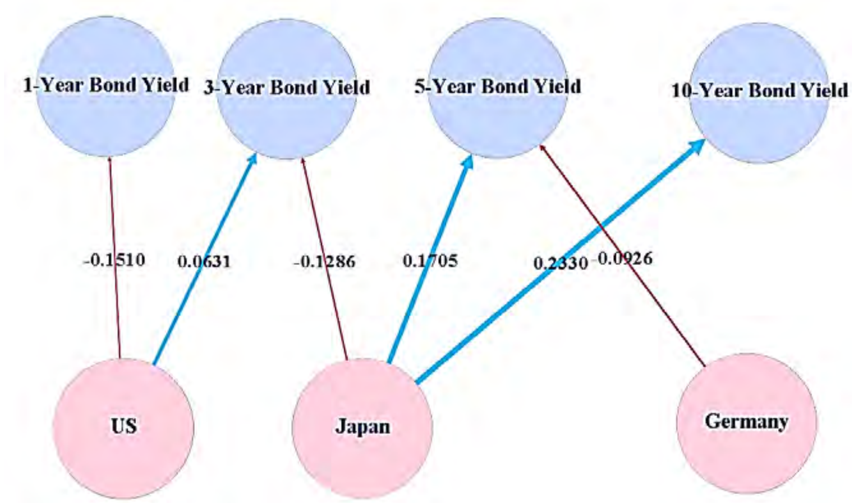
5) Malaysia



6) Philippines



7) Thailand



US = United States, VAR = vector autoregression.

Source: Authors' calculations.

3.2. Nonlinear STAR-VAR Estimation Results

The empirical results in this section comprise the key findings of this study. In each of the 84 estimations, the logistic STAR-VAR or LSTAR-VAR was chosen based on the procedure of Teräsvirta and Anderson (1992) at the 10% significance level. As a part of the full LSTAR-VAR estimation for the PRC, the effects of inflation in the US, Japan, and Germany on 1-year, 3-year, 5-year, and 10-year bond yields are reported in **Table 4**.

We summarize the results for all (seven emerging markets and four different bond yields) LSTAR-VAR estimation as follows. First, the significance of the γ-parameter is crucial in estimating the STAR model because it provides evidence of the validity of the STAR model specification compared to the other regime-switching models (e.g., the Markow switching model). Most of the γ estimates are significant with a few exceptions. This also means that, as a first channel of impact of an advanced economy's inflation on emerging market bond yields, inflation triggers regime change among emerging market bond yields between expansionary and contractionary regimes. We find that the value of the γ-parameter, representing the speed of regime shift, is positive and significant at the 10% level with an average of 6.8294 in 28 independent LSTAR-VAR estimations for seven emerging markets and four different bonds.

In interpreting the γ estimate, a higher estimate indicates a faster regime shift between expansion and contraction. One distinct pattern of γ estimates is that for bond yields of less than less than 3 years maturity, the value of the γ-parameter shows that the yield undergoes a relatively quicker transition between the two regimes, while bond yields of more than 5 years display relatively slower and less frequent transitions between the two regimes. For the impact of US inflation on the PRC's bonds yields, for example, the γ-parameter estimates are 8.3953, 7.9945, and 6.7019 for the 1-year, 3-year, and 5-year yields, respectively. Thus, the 1-year bond yield's higher γ estimate of 8.3953 represents a relatively faster regime transition. We find a similar pattern across all seven emerging market bond yields. In the case of the impact of US inflation on Thailand's bonds yields, the γ-parameter estimates are 19.7159, 11.2365, and 10.5048 for the 1-year, 3-year, and 10-year yields, respectively. The decline of γ estimates over longer maturities indicates shorter maturity bond yields' faster regime transition. We believe this pattern of γ estimates is related to different trading volumes for different maturity bonds. Because shorter maturity bonds have larger trading sizes, emerging market short-term bond yields respond more quickly than longer-term ones to an inflation shock from advanced economies. The *c*-parameter indicates a halfway point between the expansionary and contractionary phases of yields with an average of 0.0779.

Table 4: Estimation of Nonlinear LSTAR-VAR—Effect of Inflation in the United States, Japan, and Germany Inflation on 1-Year, 3-Year, 5-Year, and 10-Year Bond Yields in the PRC, 1999–2021

	1-Year Government Bond Yield (yld1)	3-Year Government Bond Yield (yld3)	5-Year Government Bond Yield (yld5)	10-Year Government Bond Yield (yld10)
$\phi^{US}{}_1$	0.3188*** (0.0029)	0.5006*** (0.0000)	0.5883*** (0.0000)	N.A.
$\phi^{US}{}_2$	–0.1621* (0.0541)	–0.1538** (0.0107)	–0.2702*** (0.0000)	N.A
$\phi^{US}{}_3$	0.1276 (0.2745)	0.0609 (0.5918)	0.1136 (0.1356)	N.A.
$\phi^{US}{}_4$	0.1619* (0.0621)	0.1280 (0.1480)	0.1219* (0.0536)	N.A.
$\rho^{US}{}_1$	–0.0427** (0.0143)	–0.2397*** (0.0015)	–0.5459*** (0.0000)	N.A.
$\rho^{US}{}_2$	0.1772 (0.1865)	0.0861 (0.3509)	0.2384*** (0.0048)	N.A.
$\rho^{US}{}_3$	–0.1681 (0.2858)	–0.0226 (0.8647)	–0.1377 (0.1696)	N.A.
$\rho^{US}{}_4$	–0.0697 (0.5619)	–0.0999** (0.0247)	0.2068** (0.0202)	N.A.
γ	8.3953** (0.0413)	7.9945* (0.0629)	6.7019* (0.0991)	N.A.
c	–0.1113*** (0.0000)	–0.1058*** (0.0000)	–0.0977*** (0.0000)	N.A.
$\phi^{GR}{}_1$	–0.2077 (0.3177)	0.0147 (0.8994)	0.1205* (0.0918)	0.0902 (0.1597)
$\phi^{GR}{}_2$	–0.1416 (0.2948)	–0.0526 (0.5154)	–0.0300 (0.5891)	0.0092 (0.8588)
$\phi^{GR}{}_3$	0.2591** (0.0483)	–0.0533 (0.5257)	–0.0695 (0.3072)	–0.0366 (0.4745)
$\phi^{GR}{}_4$	0.4185*** (0.0090)	0.2054** (0.0144)	0.1718*** (0.0070)	0.4976** (0.0243)
$\rho^{GR}{}_1$	–0.0066 (0.9705)	–0.1649 (0.2010)	–0.2774* (0.0622)	–0.2045* (0.0829)
$\rho^{GR}{}_2$	0.0498 (0.7646)	0.0108 (0.9218)	–0.0575 (0.4766)	–0.1628** (0.0489)
$\rho^{GR}{}_3$	–0.2982* (0.0818)	0.0227 (0.8481)	0.0713 (0.4616)	–0.0010 (0.9898)
$\rho^{GR}{}_4$	–0.3513* (0.0958)	–0.1765 (0.1832)	–0.2047** (0.0248)	0.1373 (0.1488)
γ	12.2539* (0.0556)	13.7284** (0.0374)	3.3032 (0.6956)	9.8076* (0.0538)
c	–0.0092 (0.8955)	0.1261** (0.0433)	0.1864*** (0.0005)	0.2069*** (0.0000)

	1-Year Government Bond Yield (yld1)	3-Year Government Bond Yield (yld3)	5-Year Government Bond Yield (yld5)	10-Year Government Bond Yield (yld10)
$\phi^{JP}{}_1$	–0.5053 (0.1964)	0.8013*** (0.0000)	0.0605 (0.3322)	0.0329 (0.4264)
$\phi^{JP}{}_2$	0.8659** (0.0306)	0.0115*** (0.0000)	–0.0469 (0.3416)	–0.0771 (0.1350)
$\phi^{JP}{}_3$	0.6731*** (0.0000)	0.0996** (0.0377)	–0.0223 (0.7529)	–0.0092 (0.8978)
$\phi^{JP}{}_4$	0.7476 (0.2325)	0.4725*** (0.0000)	0.2005* (0.0639)	0.1059* (0.0841)
$\rho^{JP}{}_1$	0.3981 (0.3056)	–0.7919*** (0.0000)	0.3309*** (0.0055)	0.1355 (0.3183)
$\rho^{JP}{}_2$	0.8875** (0.0292)	0.9706*** (0.0000)	–0.0502 (0.8115)	0.0778 (0.8532)
$\rho^{JP}{}_3$	–0.5662*** (0.0008)	–0.0215 (0.7682)	–0.2294** (0.0110)	0.1443 (0.4913)
$\rho^{JP}{}_4$	–0.7552 (0.2351)	–0.5384*** (0.0000)	0.0529 (0.6907)	–0.0616 (0.7671)
γ	26.2243** (0.0337)	12.4164* (0.0813)	10.0059* (0.0732)	6.3892*** (0.0006)
c	–0.2942*** (0.0000)	–0.2369 (0.1032)	0.1758*** (0.0000)	0.3522*** (0.0000)

N.A. = sufficient data not available.

Notes: The values in parentheses below the regression coefficients are the heteroskedasticity robust t-statistics based p-values; *, **, and *** represent significance at the 10%, 5%, and 1% levels, respectively. The full results for all parameter estimates are not presented due to space limitations, but are available upon request.

Source: Authors' calculations.

Here, we report the cumulative net effect of the nonlinear LSTAR-VAR estimation results across seven emerging bond markets, three advanced economies, and four different maturities of bonds. Given the estimation results of the linear LSTAR-VAR in the previous section, we are interested in gauging the cumulative net effect to evaluate the total net effect of Granger-causing three advanced economies' inflation on the Granger-caused variables of four bond yields throughout a certain time period. In the nonlinear LSTAR-VAR model estimation results, we obtained the cumulative net effect in the following way. For example, the cumulative net effect of US inflation ($Infla_t^{US}$) on the PRC's 1-year bond yield ($yld1_t^{China}$) can be measured by adding up the coefficients in the estimation equation of

$$yld1_t^{PRC} = \left[\phi_0 + \sum_{i=1}^{p}\phi_i^1 yld1_{t-i}^{PRC} + \sum_{i=1}^{p}\phi_i^2 growth_{t-i}^{PRC} + \sum_{i=1}^{p}\phi_i^3 infla_{t-i}^{PRC} + \sum_{i=1}^{p}\phi_i^4 ex_{t-i}^{PRC} + \sum_{i=1}^{p}\phi_i^5 Infla_{t-i}^{US} + \sum_{i=1}^{p}\phi_i^6 Yieldgap_{t-i}^{PRC}\right] + \left[\rho_0 + \sum_{i=1}^{p}\rho_i^1 yld1_{t-i}^{PRC} + \sum_{i=1}^{p}\rho_i^2 growth_{t-i}^{PRC} + \sum_{i=1}^{p}\rho_i^3 infla_{t-i}^{PRC} + \sum_{i=1}^{p}\rho_i^4 ex_{t-i}^{PRC} + \sum_{i=1}^{p}\rho_i^5 Infla_{t-i}^{US} + \sum_{i=1}^{p}\phi_i^6 Yieldgap_{t-i}^{PRC}\right] \cdot F(inf_{t-d}^{US}) + \varepsilon_t^1.$$

Under the condition that $Infla_t^{US}$ has a significant Granger causation on $yld1_t^{PRC}$, we tested the null hypothesis, $H_0: \phi_1^5 + \phi_2^5 + \phi_3^5 + \phi_4^5 = 0$. For the cases where the null hypothesis was not accepted at the 10% significance level, we assessed the cumulative net effect by adding up the coefficients of the Granger causing variable ($Infla_t^{US}$) $\sum_{i=1}^{4} \phi_i^5$ in the contraction regime when the transition function value becomes 0 and $\sum_{i=1}^{4} \phi_i^5 + \rho_i^5$ in the expansionary regime when the transition function value becomes one. We report all cumulative net effects in **Table 5**.

In addition, **Figure 3** presents the visualized massive and complicated cumulative net effect empirical results in the nonlinear STAR-VAR models for all seven emerging markets. For example, in the PRC's case, Japan's inflation has a stronger cumulative net effect on 1-year bond yield in the expansionary regime (represented by the thicker arrow from Japan's inflation circle to the PRC's 1-year bond yield circle). In the expansionary regime, however, Japan's inflation has a larger impact on 1-year and 3-year bond yields represented by thicker arrows.

The second channel of the effect of advanced economies' inflation on emerging market bond yields is further investigated by comparing the expansionary and contractionary regimes' cumulative net effect and Granger causation from inflation to bond yields. The effect of advanced economies' inflation on emerging market bond yields is mostly positive during both the expansionary and contractionary regimes, but it is weaker in expansionary regimes in terms of the cumulative net effect. This novel empirical finding indicates that emerging market government bond yields' responses to advanced economies' inflation do not necessarily follow a simple fixed Fisher equation relationship. The Fisher relationship between an advanced economy's inflation and an emerging market's bond yields significantly varies by regime.

To illustrate, the cumulative net effect of US inflation on 1-year bond yields is 0.1567 in the contraction regime and 0.1140 in the expansionary regime. We also find the asymmetric impact of US inflation on the PRC's 3-year and 5-year bond yields. The cumulative net effect of US inflation on 3-year bond yields is 0.3486 in the contraction regime and 0.0072 in the expansionary regime. For 5-year bond yields, it is 0.4400 in the contraction regime and 0.1009 in the expansionary regime. As another example of the asymmetric effects, we examined the Republic of Korea's bond market. The cumulative net effect of US inflation on the Republic of Korea's 1-year bond yields is 0.2263 in the contraction regime and 0.0664 in the expansionary regime. US inflation also has an asymmetric impact on the Republic of Korea's 3-year, 5-year, and 10-year bond yields. The cumulative net effect on 3-year bond yields is 0.1939 in the contraction regime and 0.1408 in the expansionary regime. For 5-year bond yields, it is 0.7868 in the contraction regime and 0.6934 in the expansionary regime. For 10-year bond yields, it is 0.0883 and 0.0394 in the contraction and expansion regimes, respectively.

In nonlinear LSTAR-VAR estimation results, we found that the inflation of advanced economies has asymmetric cumulative net effects on emerging market bond yields in seven economies and across four different maturities, which is not reported in previous works. In addition, against previous estimation results of linear VAR, we argue that advanced economies' inflation could plausibly generate asymmetric impacts on emerging market bond yields depending on market regimes.

The empirical evidence we present is also consistent with the idea that the nonlinear LSTAR-VAR model is the more appropriate specification for investigating the impact of both bond market regime changes in the long run and the cumulative net effect in the short run.

Table 5: The Effect of Inflation in the United States, Japan, and Germany on Emerging Asian Market Bond Yields—Cumulative Net Effect in Nonlinear STAR-VAR

1) People's Republic of China

Regime		1-Year Government Bond Yield (yld1)	3-Year Government Bond Yield (yld3)	5-Year Government Bond Yield (yld5)	10-Year Government Bond Yield (yld10)
Contraction	**US**	0.4462	0.5357	0.5536	---
	Japan	1.7813	1.3849	0.1918	0.0525
	Germany	0.3283	0.1142	0.1928	0.5604
Expansion	**US**	0.3429	0.2596	0.3152	---
	Japan	1.7455	1.0037	0.296	0.0525
	Germany	–0.278	0.1142	–0.2755	0.3294

2) Hong Kong, China

Regime		1-Year Government Bond Yield (yld1)	3-Year Government Bond Yield (yld3)	5-Year Government Bond Yield (yld5)	10-Year Government Bond Yield (yld10)
Contraction	**US**	---	0.4436	---	-0.1361
	Japan	0.1736	---	0.3335	0.5297
	Germany	0.3394	0.3734	0.5311	0.1699
Expansion	**US**	0.8044	0.7148	---	0.0719
	Japan	0.3059	---	2.3298	0.1287
	Germany	0.6565	0.3415	0.3135	–0.5378

3) Indonesia

Regime		1-Year Government Bond Yield (yld1)	3-Year Government Bond Yield (yld3)	5-Year Government Bond Yield (yld5)	10-Year Government Bond Yield (yld10)
Contraction	**US**	0.6631	0.8092	1.3673	1.4636
	Japan	---	0.7914	---	0.2782
	Germany	---	0.4944	1.3699	0.5744
Expansion	**US**	–0.0817	–0.5791	0.3753	0.8058
	Japan	0.4929	0.7914	---	0.6012
	Germany	1.0144	1.0973	1.4106	0.4406

4) Republic of Korea

Regime		1-Year Government Bond Yield (yld1)	3-Year Government Bond Yield (yld3)	5-Year Government Bond Yield (yld5)	10-Year Government Bond Yield (yld10)
Contraction	**US**	0.5531	0.1213	–0.2622	0.194
	Japan	1.2301	1.3222	–0.1789	---
	Germany	0.2497	0.3282	0.3178	0.1396
Expansion	**US**	0.3305	0.2203	–0.0154	0.4548
	Japan	1.2301	–0.1316	–0.2028	---
	Germany	0.2497	0.3282	–0.0054	–0.428

5) Malaysia

Regime		1-Year Government Bond Yield (yld1)	3-Year Government Bond Yield (yld3)	5-Year Government Bond Yield (yld5)	10-Year Government Bond Yield (yld10)
Contraction	**US**	---	0.0974	–0.3358	---
	Japan	---	0.6018	0.1033	---
	Germany	---	0.4883	0.2826	---
Expansion	**US**	---	0.0305	0.0619	---
	Japan	---	0.0736	0.0209	---
	Germany	---	–0.0542	–0.1621	---

6) Philippines

Regime		1-Year Government Bond Yield (yld1)	3-Year Government Bond Yield (yld3)	5-Year Government Bond Yield (yld5)	10-Year Government Bond Yield (yld10)
Contraction	**US**	–0.7065	---	---	2.6934
	Japan	1.8419	---	0.5549	0.2572
	Germany	---	---	–0.0867	0.1861
Expansion	**US**	–0.7065	---	---	1.7809
	Japan	1.6756	---	–0.0227	–0.7213
	Germany	0.7309	---	–0.5241	0.6203

7) Thailand

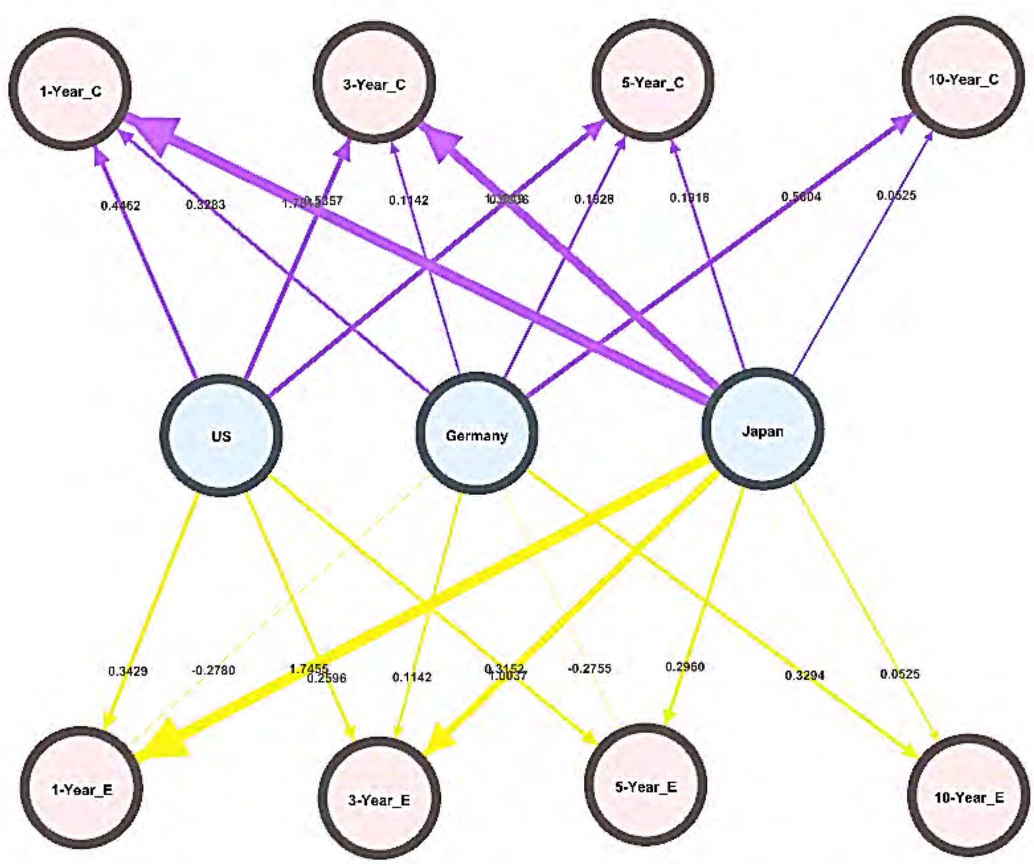
Regime		1-Year Government Bond Yield (yld1)	3-Year Government Bond Yield (yld3)	5-Year Government Bond Yield (yld5)	10-Year Government Bond Yield (yld10)
Contraction	US	0.6501	---	–0.0493	0.8816
	Japan	0.9570	0.0010	---	0.9144
	Germany	0.0981	0.7323	0.5794	0.467
Expansion	US	0.0321	---	–1.1476	0.2875
	Japan	–0.2100	–0.4851	---	0.4334
	Germany	–0.5317	–0.2378	–0.4460	–0.0772

STAR-VAR = smooth transition autoregressive–vector autoregressive, US = United States.

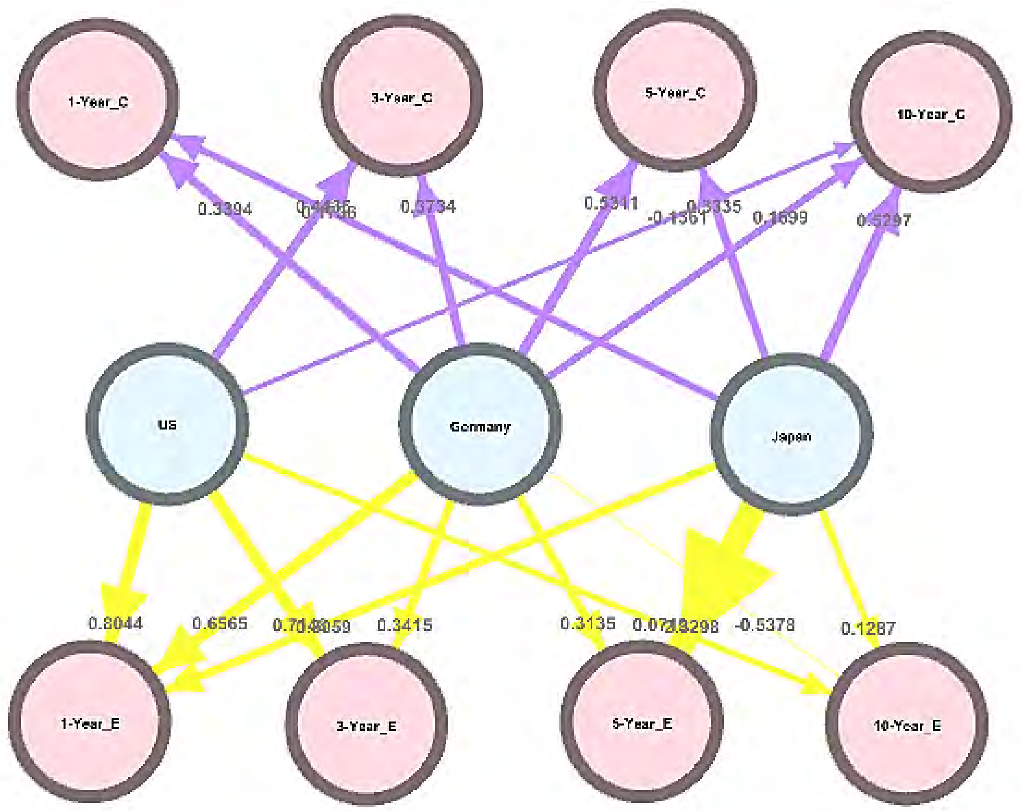
Source: Authors' calculation.

Figure 3: The Effect of Inflation in the United States, Japan, and Germany on Emerging Asian Market Bond Yields—Cumulative Net Effect in Nonlinear STAR-VAR

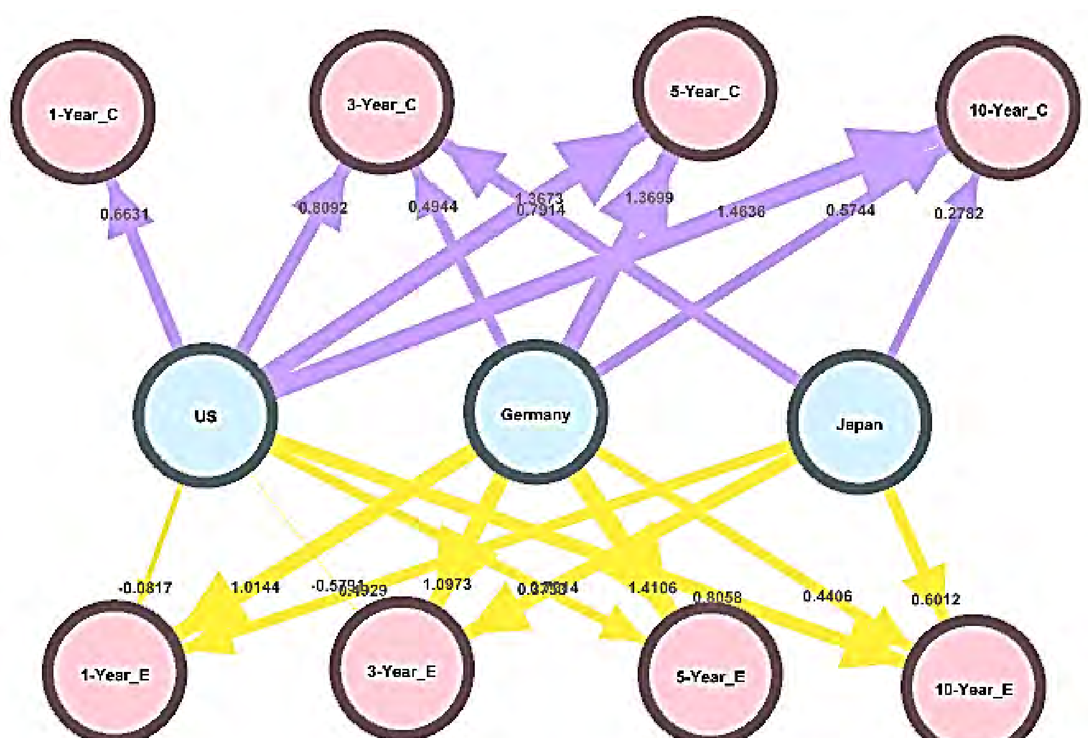
1) People's Republic of China



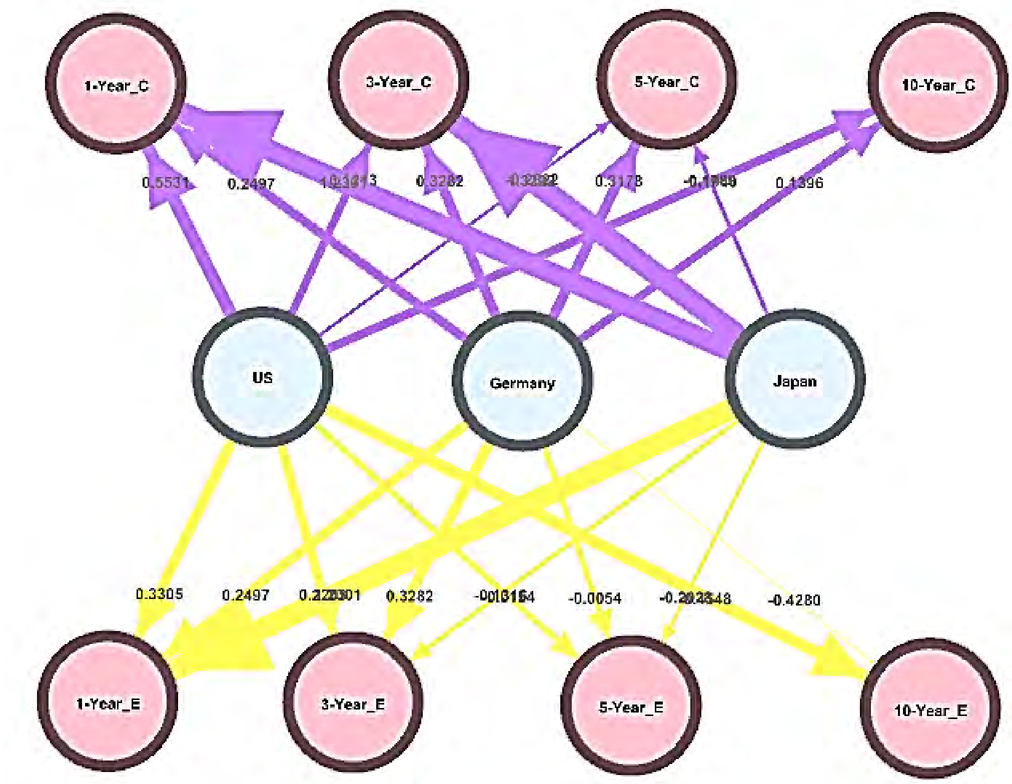
2) Hong Kong, China



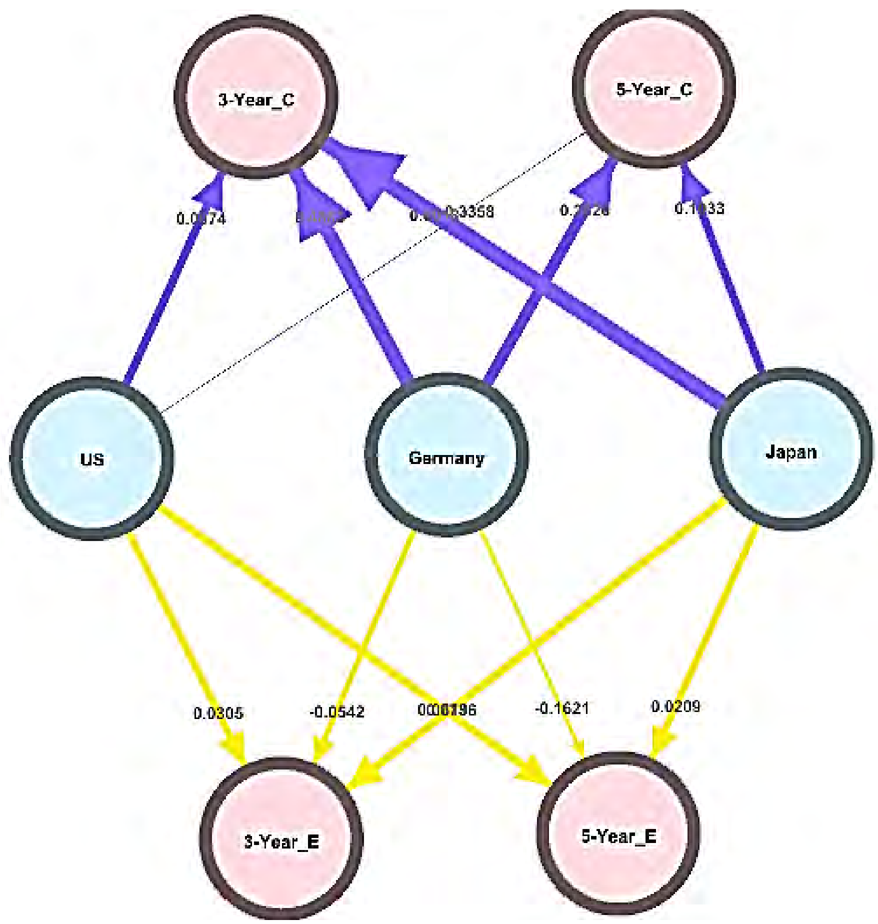
3) Indonesia



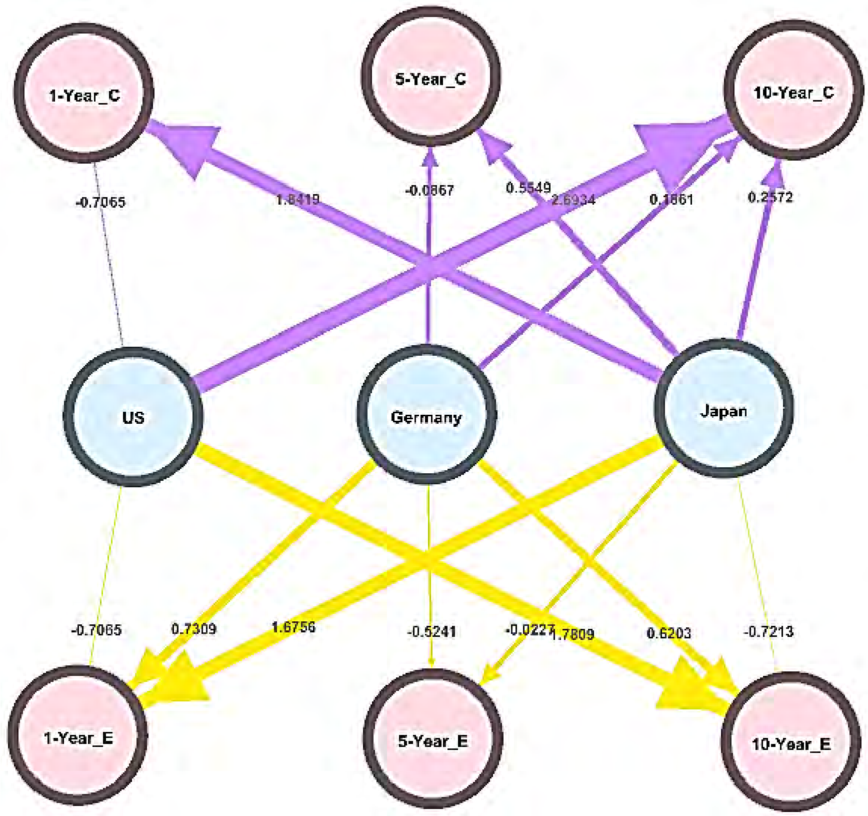
4) Republic of Korea



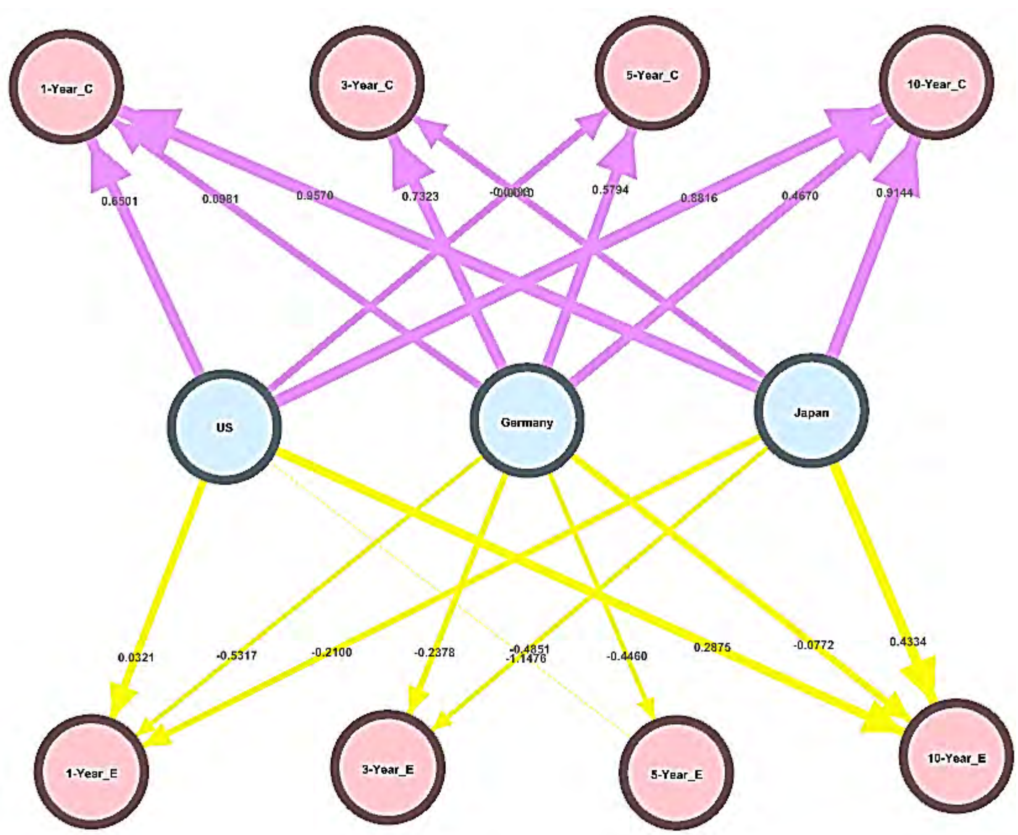
5) Malaysia



6) Philippines



7) Thailand



STAR-VAR = smooth transition autoregressive–vector autoregressive, US = United States.

Notes: The upper side indicates the contractionary regime of bond yields and the lower side indicates the expansionary regime of bond yields. Thicker arrows indicate stronger cumulative net effects. We employ the "GEPHI" in visualizing cumulative net effects. yld1_C indicates a 1-year maturity bond yield in the contractionary regime, and yld1_E C indicates a 1-year maturity bond yield in the expansionary regime.

4. **Conclusion**

The COVID-19 pandemic led to increased inflation in advanced economies and rising bond yields in emerging markets. Recent studies show that the short-run relationship between inflation and bond yield depends on market factors such as market cycles. Motivated by these recent findings and more appropriate empirical specifications, we empirically examined the relationships between three major advanced economies' inflation rates and seven emerging Asian markets' bond yields. In addition, we analyzed how these relationships are affected by whether the bond market regime is contractionary or expansionary. The LSTAR-VAR model allows us to examine endogenous regime changes within the context of the dynamic relationship between advanced economy inflation and emerging market bond yields.

We identified two distinct channels of advanced economy inflation on emerging market bond yields. First, advanced economy inflation triggers a regime shift of emerging market bond yields in the long run. The γ estimates in the LSTAR-VAR framework are significant in most of emerging Asian markets. This is interpreted as advanced economy inflation significantly triggering emerging market bond yield regime change. We further find that longer maturity (5-year and 10-year) bond yield regimes shift relatively slowly, as γ estimates increase over maturities on average.

Second, our estimation reveals the presence of asymmetries in the short-run relationship between advanced economy inflation and emerging market bond yields. In the seven emerging Asian markets and across four maturities, advanced economy inflation has a positive effect on emerging market bond yields under both contractionary and expansionary bond market regimes. However, the effect is relatively weak or inelastic under an expansionary regime but stronger or more elastic under a contractionary regime in most cases. This suggests that the response of emerging market bond yields to advanced economy inflation does not necessarily follow a simple Fisher equation relationship; the Fisher relationship becomes more regime-dependent. Since the intensity of the positive effects of advanced economy inflation changes between the contractionary and expansionary regimes, we refer to the effects as the “dynamic Fisher effects.”

Our results imply that a better understanding of the behavior of emerging market bond yields should be considered in the context of the regime-dependent asymmetric nature of the relationships between advanced economy inflation and emerging market bond yields. From the empirical results reported in this work, we question what factors explain regime shifting and asymmetric phenomena in emerging Asian bond markets. It may be reasonable to consider each economy’s bond market characteristics, such as trading volume and share of foreign investor holdings, in future research.

REFERENCES

Albagli, E., L Ceballos, S Claro, D Romero. (2019). Channels of US monetary policy spillovers to international bond markets, *Journal of Financial Economics*, 134, 447-473.

Bekaert and Engstrom. (2010). Inflation and the stock market: Understanding the “Fed Model”, *Journal of Monetary Economics*, 57, 278-294.

Belke, A., Dubova, I. and Osowski, T. (2018). Political uncertainty and international financial markets: The case of Brexit, *Applied Economics*, 50, 3752-3770.

Candelon, Bertrand, Jan Piplack and Stefan Straetmans (2008), “On measuring synchronization of bulls and bears: The case of East Asia,” *Journal of Banking & Finance*, 32(6), 1022-1035.

Duffee, Gregory R. (2018). “Expected inflation and other determinants of treasury yields,” *The Journal of Finance*, 73, 2139-2180.

Edwards, Sebastian, Javier Gomez Biscarri and Fernando Perez de Gracia (2003), “Stock market cycles, financial liberalization and volatility,” *Journal of International Money and Finance*, 22, 925-955.

Engle, Robert F. and C. W. J. Granger (1987), “Co-Integration and Error Correction: Representation, Estimation, and Testing,” *Econometrica,* 55(2), 251-276.

Escribano, Alvaro (1987) “Error-correction systems: Nonlinear adjustments to linear long-run relationships,” *CORE Discussion Papers* No. 1987030, Université catholique de Louvain.

Escribano, Alvaro and Gerard A. Pfann (1998), “Non-linear error correction, asymmetric adjustment and cointegration,” *Economic Modelling*, 15(2), 197-216.

Escribano, Alvaro and Santiago Mira (2002), “Nonlinear error correction models,” *Journal of Time Series Analysis,* 23(5), 509-522.

Gallant, A. R. and H. White (1988), A unified theory of estimation and inference for nonlinear dynamic models, Blackwell.

Granger, C. W. J. and Norman Swanson (1996), “Future developments in the study of cointegrated variables,” *Oxford Bulletin of Economics and Statistics*, 58(3), 537-553.

Hatanaka, Michio (1996), Time-series-based econometrics: Unit roots and co-integrations, Oxford University Press.

Johansen, S. (1995), Likelihood-based inference in cointegrated vector autoregressive models, Oxford University Press.

Joyce, M., P. Lildholdt and S. Sorensen (2010). “Extracting inflation expectations and infla- tion risk premia from the term structure: A joint model of the UK nominal and real yield curves,” *Journal of Banking and Finance*, 34(2), 281-294.

Kim, Sei-Wan, M.J. Choi, and Y. M. Kim (2019), “Does Intra-regional Trade Matter in Regional Stock Markets? New Evidence from the Asia-Pacific Region,” *Asian Economic Journal*, 33(3), 253-280.

Luukkonen, R., Pentti Saikkonen and Timo Teräsvirta (1988), “Testing linearity against smooth transition autoregressive models,” *Biometrika*, 75(3), 491-499.

Teräsvirta, T. (1994), “Specification, estimation and evaluation of smooth transition autoregressive models,” *Journal of the American Statistical Association*, 89(425), 208-218.

Teräsvirta, T. and H. M. Anderson (1992), “Characterizing nonlinearities in business cycles using smooth transition autoregressive models,” *Journal of Applied Econometrics*, 7, 119-136.

Tsay, R. S. (1989), “Testing and modeling threshold autoregressive processes,” *Journal of the American Statistical Association*, 84, 231-240.

Wooldridge, Jeffrey M. and Halbert White (1988), “Some invariance principles and central limit theorems for dependent heterogeneous processes,” *Econometric Theory,* 4(2), 210-230.

Yu, Ip-Wing, Kang-Por Fung and Chi-Sang Tam (2010), “Assessing financial market integration in Asia equity markets,” *Journal of Banking & Finance*, 34(12), 2874-2885.

How Does Inflation in Advanced Economies Affect Emerging Market Bond Yields?

Empirical Evidence from Two Channels

This study uses multivariable smooth transition autoregressive–vector autoregressive (STAR–VAR), a novel model to explore how inflation in advanced economies affects emerging market bond yields. Results reveal two key findings. First, advanced economy inflation has a significant effect on emerging market bond yields. Second, the short-run effect of advanced economy inflation on the bond yields of emerging markets is asymmetric between the expansion and contraction regimes. The effect is mostly positive in both regimes but stronger in a bond yield's contraction regime.

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