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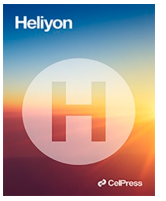

Research article

External financial and monetary policy shocks: Do they matter for Korean macroeconomy?

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ABSTRACT

Given Korea's status as a small, open economy, it exhibits a pronounced sensitivity to external shocks. Consequently, this article seeks to elucidate the impact of external financial and monetary policy shocks on the fluctuation of critical macroeconomic variables within Korea. Employing Bayesian estimation alongside the impulse response function for empirical analysis, the findings reveal that external financial and monetary policy shocks precipitate declines in exports, output, employment, real wages, consumption, investment, and imports. Conversely, these shocks are associated with increases in both the price level and inflation, highlighting the multifaceted effects of external pressures on the domestic economic landscape. Further, through forecast error variance decomposition, this study demonstrates that, relative to shocks stemming from productivity, terms of trade, and real exchange rate variations, external financial and monetary policy shocks exert a considerably milder impact on the fluctuations of Korea's key macroeconomic variables. This insight suggests a potential area for enhancement in the existing Korean literature on this topic, advocating for the integration of these findings to enrich understanding and analysis. In summary, by delving into the nuanced effects of external shocks on Korea's economy, this article contributes valuable perspectives to the discourse, suggesting avenues for further research and policy formulation. The integration of these results into the broader body of Korean economic literature could significantly augment current understandings and interpretations of Korea's economic dynamics in the face of global financial and monetary turbulence.

1. Introduction

South Korea's economic landscape, characterized by its open nature and heavy reliance on export-driven sectors such as automotive and semiconductor manufacturing, secures its pivotal role in the international arena. Historically, this economic configuration has rendered South Korea vulnerable to external financial and monetary disturbances, thereby influencing its macroeconomic equilibrium. Research conducted by Gereffi et al. [1] suggests that South Korea is strategically transitioning towards fortifying its domestic markets with innovative products to lessen these susceptibilities by diminishing its export dependence. The effects of external shocks on economies analogous to South Korea's have been extensively examined. Research by Park and Lee [2], Kim and Lee [3], and Jeon et al. [4] elucidates the profound implications of financial integration and external disturbances on the South Korean economy, indicating that the nation's handling of such shocks could shed light on wider economic dynamics. In particular, the repercussions of these shocks on crucial macroeconomic indicators in South Korea, including exports, production, employment, and investment,

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highlight the pressing necessity for policies aimed at bolstering economic resilience. Further, investigations into the ramifications of monetary policy fluctuations, notably on leading economies such as South Korea by Kim and Mehrotra [5], Kim and Oh [6], Albrizio et al. [7], Hwang et al. [8], and Park [9], underscore the profound impact of these fluctuations on South Korean economic metrics. These studies emphasize the global economy's interdependence and the imperative for nations like South Korea to establish effective strategies to mitigate the effects of external stressors. Hence, this analysis of South Korea's economic maneuvering in response to external shocks underscores the significance of strategic economic planning and policy development. By prioritizing economic diversification and the reinforcement of domestic market robustness, South Korea is better positioned to navigate the intricacies of global financial and monetary policies, thereby ensuring a more stable economic trajectory in the face of external uncertainties.

The global financial crisis may have a detrimental effect on the macroeconomic environment in Korea. To be more specific, the financial crisis may have an impact on economic growth in the following ways: Firstly, it may lessen the availability of money; secondly, it may reduce the trust of investors; and thirdly, it may cause inflation to rise. In the meantime, the financial crisis might also have an influence on Korea's export sector, since a weaker global economy could lead to reduced demand for items made in Korea. In addition, the global financial crisis might also have an effect on the labor market in Korea. Because of the downturn in the economy, firms may have to lay off employees, which would contribute to a rise in the country's unemployment rate. As a consequence of this, the government of Korea has to take action in order to lessen the effect that the financial crisis is having on the macroeconomy in order to keep economic development steady and sustainable. For example, in the aftermath of the financial crisis, information from the Korea Statistical Office showed that the average monthly income of urban households in Korea was 1.76 million won in the third quarter of 1998. This was the lowest point in the income level for urban households in Korea in the previous 35 years. The nominal rise in wages for Koreans in 1998 was 2.5 %, while the increase in consumer prices during the same time was 7.5 %, which means that real wage growth for Koreans was 10 %. Moreover, in July of 1997, the rate of unemployment in Korea was 2.2 %, but by December of the same year, it had risen to 3.1 %. The rate of unemployment was at its lowest point, 5.9 percent, in February 1998, six months after the crisis. It then rose to 7.6 percent in July of the same year, and then it continued to rise until it reached 8.6 percent in February 1999. The rise in unemployment was accompanied by significant changes in the structure of employment. According to statistics from the Korea Statistical Office, the proportion of casual workers among the employed was 14.1 percent in 1997, 31.6 percent for short-term employment, and 54.3 percent for full-time employment. In March 1999, the corresponding proportions were 17.4 percent, 33.2 percent, and 49.4 percent, respectively. This change in the structure of employment was accompanied by a rise in unemployment. According to the findings, the percentage of households holding regular occupations has been steadily declining, while the number of households holding casual or informal jobs has been steadily rising.

In addition, external monetary policies such as those imposed by other countries, such as the United States' quantitative easing policy, are a significant factor in the country's unstable macroeconomic environment. The Korean macroeconomy is strongly influenced by monetary policies implemented in other countries. Because Korea is an open country and its economy is intimately connected to the global market, the monetary policies of other countries may have an effect, either directly or indirectly, on the economy of Korea. For instance, since the United States economy is the largest in the world, the monetary policy of the United States has a substantial influence on the economy of Korea. If monetary policy in the United States were to become more accommodating, it is possible that this would result in an appreciation of the Korean Won. This, in turn, would put pressure on the export sectors in Korea. In a similar vein, the monetary policies of other countries may have an impact on the investment and consumption levels in Korea. For instance, if interest rates in other countries rise, foreign investors in Korea may decide to move their funds elsewhere in search of greater returns on their investments. This would have the effect of lowering domestic demand in Korea. The overall effect of external monetary policies on Korea's macroeconomy may be described as complicated; yet, given their significance to the Korean economy, it is imperative that this aspect be taken into full account. The previous analysis of external financial and monetary policy demonstrated that the influence these policies have on Korea is impossible to ignore. As a result, the purpose of this article is to explore the influence that shocks to external financial and monetary policy have on the level of volatility experienced by macroeconomic indicators in Korea. The findings of the empirical inquiry, which used a Bayesian estimate and impulse response function, indicate that declines in export, output, employment, real wages, consumption, investment, and import are the direct outcomes of shocks caused by external financial and monetary policy. On the other hand, the findings suggest that these two external shocks are responsible for an increase in both the overall price level and inflation. Moreover, the forecast error variance decomposition shows that external financial and monetary policy shocks have a substantially less effect on the variability of important Korean macroeconomic variables as compared to productivity, terms of trade, and real exchange rate shocks.

This research delineates three pivotal contributions that enhance our comprehension of South Korea's economic dynamics in the face of external financial and monetary policy shocks, juxtaposed against the backdrop of existing scholarship to underscore their significance: Firstly, this investigation delves into the multifaceted impact of external shocks on a broad spectrum of macroeconomic variables in South Korea, including exports, output, employment, real wages, consumption, investment, and imports. Employing Bayesian estimation alongside the impulse response function for empirical scrutiny, it furnishes a nuanced depiction of the economy's responsiveness to such perturbations. This approach marks a departure from prior studies by Han et al. [10], Ha et al. [11], and Hahn and Pyun [12], which predominantly concentrated on the repercussions of external shocks on the nation's export sector, lacking a holistic economic perspective. Our analysis, therefore, extends the discourse by offering a panoramic view of South Korea's economic susceptibility to external influences. Secondly, a salient discovery of this study is the elucidation of inflationary pressures triggered by external financial and monetary policy shocks, manifesting in elevated price levels and inflation rates. This finding stands in contrast to the observations of Hwang and Suh [13], Lee and Park [14], Hur and Kim [15], and Cho and Kim [16], who identified minimal effects of similar shocks on inflation. The application of Bayesian estimation techniques underscores the critical role of methodological rigor in revealing these inflationary outcomes, thereby enriching our understanding of the inflationary impact of external shocks. Finally,

through the application of forecast error variance decomposition, this study innovatively contrasts the influence of external financial and monetary policy shocks against disturbances stemming from productivity, terms of trade, and real exchange rate variations. The findings suggest that external shocks exert a comparatively lesser effect on the fluctuations of key macroeconomic variables in Korea, challenging the assertions by Adebayo et al. [17], He [18], and Wang and He [19] regarding the predominant role of external shocks in macroeconomic variability. This insight prompts a reevaluation of the relative significance of various shock types for the Korean economy. In summation, this article substantially contributes to the scholarly dialogue by conducting an in-depth exploration of the impacts of external financial and monetary policy shocks on South Korea's macroeconomic landscape, illuminating the resultant inflationary pressures, and recalibrating our understanding of the relative effects of different shock types. By synthesizing these insights, this work paves the way for future research and policy formulation aimed at bolstering Korea's economic resilience and sensitivity to external disturbances.

The organization of the remaining parts of the article is shown by: Section 2 performs an examination of the relevant previous literature; Section 3 offers the model; Section 4 assesses and discusses the findings; and Section 5 delivers the conclusions drawn from the study.

2. Literature review

The scholarly discourse on the ramifications of external or foreign financial shocks on macroeconomic indicators unveils a multifaceted web of influences spanning exports, output, employment, price levels, wages, inflation, consumption, investment, and trade balances. Initiated by contributions from Fernández-Villaverde and Guerrón-Quintana [20], Chiarini et al. [21], Vianna [22], and Yahya and Lee [23], the concept of the financial accelerator emerges as a critical framework. This theory posits that external shocks not only disturb economic equilibrium but, under adverse financial conditions, can magnify business cycle volatility, thus affecting investment and output more severely. This insight lays the groundwork for understanding how macroeconomic indicators are susceptible to external perturbations. Expanding upon this foundation, the works of Bonciani and Ricci [24], Yildirim and Arifli [25], and Boateng et al. [26] delve into the dynamics of terms-of-trade shocks in emerging markets, showcasing how external price fluctuations can precipitate significant disruptions in exports and, consequently, overall economic performance. Their analyses highlight the criticality of export diversification as a strategic buffer against such volatility. In the realm of labor markets, studies by Adeiza et al. [27] and Lozej et al. [28] underscore the potential of monetary policy to alleviate the negative repercussions of external shocks on employment and wages. These findings underscore the indispensable role of policy measures in safeguarding economic stability. Turning to inflation, research by Dou et al. [29], Shobande and Shodipe [30], and Bai and Deng [31] scrutinizes the impact of external financial shocks within economies operating under pegged exchange rate systems. Their studies reveal a heightened vulnerability to inflation in such contexts, owing to the limited maneuverability of monetary policy. On the front of consumption and investment, inquiries by Zhang et al. [32], Gong et al. [33], and Lubello and Rouabah [34] examine how monetary policy shocks intersect with corporate debt levels. Findings suggest that elevated indebtedness exacerbates the downturns in consumption and investment following external shocks, highlighting the importance of corporate leverage in economic resilience. Broadening the perspective, the discourse on financial globalization through works by Croitorov et al. [35], Greenwood-Nimmo et al. [36], and Jin et al. [37] illuminates how global financial integration can intensify the transmission of external shocks, underscoring the interconnectedness and vulnerability of global economies. Conversely, Goczek and Witkowski [38], Bhattacharjee and Pati [39], and Li [40] challenge prevailing notions by suggesting that the perceived magnitude of external shock impacts might be inflated due to a contagion effect measurement bias. Their analysis calls for a refined understanding that accounts for market volatility. In the context of policy constraints, Devereux and Yetman [41], Aizenman et al. [42], Obstfeld and Taylor [43], and Cavallino and Sandri [44] explore the international finance trilemma, highlighting the challenges policymakers face in balancing fixed exchange rates, open capital accounts, and the effective use of monetary policy in response to external shocks. Lastly, historical analyses of financial crises by Jesus et al. [45], Liu et al. [46], Attílio [47], and Peykani et al. [48] offer a longitudinal view, evidencing the lasting impacts of external financial shocks on economies across centuries. In sum, the body of literature presents a nuanced panorama of the effects of external financial shocks on macroeconomic stability, emphasizing the delicate interplay between global financial openness and economic resilience. It underscores the pivotal roles of export diversification, adept monetary policy, and financial regulation in mitigating the adverse outcomes of such disturbances.

The scholarly landscape is rich with debates on the effects of external or foreign monetary policy shocks on macroeconomic indicators, revealing a complex interplay of factors that shape the global economic fabric. Initially, foundational research by Oyekola et al. [49], Erceg et al. [50], Oyekola et al. [49], and Rodríguez et al. [51] highlights the disruption of international trade flows due to adjustments in external monetary policies. These studies pinpoint the trade balance's vulnerability to shifts in foreign interest rates, setting the stage for further exploration into the nuances of economic interdependence. Building on this premise, Freitas [52], Pfeiffer and Varga [53], and Zhang et al. [54] delve into the mechanisms through which policy shocks are transmitted across borders. Their research emphasizes the significant role of cross-border banking flows in affecting domestic investment and output, demonstrating how international financial linkages can magnify the repercussions of foreign monetary policy adjustments. Contributions from Lie [55] enrich the discourse by scrutinizing the labor market implications of external monetary shocks. Their analysis reveals that such shocks precipitate short-term labor market adjustments, with labor demand elasticity being a determinant factor in the extent of these effects. On the topic of inflation and price levels, Bhattarai et al. [56] and Lastauskas and Nguyen [57] offer crucial insights into how major economies' monetary policy decisions influence global inflation dynamics. This interconnection underscores the importance of a sophisticated approach to inflation targeting in an increasingly globalized economic context. Further research by Yang et al. [58] and Kim [59] investigates the impact of anticipated future monetary policy on consumer confidence and spending. They argue that

anticipatory behaviors significantly influence the consumption response to external shocks, highlighting the psychological dimensions of economic phenomena. von Brasch et al. [60] explore the dynamics of investment in light of foreign interest rate changes. Their findings highlight the interconnectedness of global financial markets by showing that these changes have a significant impact on domestic investment decisions through expectations regarding exchange rates and the mobility of capital flows. Recent studies by Devereux et al. [61], Zhang et al. [62], and Caldara et al. [63] introduce the concept of the global financial cycle. They argue that monetary policy actions in core economies trigger synchronized movements in capital flows, asset prices, and credit growth worldwide, with significant implications for the macroeconomic stability of small, open economies. Caputo and Pedersen [64] examine the moderating role of exchange rate regimes on the impact of external shocks. Their findings suggest that economies with more flexible exchange rates might better withstand such shocks through currency adjustments. Kabundi and De Simone [65], Jin and De Simone [66], and Malovaná et al. [67] shed light on the risk-taking channel of monetary policy, noting that low interest rates in major economies can encourage increased leverage and risk-taking abroad. This phenomenon could amplify the effects of policy shocks on global financial stability. Lastly, a historical lens provided by Bernanke [68] illustrates the variable long-term effects of external monetary policy shocks on macroeconomic indicators, emphasizing the profound implications for economic policy and international cooperation. In conclusion, the body of literature presents a detailed and nuanced understanding of the impacts of foreign monetary policy shocks on macroeconomic indicators. It underscores the intricate relationship between international financial integration, the transmission of monetary policy, and domestic economic conditions. This complexity necessitates careful policy consideration to mitigate adverse effects and harness positive influences, emphasizing the critical need for informed international cooperation and policy coordination.

Drawing upon the comprehensive literature review previously outlined, this article delineates its research objectives with a focus on the Republic of Korea—a nation characterized by its small, open economy and, consequently, its vulnerability to macroeconomic fluctuations triggered by external disturbances. This investigation aims to dissect the ramifications of external financial and monetary policy shocks on the volatility of Korea's macroeconomic environment. By doing so, this study endeavors to augment the existing corpus of knowledge on this subject, offering fresh insights and understanding into the dynamics of external shocks and their impacts on economies similar to Korea's.

3. Model

3.1. Households

It is assumed that households in a given country are homogeneous. They consume both domestically produced and imported goods. Referring to the work of Dixit and Stiglitz [69], the following outlines the pattern of household consumption of goods:

$$C_t^h = \left[\int_0^1 C_t^h(j)^{\frac{\epsilon^h-1}{\epsilon^h}}\right]^{\frac{\epsilon^h}{\epsilon^h-1}}. \tag{1}$$

$$C_t^f = \left[\int_0^1 C_t^f(jj)^{\frac{\epsilon^f-1}{\epsilon^f}}\right]^{\frac{\epsilon^f}{\epsilon^f-1}}. \tag{2}$$

In Equations (1) and (2), C_t^h denotes the household consumption of home country produced goods of brand j at t period; C_t^f denotes denotes the household consumption of foreign country produced goods of brand jj at t period; ϵ^h denotes the constant substitution elasticity of home country produced goods; ϵ^f denotes the constant substitution elasticity of foreign country produced goods. For each kind of product, no one brand can fully substitute for the others. Hence, both substitution elasticity coefficients (ϵ^h and ϵ^f) exceed one. The goal of the household is to maximize utility throughout time. Consumption and leisure generate the utility. In this article, work is considered to be a disutility. The rationale is that the work decreases the utility of the household. In accordance with the study of Anzoategui et al. [70], a typical domestic household optimizes the following lifetime utility function:

$$U = E_t\sum\nolimits_{i=0}^{\infty}\beta^i\left[\frac{C_{t+i}^{1-\sigma}(j)}{1-\sigma} - \frac{L_{t+i}^{1+n}(j)}{1+n}\right]. \tag{3}$$

In Equation (3), E_t denotes the expectation operator conditional on information available at time t; σ denotes the consumption risk aversion of consumer; n denotes the elasticity of labor supply of intertemporal substitution. Constant elasticity of substitution of the composite consumption index between the home country and the foreign country yields:

$$C_t = \left[(1-\alpha)^{\frac{1}{\eta}}\left(C_t^h\right)^{\frac{\eta-1}{\eta}} + \alpha^{\frac{1}{\eta}}\left(C_t^f\right)^{\frac{\eta-1}{\eta}}\right]^{\frac{\eta}{\eta-1}}. \tag{4}$$

In Equation (4), C_t denotes the final consumption goods of household, which is a composite consumption index. It consists of home country produced goods consumption (C_t^h) and foreign country produced goods consumption (C_t^f); α denotes the preference degree of home country household for foreign country produced goods; η denotes the constant elasticity. It evaluates the constant elasticity between home-country-produced goods and foreign-country-produced goods from the standpoint of domestic households. The imports from foreign countries determine the consumption of foreign-made goods (C_t^f) by domestic households. In reality, South Korea is an

export- and import-oriented country. To simplify, we suppose that foreign-produced goods are exclusively imported, whereas domestic producers do not produce these goods abroad. The form of the intertemporal budget constraint for home country households' utility is:

$$P_tC_t + B_{t+1} = W_tL_t + R_tB_t + D_t. \tag{5}$$

In Equation (5), P_t denotes the consumer price index; W_t denotes the nominal wage; R_t denotes the deposit interest rate; B_t denotes the household's bonds; D_t denotes the dividends. Combining equations (3) and (5) yields the following optimal first-order condition:

$$\Lambda_t = \frac{C_t^{-\sigma}}{P_t}. \tag{6}$$

$$\frac{C_t^{-\sigma}}{L_t^n} = \frac{P_t}{W_t}. \tag{7}$$

$$E_t\left(\beta R_{t+1}\Lambda_{t,t+1}\right) = 0. \tag{8}$$

In Equations (6)–(8), Λ_t denotes the Lagrange multiplier; $\Lambda_{t,t+1} = \frac{\Lambda_t}{\Lambda_{t+1}}$ denotes the utility discount of household; $\pi_t = \frac{P_t}{P_{t-1}}$ denotes the inflation rate.

3.2. Consumption goods retailer

In a market with perfect competition, the retailer is considered the integrator of final goods. In this article, the existence of two categories of retailers is assumed. One is to integrate the general goods (C_t). Another is to integrate the investment goods (I_t). For the general goods retailer, they integrate the final general goods as shows in equation (4). Given that the retailer operates in a completely competitive market, its equilibrium profit will be zero. Given any level of production, the optimal demand for domestically produced goods and imports is expressed as follows:

$$C_t^h = (1-\alpha)\left(\frac{P_t^h}{P_t}\right)^{-\eta} C_t. \tag{9}$$

$$C_t^f = \alpha\left(\frac{P_t^f}{P_t}\right)^{-\eta} C_t. \tag{10}$$

In Equations (9) and (10), P_t^h denotes the price of home country produced goods; P_t^f denotes the price of foreign country produced goods. Then, the form of consumer price index gives as shown in Equation (11):

$$P_t = \left[(1-\alpha)\left(P_t^h\right)^{\frac{\eta-1}{\eta}} + \alpha\left(P_t^f\right)^{\frac{\eta-1}{\eta}}\right]^{\frac{\eta}{\eta-1}}. \tag{11}$$

Meanwhile, the home country produced goods price inflation gives as shown in Equation (12),:

$$\pi_t^h = \frac{P_t^h}{P_{t-1}^h}. \tag{12}$$

The foreign country produced goods price inflation gives as shown in Equation (13),:

$$\pi_t^f = \frac{P_t^f}{P_{t-1}^f}. \tag{13}$$

3.3. Investment goods retailer

For the investment goods retailer, investment products are sold to the capital producer. In addition, the retailer integrates the investment goods in the same technological manner as the retailer of general goods, as shown in equation (4). Its form is shown as follows:

$$I_t = \left[(1-\xi)^{\frac{1}{\zeta}}\left(I_t^h\right)^{\frac{\zeta-1}{\zeta}} + \xi^{\frac{1}{\zeta}}\left(I_t^f\right)^{\frac{\zeta-1}{\zeta}}\right]^{\frac{\zeta}{\zeta-1}}. \tag{14}$$

In Equation (14), I_t denotes the investment goods which is a composite investment goods index; I_t^h denotes the home country produced investment goods; I_t^f denotes the foreign country produced investment goods; ξ denotes the preference degree of home country capital producers for the foreign country produced investment goods; ζ denotes the constant elasticity. From the perspective of home country home country capital producers, it measures the constant elasticity between home country produced investment goods and foreign country produced investment goods. Because the retailer is situated in a completely competitive market, its earnings in the equilibrium state are zero. Given any production level, the optimal demand pattern for domestically produced and imported goods appears as

follows as shown in Equations (15) and (16),:

$$I_t^h = (1-\xi)\left(\frac{P_t^h}{P_t}\right)^{-\zeta} I_t. \tag{15}$$

$$I_t^f = (1-\xi)\left(\frac{P_t^f}{P_t}\right)^{-\zeta} I_t. \tag{16}$$

Meanwhile, the producer price index gives as:

$$P_{i,t} = \left[(1-\xi)\left(P_t^h\right)^{\frac{\zeta-1}{\zeta}} + \xi\left(P_t^f\right)^{\frac{\zeta-1}{\zeta}}\right]^{\frac{\zeta}{\zeta-1}}. \tag{17}$$

In Equation (17), $P_{i,t}$ denotes the producer price index.

3.4. Financial intermediaries

As is common knowledge, all types of banks serve as financial intermediaries. These banks are responsible for absorbing deposits from households and providing capital loans to producers. According to the study of Gertler and Karadi [71], the assets and liabilities of the bank fulfill the following equation:

$$Q_t S_{j,t} = N_{j,t} + B_{j,t+1}. \tag{18}$$

In Equation (18), $N_{j,t}$ denotes the net asset owned by bank j at the end of t period; $B_{j,t+1}$ denotes the deposits from the households which are absorbed by the banks; $S_{j,t}$ denotes the number of loans provided by the bank to the producer at t period. Q_t denotes the total amount of loans provided by the banks. The banks must pay families the risk-free rate of interest. Moreover, if the banks provide loans to the producers, the bank will also benefit from them. Consequently, given the banks' assets and liabilities, the accumulation equation for their net assets is as follows:

$$N_{j,t+1} = R_{k,t+1} Q_t S_{j,t} - R_{t+1} B_{j,t+1}. \tag{19}$$

In Equation (19), R_t denotes the real interest rate paid by the banks to the households in each period; $R_{k,t}$ denotes the profits of banks from the producers. Then, combining equations (18) and (19) yields:

$$N_{j,t+1} = \left(R_{k,t+1} - R_{t+1}\right) Q_t S_{j,t} + R_{t+1} N_{j,t}. \tag{20}$$

In Equation (20), to prevent the expansion of banks' net assets indefinitely, we suppose that each bank has a specific chance (θ) of surviving the next period. In other words, each bank has a probability of $1-\theta$ to withdraw from the credit market at the current period. They will immediately become general households. Exiting the loan market, the purpose of the financial intermediaries is to maximize its expected net assets ($V_{j,t}$).

$$V_{j,t} = E_t \sum_{i=0}^{\infty} (1-\theta)^i \theta^i \beta^{i+1} \lambda_{t,t+1+i} \left[\left(R_{k,t+1+i} - R_{t+1+i}\right) Q_{t+i} S_{j,t+i} + R_{t+1+i} N_{j,t+i}\right]. \tag{21}$$

According to equation (21), the financial intermediaries have the incentive to extend its total credit indefinitely during any time in which the expected net return of the banks on the producers' investment $[E_t(R_{k,t+1} - R_{t+1})]$ is positive. Therefore, the principal-agent issue of bank funds is included in the model. We suppose that the bank may choose each time not to fulfill the loan agreement with the households. A portion of the bank's total assets (λ) may be removed from the credit market. Due to the principal-agent issue with bank funds, households must guarantee that the bank's total assets fulfill the following incentive compatibility restrictions to prevent default-related losses as shown in Equation (22).

$$V_{j,t} \geq \lambda Q_t S_{j,t}. \tag{22}$$

In terms of economic significance, this constraint dictates that the expected net assets that a bank can obtain when it performs the contract and exits the credit market should not be less than the benefits that the bank (on the right side) can obtain when it chooses not to comply with the contract at the current period. Therefore, once this limitation is removed, the bank will continue to execute its own contracts and conduct normal investment and business operations. To simplify, we write $V_{j,t}$ in recursion form:

$$V_{j,t} = \nu_t Q_t S_{j,t} + \eta_t N_{j,t}. \tag{23}$$

In Equation (23), $\nu_t = E_t \beta \lambda_{t,t+1}\left[(1-\theta)(R_{k,t+1} - R_{t+1}) + \theta \frac{Q_{t+1} S_{j,t+1}}{Q_t S_{j,t}} \nu_{t+1}\right]$; $\eta_t = E_t \lambda_{t,t+1}\left[(1-\theta) + \beta \lambda_{t,t+1} \theta \frac{N_{j,t+1}}{N_{j,t}} \eta_{t+1}\right]$; $\frac{Q_{t+1} S_{j,t+1}}{Q_t S_{j,t}}$ denotes the growth rate of banks' total assets from t period to $t+1$ period; $\frac{N_{j,t+1}}{N_{j,t}}$ denotes the growth rate of banks' net assets. The incentive compatibility restriction holds under optimal behavior. The recursion formula applied to net assets [together with equations (22) and (23)] yields:

$$Q_t S_{j,t} = \frac{\eta_t}{\Lambda - \nu_t} N_{j,t} = \Phi_t N_{j,t}. \tag{24}$$

In Equation (24), Φ_t denotes the leverage ratio of banks. Therefore, when the net asset value ($N_{j,t}$) of a bank is given, the total loan value that a bank can issue can not exceed $\Phi N_{j,t}$ at most. Given the leverage ratio of bank financing, the bank's net asset accumulation equation (j) can be further reduced as follows as shown in Equation (25):

$$N_{j,t+1} = \left[\left(R_{k,t+1} - R_{t+1}\right)\Phi_t + R_{t+1}\right] N_{j,t}. \tag{25}$$

Consequently, the growth rate of banks' net assets can be calculated in the following manner as shown in Equation (26):

$$\frac{N_{j,t+1}}{N_{j,t}} = \left(R_{k,t+1} - R_{t+1}\right)\Phi_t + R_{t+1}. \tag{26}$$

The growth rate of banks' total assets from period A to period B can be refined as follows as shown in Equation (27):

$$\frac{Q_{t+1} S_{j,t+1}}{Q_t S_{j,t}} = \frac{\Phi_{t+1}}{\Phi_t}\left[\left(R_{k,t+1} - R_{t+1}\right)\Phi_t + R_{t+1}\right]. \tag{27}$$

The net asset accumulation equation of bank (j) and the correlation parameters of its leverage ratio are no longer independently associated with bank (j)'s features. Therefore, the asset constraint equation can be linearly applied to the financial intermediaries as shown in Equation (28):

$$Q_t S_t = \frac{\eta_t}{\Lambda - \nu_t} N_t = \Phi_t N_t. \tag{28}$$

According to the studies of Bernanke et al. [72] and Fernandez-Villaverde [73], the bank's next challenge is to determine the optimal leverage level to maximize their net return. The first-order condition is shown as follows:

$$\Phi_t = \nu_E\left(\frac{E_t \pi_{t+1} R_{k,t+1}}{R_t}\right). \tag{29}$$

In Equation (28), ν_E denotes a function that links the leverage of a bank to the expected return of capital over the financing cost. Rearranging equation (25), we can characterize the bank's external financing premium as the equation of bank leverage. Due to the aforementioned analysis, we can determine the financial intermediaries' net asset motion equation. As we all know, the total net assets of the financial intermediaries equal the sum of the net assets of the banks that left and the net assets of the banks that arrived during the current time.

$$N_t = N_{e,t} + N_{n,t}. \tag{30}$$

In Equation (30), N_t denotes the total net assets of the financial intermediaries; $N_{e,t}$ denotes the net assets of the bank left at the current period; $N_{n,t}$ denotes the net assets of new bank entering. At t period, a bank with a ratio of $t+1$ will continue to exist in the next period as shown in Equation (31).

$$N_{e,t} = \theta\left[\left(R_{k,t} - R_t\right)\Phi_t + R_t\right] N_{t-1}. \tag{31}$$

We assume that the net assets of the newly entered bank is the proportion ($\frac{\omega}{1-\theta}$) of the assets of the last exiting bank at the current assets ($\frac{1-\theta}{Q_t S_{t-1}}$) as shown in Equation (32).

$$N_{n,t} = \omega Q_t S_{t-1}. \tag{32}$$

The dynamic equation of the financial intermediaries' net assets yields as shown in Equation (33):

$$N_t = \theta\left[\left(R_{k,t} - R_t\right)\Phi_t + R_t\right] N_{t-1} + \omega Q_t S_{t-1}. \tag{33}$$

3.5. Firms

Firms are accountable for the production section. As is common knowledge, producers are monopolistic rivals. All of their goods are sold to retailers in both domestic and international markets. At the end of each t period, the producers acquire capital from the capital provider for use in the next period's production. After the $t+1$ period of production, the producers decide to sell their depleted capital on the open market. The financial intermediaries provide the funds that producers utilize to acquire capital. The identification of the financier thus provides:

$$Q_t S_t = Q_t K_{t+1}. \tag{34}$$

In Equation (34), K_{t+1} denotes the producers purchase the capital from the capital supplier for the next period production at the end of each t period; Q_t denotes he price of each unit of capital; $Q_t S_t$ denotes the financing amount. We suppose that domestic producers generate goods according to the Cobb-Douglas function:

$$Y_t(j) = A_t[K_t(j)]^{\gamma}[L_t(j)]^{1-\gamma}. \tag{35}$$

In Equation (35), $Y_t(j)$ denotes the output of j goods; A_t denotes the total factor productivity; $K_t(j)$ denotes the capital input of j goods; $L_t(j)$ denotes the labor input of j goods; γ denotes the share of capital in production. The domestically made goods are homogeneous and distinct. Perfectly competitive retailers include their outputs in the form of standard Dixit-Stiglitz. Consequently, the demand curve for each producer results in:

$$Y_t(j) = \left[\frac{P_t^h(j)}{P_t^h}\right]^{-\epsilon} Y_t. \tag{36}$$

In Equation (36), Y_t denotes the output of general goods after the final integration. Maximizing profits is the optimal strategy for producers. Their expenses consist of worker wages and the principle and interest needed to acquire the capital from the previous term of financing. Their revenues are generated by the sale of goods to retailers and worn-out capital to capital producers. Consequently, based on the study of Rotemberg [74], the optimal issue of producer (j) is represented by the function below:

$$\prod_t^h(j) = P_t^h Y_t(j) + Q_t(1-\delta)K_t(j) - W_t L_t(j) - R_{k,t}Q_{t-1}K_t(j) - \frac{\kappa_{p,h}}{2}\left[\frac{\frac{P_t^h(j)}{P_{t-1}^h(j)}}{(\pi_{t-1}^h)^{\iota_h}\pi^{1-\iota_h}} - 1\right]^2 P_t^h Y_t. \tag{37}$$

In Equation (37), $\kappa_{p,h}$ denotes the adjustment cost parameter; ι_h denotes the extent to which the producer price's adjustments are linked to past period inflation. The objective of the producers is to maximize their current profit value by selecting the input amount and output price. To achieve this objective, we shall apply the household stochastic discount factor in this work. Additionally, this objective is bound by the demand function of retailers. The first-order conditions for labor input and capital input are therefore as shown in Equations (38) and (39):

$$W_t = \frac{(1-\gamma)Y_t\left(P_t^h - \Omega_t^h\right)}{L_t}. \tag{38}$$

$$R_{k,t} = \frac{\gamma Y_t\left(P_t^h - \Omega_t^h\right) + Q_t(1-\delta)K_t}{Q_{t-1}K_t}. \tag{39}$$

Meanwhile, according to the definition, the link between inflation and the price of domestically produced goods yields as shown in Equation (40):

$$\pi_t^h = \frac{P_t^h}{P_{t-1}^h}. \tag{40}$$

3.6. Importer

Under conditions of monopolistic competition, the importer imports goods made abroad. jj denotes every kind of importer. These importers will price and distinguish their imported goods. They will then sell these disparate goods to the perfect competitive retailer. To integrate these goods into other homogenous imported goods, the standard Dixit-Stiglitz integration approach is used. Therefore, importer demand curves yield as shown in Equation (41):

$$Y_t^f(jj) = \left[\frac{P_t^f(jj)}{P_t^f}\right]^{-\varphi} Y_t^f. \tag{41}$$

Importers seek to optimize their current profitability by choosing the amount of inputs and the cost of their goods. To achieve this objective, we shall apply the household stochastic discount factor in this work. Additionally, this objective is bound by the demand function of retailers. The optimal issue for an importer is described by the following function:

$$\prod_t^f(jj) = P_t^f(jj)Y_t^f(jj) + e_t P_t^{h*} Y_t^f(jj) - \frac{\kappa_{p,f}}{2}\left[\frac{\frac{P_t^f(jj)}{P_{t-1}^f(jj)}}{\left(\pi_{t-1}^f\right)^{\iota_f}\pi^{1-\iota_f}} - 1\right]^2 P_t^f Y_t^f. \tag{42}$$

In Equation (42), e_t denotes the nominal exchange rate in terms of foreign currency; $\kappa_{p,f}$ denotes the adjustment cost parameter; ι_f denotes the extent to which the producer price adjustments are linked to past period inflation. The first-order condition for the pricing of foreign-made goods yields as shown in Equation (43):

$$\frac{\left[\pi_t^f-\left(\pi_{t-1}^h\right)^{\iota_f}\pi^{1-\iota_f}\right]\pi_t^f}{\left[\left(\pi_{t-1}^f\right)^{\iota_f}\pi^{1-\iota_f}\right]^2}=E_t\beta\lambda_{t,t+1}\left[\frac{\pi_{t+1}^f-\left(\pi_t^f\right)^{\iota_f}\pi^{1-\iota_f}}{\left(\pi_t^f\right)^{\iota_f}\pi^{1-\iota_f}}\right]\left[\frac{\left(\pi_{t+1}^f\right)^2Y_{t+1}^f}{\left(\pi_t^f\right)^{\iota_f}\pi^{1-\iota_f}\pi_{t+1}Y_t^f}\right]+\frac{\epsilon\varsigma_tP_t^{h*}}{\kappa_{p,f}P_t^f}-\frac{\epsilon-1}{\kappa_{p,f}}. \tag{43}$$

According to the definition, the link between the price inflation of imported goods and their price is as shown in Equation (44):

$$\pi_t^f=\frac{P_t^f}{P_{t-1}^f}. \tag{44}$$

3.7. Capital producer

At the conclusion of the time period, the capital-specializing producer purchases the capitals used to produce the goods from the other producers. Then, they will fix the capital that has depreciated and develop new capital. After that, they will sell both the repaired and freshly produced capital goods concurrently. As previously mentioned, the typical cost of restoring worn-out capital is $1. We assume that capital producers incur no expense while repairing worn-out capitals. There is, however, an adjustment cost associated with the development of new capital. Therefore, the law of motion of capital gives:

$$K_t=(1-\delta)K_{t-1}+\left[1-\frac{\psi}{2}\left(\frac{I_t-I_{t-1}}{I_{t-1}}\right)^2\right]I_t. \tag{45}$$

In Equation (45), ψ denotes the adjustment cost parameter. Capital producers are motivated to maximize the discounted benefit of their production.

$$\prod_t^h=E_t\sum_{j=t}^{\infty}\beta^{j-t}\Lambda_{t,j}\left[Q_tK_t-Q_t(1-\delta)K_{t-1}-\frac{P_{t,j}}{P_t}I_t\right]. \tag{46}$$

In Equation (46), Q_t denotes the price that the capital producers resell their capital goods. The objective function is constrained by the rule of capital motion. These producers of capital can opt to invest (I_t) in order to enhance their profits. Therefore, the first-order condition for maximizing their profits is:

$$Q_t-\psi Q_t\left(\frac{I_t-I_{t-1}}{I_{t-1}}\right)^2=Q_t\frac{\psi}{2}\left(\frac{I_t-I_{t-1}}{I_{t-1}}\right)^2+E_t\left[\beta\lambda_{t,t+1}\psi Q_{t+1}\frac{I_t-I_{t-1}}{I_{t-1}}\left(\frac{I_{t+1}}{I_t}\right)^2-\frac{P_{t,j}}{P_t}\right]. \tag{47}$$

3.8. Central bank

Based on the studies of Kim [75] and Song [76], we assume that the central bank regulates the money market through interest rates. A Taylor rule of simplicity is adopted. The Taylor rule results in:

$$\log R_t=\rho_r\log R_{t-1}+(1-\rho_r)\left(\log R+\psi_\pi\frac{\pi_t}{\pi}+\Psi_y\log\frac{Y_t}{Y}\right). \tag{48}$$

In Equation (48), ρ_r denotes the interest rate smoothing coefficient; ψ_π denotes the response coefficients of Taylor rule to inflation gap; Ψ_y denotes the response coefficients of Taylor rule to output gap.

3.9. Market clearing condition

The domestic economy generated final goods that were consumed, invested in, and exported as shown in Equation (49):

$$Y_t=C_t^h+I_t^h+Y_t^{f*}. \tag{49}$$

Imported goods are utilized only for consumption and investment as shown in Equation (50).

$$Y_t^f=C_t^f+I_t^f. \tag{50}$$

In terms of a foreign country, the final commodities are used for consumption, investment, and export:

$$Y_t^*=C_t^{h*}+I_t^{h*}+Y_t^f. \tag{51}$$

In Equation (51), $*$ denotes the foreign country. Likewise, imported goods are the final goods of domestic production. And these goods are exclusively consumed and invested in as shown in Equation (52):

$$Y_t^{f*}=C_t^{f*}+I_t^{f*}. \tag{52}$$

In addition, we assume that two economic entities have the same proportion of constant expenditures. In addition, we assume that the

uncovered interest parity requirement and exchange rate are the same for both countries, which means that the presence of arbitrage entails the existence of the following conditions as shown in Equation (53):

$$(1+r_t)=\left(1+r_t^*\right)\frac{e_{t+1}}{e_t}. \tag{53}$$

The equilibrium of the model is defined as the price and allocation that maximize discounted household utility. Both financial intermediaries and firms can optimize the value of dividends after discounting. All producers will maximize the discounted value of their profits within their respective constraints. Ultimately, all markets will be cleared.

4. Results and discussion

4.1. Parameter calibration and estimation

The article's parameters are derived from two considerations. One is the calibration of the parameters. These kinds of parameters are derived from previous work. In addition, another is parameter estimation. Using quarterly data from the Bank of Korea's economic statistics system for Bayesian estimation, these estimated parameters can be derived. For parameter calibration, the results are shown in Table 1.

Then we turn to Bayesian estimation. The Economic Statistics System of the Bank of Korea provides the quarterly statistics utilized in this study for the period Q1 2000 to Q4 2022. We determine South Korea's GDP and the deposit interest rate based on the specified factors. In accordance with Fujiwara and Wang [92], both variables were first logarithmized to eliminate their respective trends. They were then given the first-order difference. Lastly, after subtracting the first-order difference, they were multiplied by 100. In this study, there are a total of 88 observations. For a formal setup of the Bayesian method, let $p(\theta_M|M)$ indicate the prior distribution of the parameter vector (θ_M) for some model. Let the likelihood function of the observed data be conditional on the model and its parameters being represented by $L(\theta_M|Y_T,M)\equiv p(Y_T|\theta_M,M)$. $p(Y_T|\theta_M,M)$ denotes the density probability function rate value. Y denotes the observations until period T. $p(\bullet)$ denotes the probability density function, such as gamma, beta, generalized beta, normal, inverse gamma, shifted gamma, and uniform function. Also, the marginal density function of the data under the model is expressed as shown in Equation (54):

$$p(Y_T|\theta_M,M)=\int_{\theta_M}^{1}p(\theta_M,Y_T|M)d\theta_M=\int_{\theta_M}^{1}p(Y_T|\theta_M,M)p(\theta_M|M)d\theta_M. \tag{54}$$

Using Bayes' theorem, the posterior density ($p(Y_T|\theta_M,M)$) can be represented as the product of the likelihood function and the prior density as shown in Equations (55) and (56):

$$p(\theta_M|Y_T,M)=\frac{p(Y_T|\theta_M,M)p(\theta_M|M)}{(Y_T|M)}. \tag{55}$$

$$p(\theta_M|Y_T,M)=\frac{L(\theta_M|Y_T,M)p(\theta_M|M)}{\int_{\theta_M}^{1}p(Y_T|\theta_M,M)p(\theta_M|M)d\theta_M}. \tag{56}$$

The posterior kernel corresponds to the numerator of the posterior density, which is denoted by $k(\theta_M|Y_T,M)\equiv L(Y_T|\theta_M,M)p(\theta_M|M)$. Also, the posterior distribution of the parameter vector (θ_M) for the model (M) is directly proportional to the posterior density. It can be shown as follows as shown in Equation (57):

$$p(\theta_M|Y_T,M)\propto L(\theta_M|Y_T,M)p(\theta_M|M). \tag{57}$$

The aforementioned distribution is defined by conventional central tendency indicators such as the mean, median, or mode and

Table 1
Results of parameter calibration.

Parameter	Value	Definition	Source
β	0.99	Discount factor	Iacoviello [77]; Monaciii [78]
n	0.56	Intertemporal substitution elasticity of labor supply	Lee [79]
σ	2	Risk aversion coefficient	Piao and Joo [80]
ζ	0.25	Elasticity of substitution of domestic and foreign investment goods demand	Kim [81]
η	1	Elasticity of domestic and foreign goods consumption demand	Monaciii [78]
ψ	5	Capital adjustment cost parameter	Kim [81]
$\kappa_{p,f}$	5	Viscous parameter of import goods price adjustment	Yie and Yoo [82]
ι_f	0.5	Degree to which import price adjustments are linked to past inflation	Zhang and zhang [83]; He and Lee [84]
φ	15.5	Substitution elasticity of foreign goods	Gust et al. [85]; He [86]
ω	0.002	New bank transfer ratio	Gertler et al. [87]; He and Wang [88]
R_k	2.2	Loan interest rate	Han et al. [89]
R	0.891	Risk-free interest rate	Kim [90]
Φ	12.5	Leverage ratio	Lee and Kim [91]

dispersion measurements such as the standard deviation and certain percentiles. When the model and accessible data are provided, the likelihood function may be determined using the Kalman filter or other particle filters for nonlinear models. The results are shown in Table 2.

4.2. The effect of external financial policy on Korean key macroeconomic variables

When it comes to swings in the macroeconomy, Korea is susceptible to shocks from the outside world since it is an open and small country. As a result, the objective of this subsection is to investigate the effect that shocks such bank bankruptcy and financial system collapse from the global financial system have on the key macroeconomic indicators including export, output, employment (L), price level (P), real wages (W), inflation, consumption (C), investment (I), and import in Korea. The results show in Fig. 1.

This subsection delves into the impact of external financial disturbances on South Korea's export dynamics, as illustrated in Fig. 1. The figure shows a marked decline in export performance, a pattern consistent with research by Di Pietro et al. [93], Li et al. [94], Trofimov and Aris [95], and Šťastná et al. [96].These studies highlight the vulnerability of export-reliant economies to worldwide financial fluctuations.Such export reductions trigger a series of economic consequences, including lower production rates. This situation forces businesses to consider downsizing as a cost-reduction measure, negatively affecting employment. This trend is supported by Nicola et al. [97], Read et al. [98], Verschuur et al. [99], and Laborde et al. [100], who explore the intricate relationship between external shocks and domestic labor markets. Moreover, an increase in external prices leads to higher price levels in Korea, exacerbating economic strain by eroding real wages and reducing consumer spending. This aligns with observations on inflation by Ahn et al. [101], Hur and Rhee [102], and Pontines [103]. Inflation also deters investment by raising costs, underscoring the far-reaching consequences of external financial shocks on various economic sectors, as discussed by Park [104] and Aftab and Phylaktis [105]. Acknowledging the limitations of our study, we highlight the possibility of nonlinear economic reactions to these shocks in the Korean context. We stress the need for further research to evaluate the effectiveness of policy measures in mitigating these adverse impacts. By engaging with existing literature, our analysis not only situates our findings within the academic community but also emphasizes their practical significance for policymakers and industry leaders navigating the complexities of global financial interconnections.

4.3. The effect of external monetary policy on Korean key macroeconomic variables

Adjustments to external monetary policies, such as the implementation of quantitative easing in the United States, would inevitably influence the volatility of macroeconomic indicators in Korea. Therefore, the aim of this subsection is to explore the effect of external monetary policy on key macroeconomic variables' fluctuations in Korea.

Fig. 2 illustrates the decline in Korean exports in reaction to external monetary policy shocks—a trend with widespread repercussions for the nation's economy. Such downturns lead to decreased output and investment among firms, reflecting the adverse effects of reduced global demand on domestic productivity and growth. This observation aligns with studies by Cunado and de Gracia [106], Liu et al. [107], Kim et al. [108], Choe et al. [109], and Kim and Sohn [110], highlighting the direct correlation between global demand fluctuations and domestic economic activities. Households face challenges as well, with increased external prices driving up

Table 2
Results of Bayesian estimation.

Parameter	Definition	Prior mean	Posterior mean	95 % HPD interval	Prior distribution	Posterior deviation
α	Household preference for foreign goods consumption	0.3	0.292	[0.273, 0.31]	Beta	0.01
γ	Share of capital in producing home country goods	0.2	0.209	[0.191,0.23]	Beta	0.01
θ	Survival rate of banks	0.97	0.964	[0.945,0.983]	Normal	0.01
δ	Capital depreciation rate	0.025	0.023	[0.021,0.26]	Beta	0.01
ξ	Preference of producer specialized in capital for foreign investment goods	0.3	0.3	[0.281,0.321	Normal	0.01
ψ	Linkage between home country goods price adjustment and past inflation	0.5	0.499	[0.48,0.519]	Normal	0.01
ϵ	Substitution elasticity of home country goods	7.7	7.699	[7.681,7.718]	Gamma	0.01
$\kappa_{p,h}$	Sticky parameter of home country goods price adjustment	5	4.946	[4.373,5.531]	Gamma	0.3
ψ_π	Response coefficient of inflation	1.7	2.516	[2.249,2.777]	Normal	0.3
ρ_r	Interest rate smoothing parameter	0.75	0.75	[0.747,0.752]	Normal	0.001
Ψ_y	Response coefficient of output gap	0.4	0.499	[0.457,0.514]	Beta	0.05
e_a	External technology shock	0.9	0.9	[0.898,0.902]	Inverse gamma	0.02
e_r	External monetary policy shock	1.2	2.078	[1.455,2.705]	Inverse gamma	0.2
e_n	External financial policy shock	6	6.028	[5.641,6.441]	Inverse gamma	0.2
e_t	Terms of trade shock	0.5	0.742	[0.569,0.898]	Inverse gamma	0.2
e_e	Real exchange rate shock	0.7	0.847	[0.792,0.889]	Inverse gamma	0.2
$\rho_{\_a}$	persistence of technology shock	0.75	0.96	[0.922,0.987]	Beta	0.1
$\rho_{\_r}$	persistence of monetary policy shock	0.75	0.95	[0.931,0.982]	Beta	0.1
$\rho_{\_n}$	persistence of financial policy shock	0.5	0.8	[0.726,0.925]	Beta	0.1
$\rho_{\_t}$	persistence of trade shock	0.5	0.48	[0.217,0.828]	Beta	0.2
$\rho_{\_e}$	persistence of real exchange rate shock	0.5	0.54	[0.165,0.744]	Beta	0.2

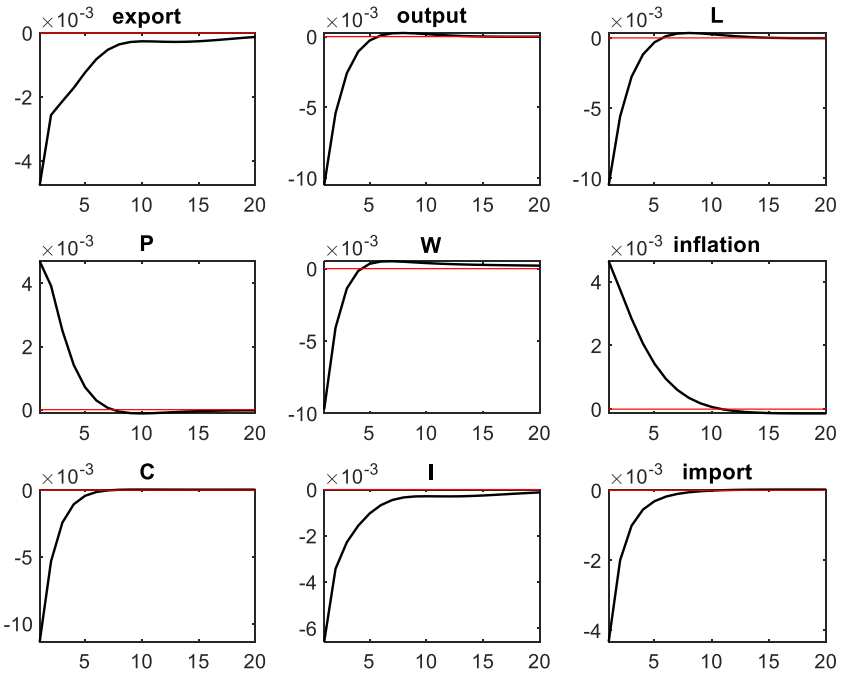

Fig. 1. Results of external financial shock (L, employment; P, price level; W, real wages; I, inflation; C, consumption; I, investment).

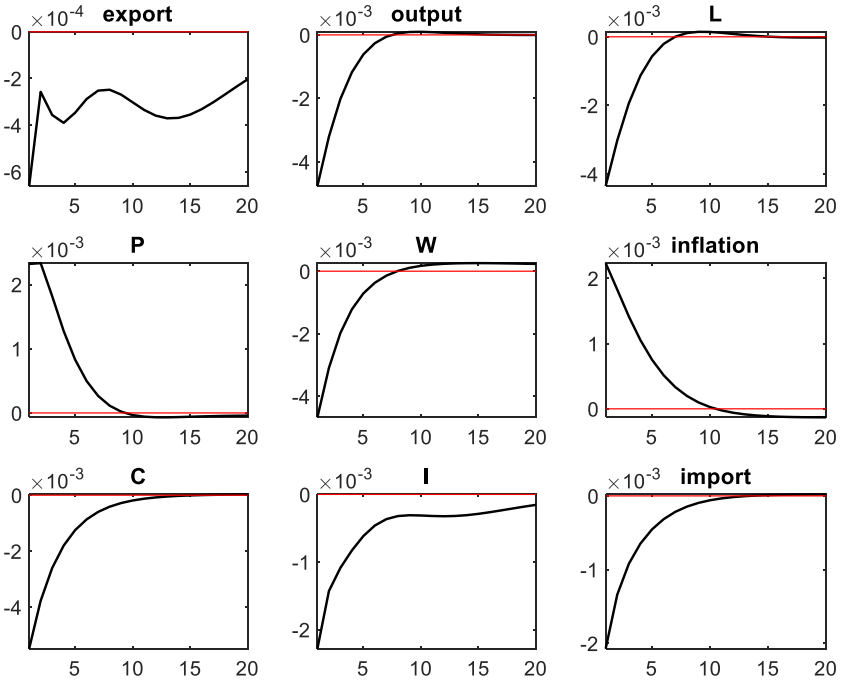

Fig. 2. Results of external monetary policy shock (L, employment; P, price level; W, real wages; I, inflation; C, consumption; I, investment).

domestic inflation, diminishing real wages, and leading to a reduction in consumption due to lower disposable incomes and purchasing power. This aligns with findings by Urom et al. [111], who noted the immediate effects of price shocks on consumer behavior and economic wellbeing. Additionally, higher prices reduce import demand as consumers prioritize savings amidst economic uncertainties, a behavior documented by Zhong et al. [112] and Kim and Kwan [113]. This body of research, including earlier studies by Aloui et al. [114], Kim [115], Choi et al. [116], and Gulzar et al. [117], offers insight into Korea's economic vulnerability to external monetary policies. It underscores the importance of global financial interconnectedness and its impact on Korea's export-driven economy. The

studies suggest policy measures to mitigate these effects, such as diversifying the economic base, strengthening export sector resilience, and stabilizing domestic prices to protect real wages. Nonetheless, the complexity of global economic interdependencies poses challenges in predicting the precise impact of external shocks. Future research should aim to develop more sophisticated models to better understand these dynamics. In sum, this research not only elucidates the immediate effects of external monetary policy shocks on Korea's economy but also emphasizes the necessity for comprehensive strategies to lessen these impacts, underscoring the importance of understanding the complex interplay between external shocks and domestic economic indicators for effective policy formulation.

4.4. Forecast error variance decomposition

In this subsection, we conduct a variance decomposition analysis on the estimated model to explore the external factors behind South Korea's key macroeconomic variables' fluctuations. Specifically, we assess the impact of each model shock on fluctuations in output, consumption, investment, and inflation. According to Smets and Wouters [118], the short run is defined as 1–4 quarters (one year), the medium run as 10 quarters (2.5 years), and the long run as 100 quarters (25 years). The findings for these four variables at various time horizons are shown in Table 3.

In the very near run (one year), Table 1 reveals that the real exchange rate, terms of trade, external productivity, external monetary policy, and external financial shock is the primary drivers of output. At that horizon, the real exchange rate shock is the primary driver of output, accounting for approximately 46 % of output variation, followed by the terms of trade shock (27 %), external productivity shock (18.80 %), external monetary policy shock (5.13 %), and external financial shock (1.61 %). However, after the first four quarters, the terms of trade shock supplant the real exchange rate shock as the primary medium- and long-term driver of output. In particular, it accounts for around 73 % of the long-term variance in output, followed by external productivity shocks (19.90 %), external monetary policy shocks (0.47 %), and external financial shocks (0.22 %). Regarding the consumption drivers in the South Korean economy, the real exchange rate shock, terms of trade shock, external productivity shock, external monetary policy shock, and external financial shock are the most influential. Real exchange rate shocks contribute the most to consumption fluctuations in the short run (53.83 %), followed by external productivity shocks (30.70 %), terms of trade shocks (9.29 %), external monetary policy shocks (6.11 %), and external financial shocks (0.03 %). In the medium- and long-term, however, the terms of trade shock and the external productivity shock will dominate the South Korean economy's consumption.

Real exchange rate shock, terms of trade shock, and external productivity shock are identified as the primary drivers of investment across all time horizons. Among the five shocks, the real exchange rate shock is seen as the primary and most influential investment driver, accounting for around 59.92 %, 38.66 %, and 24.79 % in the short, medium, and long periods, respectively. In addition, external monetary policy shock and external financial shock moderately influence investment in the South Korean economy across all time frames. Similar conclusions are reached on the factors that influence inflation. In other words, the real exchange rate shock, the terms of trade shock, and the external productivity shock are the primary drivers of the volatility in inflation over all horizons. Quantitatively, the real exchange rate shock dominates, accounting for 59.96 % of inflation over the long term, followed by the terms of trade shock (30.15 %), with external productivity, external monetary policy, and external financial shocks having a small impact on inflation over the long term.

Table 3
Results of forecast error variance decomposition (in percent).

Shock	output	consumption	investment	inflation
Forecast horizon: 1st quarter				
Productivity	18.80	30.70	8.12	6.15
Monetary policy	5.13	6.11	7.11	2.63
Finance	1.61	0.06	0.80	0.07
Terms of trade	27.81	9.29	24.61	22.88
Real exchange rate	46.64	53.83	59.36	68.26
Forecast horizon: 4th quarter				
Productivity	24.98	33.17	27.11	6.21
Monetary policy	1.40	1.55	3.72	3.42
Finance	0.55	0.01	0.43	0.10
Terms of trade	45.06	34.71	8.80	29.59
Real exchange rate	28.02	30.57	59.92	60.68
Forecast horizon: 10th quarter				
Productivity	22.99	28.93	34.02	6.35
Monetary policy	0.55	13.41	2.08	3.38
Finance	0.29	0.00	0.27	0.10
Terms of trade	63.54	57.38	24.97	29.87
Real exchange rate	12.63	0.55	38.66	60.30
Forecast horizon: 100th quarter				
Productivity	17.90	21.76	24.67	6.42
Monetary policy	0.47	0.45	1.35	3.36
Finance	0.26	0.04	0.18	0.10
Terms of trade	73.28	69.48	49.00	30.15
Real exchange rate	8.10	8.27	24.79	59.96

5. Conclusions

This research explores the repercussions of external financial and monetary policy shocks on the volatility of crucial macroeconomic variables in South Korea, leveraging sophisticated methodologies like Bayesian estimation and impulse response analysis. The findings illuminate the significant adverse impacts of such external shocks on essential economic indicators, including exports, output, employment, real wages, consumption, investment, and imports, highlighting the Korean economy's susceptibility to international financial trends. In contrast, an intriguing aspect of these shocks is their contribution to an increase in the general price level and inflation, showcasing a complex interaction between external economic forces and domestic economic conditions. Our analysis, particularly through forecast error variance decomposition, offers a discerning perspective on the relative influence of these external shocks compared to internal dynamics such as productivity, terms of trade, and real exchange rate variations. It reveals a somewhat unexpected resilience within the Korean economic structure against external shocks, likely a reflection of effective policy measures and the country's strides towards economic diversification. The implications of our study are manifold. First, it suggests that South Korea's policy endeavors, especially those directed at fostering innovation and diminishing export reliance, may be effectively buffering the economy from the volatility instigated by external shocks. This observation is in harmony with the nation's strategic orientation towards bolstering the domestic market with innovative products, thus nurturing a more robust and balanced economic framework. Second, the differential impact of external shocks across various economic sectors underscores the necessity for a nuanced policy response. Policymakers are encouraged to continue refining their strategies not only to alleviate the negative repercussions of these shocks but also to leverage the inherent strengths of the Korean economy in navigating through the challenges posed by global economic fluctuations. In sum, this article enriches our comprehension of the interplay between external financial and monetary policy shocks and their effects on an open and relatively diminutive economy like South Korea's. By delineating specific areas of impact and underscoring the Korean economy's overall resilience, this study offers invaluable insights for policymakers, economists, and academics interested in the dynamics of national economic policies within the global economic milieu. As South Korea progresses in a swiftly evolving global economic environment, the insights derived from this analysis will be pivotal in informing the nation's economic strategy and policy development.

In addition, this study does have several limitations; nonetheless, those limitations put future researchers on the proper path for additional exploration since they indicate where more investigation should be focused. First, the focus of this article is solely on the effect that shocks to external financial and monetary policy have on the degree to which macroeconomic indicators in Korea exhibit volatility. This subject may be revisited in the future by researchers who use alternative kinds of external shocks, which may result in different results. Second, only analysis up to the point of variance decomposition is provided in this article. Therefore, in the future, academics may carry out a welfare loss study, which would make the findings of this study much more compelling. Third, future researchers could perform an analysis of the topic of this article using structural vector autoregressive techniques, then compare the results of that analysis with the results of this article; the reliability of the results of this article would be confirmed if the results of both analyses were consistent with one another. This would make the findings of this article more accurate.

Data availability statement

The data presented in this study are included in this article.

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Yugang He: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The author declares no conflict of interest.

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