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The Time-varying Reponses of Saudi Arabia Economy to Workers Remittance Outflows Shocks

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Abstract

This study employs the Time-varying Parameters Vector Autoregressive (TVP-VAR) model with stochastic volatility to examine the impact of the remittance outflows on non-oil GDP, investment and current account balance (CAB) in Saudi Arabia for 1970-2012. Results show that the TVP-VAR model is of use for examining inter-temporal dynamics between remittance outflows, non-oil GDP, investment and the CAB in Saudi Arabia. Moreover, an analysis of time-varying impulse responses of non-oil GDP, investment and the CAB to structural remittance outflows shocks suggests that responses depend on the magnitude of structural volatilities of remittance outflows. In particular, highly volatile remittance outflow levels are likely to have persistent negative effects on non-oil GDP, investment and CAB levels in the 1970s and the1980s. However, we observe that the time-varying response of non-oil GDP to remittance shocks displays a negative pattern during 1980-1992 and positive otherwise. Remittances have a persistent negative effect on CAB over the period 1971-2012. Regarding the effect of remittances on investment, the results indicate that there have been sizeable negative responses of investment to remittances shocks during the period 1985-1995. These findings imply that monetary policies must consider high- and low-volatility regimes of remittance outflows and time-varying patterns of relationships non-oil GDP, investment, CAB and remittance outflows. Finally, our results put forward monetary incentives to keep in foreign workers' earnings to promote investment, such as free participation in the stock market, and to enhance current account surplus.

Keywords: Current account balance; Remittance outflows; TVP-VAR model; Stochastic volatility

Introduction

Since the first oil crisis in the 1970s, the Saudi economy has undergone major changes through target development plans to enhance persistent growth and sustainable development. The successive development plans were based on migrant workers to overcome the lack of skilled domestic labor. The share of migrants in the population of Saudi Arabia has increased since the 1970s, reaching 31% in 2010. Thus, the Saudi Arabia constitutes a major destination in the world for migrant workers [1], implying an important upward trend in remittance outflows and unemployment for Saudi citizens.

The increase of external labor force has led to an important increase in workers' remittances from Saudi Arabia. For instance, remittances outflows from Saudi Arabia are the largest among the remitting countries with an estimated value of remittances equal to $30 billion in 2012. The significant amount of the migrant remittances raises the question of their macroeconomic effects on the remitting countries such as Saudi Arabia.

Recently, there has been an ongoing debate on the macroeconomic effects of remittance outflows on the remitting country such as Saudi Arabia. However, the literature on remittances has neglected the macroeconomic consequences of remittances outflows on the sending countries, focusing mainly on their effects on the receiving countries. As pointed by Razgallah [2], the ignorance in the literature of the impact of remittances outflows on remitting countries could be explained by the relative low share of remittances in remitting countries' GDP. To overcome this shortcoming, some studies [1,3-5] examined the macroeconomic effects of remittance outflows. These studies focused mainly on testing the Granger causality and co-integration between remittance outflows and a set of macro indicators such as economic growth, inflation, exchange rate, government expenditures and exports.

However, none of the previous studies have examined the effects of remittance outflows on non-oil GDP, current account balance (CAB) and investment. Our aim is to study the impact of structural shocks of remittance outflows on non-oil GDP, current account balance (CAB) and investment in Saudi Arabia for 1970-2012. This study makes two contributions: first, we attempt to investigate the relationship between remittance outflows, non-oil GDP, and current account balance (CAB) and investment variables; second, we study the impact of structural remittance outflows shocks on non-oil GDP, current account balance (CAB) and investment variables. Unlike previous studies, we use a Time Varying Parameters Vector Autoregressive (TVP-VAR) model with stochastic volatility, which involves examining stochastic volatility levels and time-varying impulse responses of a system of variables that considers non-oil GDP, current account balance (CAB) and investment to structural remittance outflows shocks.

Overview of Saudi Economy and Remittance Outflows

With oil reserves estimated to account for 16% of the world's reserves, Saudi Arabia is the largest oil producer and exporter. Thus, Saudi Arabia is an oil-based economy in which oil revenues represented 90% of government income, 85% of export earnings and 50% of GDP (Saudi GDP) is around 40% and employing 75% of the labor force. Saudi Arabia has a population of 29 million people in 2011, of which Saudi citizens represent only 68%, and the remaining percentage of the population is foreign workers. These immigrants represent about 80%

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of the work force. The unemployment rate, according to Ministry of labor is about 12.1% (2012).

Moreover, the development strategy was based on the reconstruction of the economy, focusing on provision of modern infrastructure, development of human resources, increasing productivity, diversifying the economic base and development of the private sector by providing a favorable environment for activities to play a leading role in development. Unfortunately, in the early stages of its development plans, Saudi Arabia faced the problem of the insufficiency of domestic skilled labor to conduct efficiently its development strategy. Hence, it became necessary to hire foreign workers.

On the other hand, the important upward trend in the demand of foreign workers has led to an important increase in workers' remittances from Saudi Arabia. The pattern path of remittance outflows has observed an upward trend. Indeed, the amount of remittance outflows from Saudi Arabia grew at an increasing rate through the 1971-2012 periods (an annual growth rate of 12%). The dynamics of non-oil GDP, remittance outflows, current account balance (CAB) and investment are further characterized in Table 1. The table indicates that there is a structural change in outflow remittance as percentage of GDP. Indeed, this percentage showed an increase during the period 1970-1999 and a decline during the period 2000-2012. This trend in remittance outflow was likely to follow the movements of GDP growth and oil price changes. Furthermore, the data showed that there were strong negative correlations between remittance and non-oil GDP (-54%), and CAB (-8%) and investment (-68%).

Literature Review

Remittance outflows have become a growing phenomenon in world development economics. Given the considerable growth in remittance outflows, it is not surprising that a sizeable amount of research has now been devoted to understand the determinants and consequences of this phenomenon. Thus, most research has focused on the implications for recipient countries [6-8].

The significant amount of remittance outflows from Saudi Arabia as well as from the other Golf Cooperation Countries has produced an increasing interest in the literature. Recently, the focus shifted to deal with the macroeconomic effects of remittance outflows in the sending countries. An earlier study by El-Sakka and McNabb [9] investigated thedeterminants of migrants' remittances to home countries. They found that the exchange rate and interest rate differentials are the key of remittance.In this line, Vargas-Silva and Huang found that remittance outflows are more determined by changes in macroeconomic conditions of the recipient country. On the other hand, Rajan and Nair observed that the key determinants are the private capital flows.

However, few studies have examined the macroeconomic effects of remittance outflows in the host countries. In this respect, Sayan [10] examined the output fluctuations resulting from remittance outflows. Other studies [2,3,11] have examined the inflationary and Dutch Disease effects of remittance outflows. Recently, Termos et al. [5] examined the effect of remittance outflows on inflation in the GCC. They found that the growth of remittance outflows depresses the inflation rate. Finally, Alkhathlan [1] examined the short and long term relationships between a set of macroeconomic indicators and outflow of workers' remittances in Saudi Arabia. The results suggest that remittance outflows have a negative effect on economic growth due to an increasing inflation, which leads to less consumption and more outflow of capital.

Years	GDP-Nonoil growth rate	Remittance outflows	CAB	Investment
1970-79	13.8	2.45	20.34	18.58
1980-89	1.98	5	-3.13	22.09
1990-99	2.98	10.48	-4.92	19.25
2000-09	6.78	5.9	15.28	20.72
2010	9.14	5.58	12.67	24.5
2011	7.67	5.17	23.68	22.66
2012	5.67	4.73	22.45	22.34

Source: World Development database and SAMA annual statistics

Table 1: Trends in the annual growth rate of GDP-non oil. Average of remittance outflows, CAB and investment as percentage of GDP.

These studies focused mainly on testing the Granger causality and co-integration between remittance outflows and a set of macro indicators such that economic growth, inflation, exchange rate, government expenditures and exports. However, none of the previous studies have examined the effect of remittance outflows on non-oil GDP, current account balance and investment. Our aim is to study the impact of structural shocks of remittance outflows on non-oil GDP, current account balance and investment in Saudi Arabia over the period 1971-2012. Unlike previous studies, we use a Time Varying Parameters Vector Autoregressive (TVP-VAR) model with stochastic volatility. Within this framework, parameter time-variations and the stochastic volatilities of innovations allow one to account for instabilities within inter-temporal links of the remittance outflows, non-oil GDP, current account balance and investmentover time.

No existing empirical study addresses how non-oil GDP, current account balance and investment variables react simultaneously to remittance outflows structural shocks over time. For this reason, this paper considers a TVP-VARmodel with stochastic volatility, allowing for both coefficients time-variations and structural shockvariances. In sum, as stated by Nakajima [12], the TVP-VAR model serves as a useful tool for examining the time-varying relationship between the variables of interest and their simultaneous responses to underlying shocks over time. Thus, we attempt to examine time-varying effects of structural remittance outflows shocks on non-oil GDP, current account balance and investment; using a time-varying framework which allows us to not only identify the general relationship between the variables of interest, but to determine also how these relationships change over time.

This paper focuses on the Saudi Arabian economy. To examine the relationship between remittance outflows, non-oil GDP, current account balance and investment, the three following issues are examined: Is it fruitful to employ a TVP-VAR model? Is the use of time-varying impulse responses functions justified, and does the relationship present uniform properties over the sample period or is there evidence of structural changes?

Methodology and Data

TVP-VAR model

In this study, a TVP-VAR model with stochastic volatility was used. The TVP-VAR model was first used by Primiceri [13] and Nakajima [12] to examine changes in the transmission of monetary policy and fluctuations in exogenous shock variances. This study is the first to examine changes in the transmission of remittances shocks on non-oil GDP, current account balance and investment in Saudi Arabia for 1971-2012.

Following Nakajima [12], we used the TVP-VAR model with stochastic volatility:

$$y_t = c_t + B_{1t} y_{t-1} + \cdots + B_{qt} y_{t-q} + u_t \quad (1)$$

for $t = q+1, \cdots, T$, where y_t is a (4×1) vector ofremittance outflows, non-oil GDP, CAB and investment variables; $B_{1t}, \cdots, B_{qt}$ are (4×4) matrices of time-varying VAR parameters. The unobservable structural shocks u_t are defined as $u_t = A_t \Sigma_t$ with a time-varying variance-covariance matrix $\dot{U}_t = A_t^{-1}\Sigma_t \Sigma_t A_t^{-1}$, where A_t is a lower-triangular matrix with diagonal elements that are equal to one, and $\Sigma_t = diag(\sigma_{1t}, \sigma_{2t}, \sigma_{3t})$ contains standard deviations of the structural shocks. Let us define B as the stacked row vector of $B_{1t}, \cdots, B_{qt}$, α_t is the stacked row vector of free elements of A_t, and $h_t = (h_{1t}, h_{2t}, h_{3t})'$ where $h_{jt} = \log(\sigma_{jt}^2), j = 1,2,3,4$. The time-varying parameters are assumed to follow a random walk process:

$$\begin{pmatrix} B_{t+1} \\ \alpha_{t+1} \\ h_{t+1} \end{pmatrix} = \begin{pmatrix} B_t \\ \alpha_t \\ h_t \end{pmatrix} + \upsilon_t \sim N\left(0, \begin{pmatrix} I & 0 & 0 & 0 \\ 0 & \Sigma_B & 0 & 0 \\ 0 & 0 & \Sigma_\alpha & 0 \\ 0 & 0 & 0 & \Sigma_h \end{pmatrix}\right),$$

for $t = q+1, \cdots, T$; with $B_{q+1} \backsim N(\mu_{B_0}, \Sigma_{B_0}), \alpha_{q+1} \backsim N(\mu_{\alpha_0}, \Sigma_{\alpha_0})$ and $h_{q+1} \backsim N(\mu_{h_0}, \Sigma_{h_0})$.

Further, it is assumed that shocks are uncorrelated among the time-varying parameters and the covariance matrices $\Sigma_B, \Sigma_\alpha, \Sigma_h$ are assumed to be diagonal.

Regarding the estimation of the TVP-VAR model with stochastic volatility, Nakajima [12] suggests a Bayesian inference based on the Markov Chain Monte Carlo (MCMC) method. The MCMC method of overcoming the over-parameterization problems associated with the TVP-VAR model. As MCMC method implementation requires an assessment of the joint posterior distribution of the parameters of interest under certain prior probability, Nakajima makes use of the following priors:

$\Sigma_B \sim IW(25, 0.01I), (\Sigma_\alpha)_i^{-2} \sim Gamma(4, 0.02), (\Sigma_h)_i^{-2} \sim Gamma(4, 0.02)$, where IW denotes the inverse Wishart distribution, $(\Sigma_\alpha)_i^{-2}$ and $(\Sigma_h)_i^{-2}$ are the i - diagonal elements of the matrices Σ_α and Σ_h respectively. Finally, for the initial set of the time-varying parameters, the flat priors are: $\mu_{B_0} = \mu_{\alpha_0} = \mu_{h_0} = 0$ and $\Sigma_{B_0} = \Sigma_{\alpha_0} = \Sigma_{h_0} = 10 \times I$.

Data

The dataset consists of annual observations, and the sample covers the 1971-2012 period. Variables used include the following: remittance outflows (measured as remittances-GDP ratio), annual growth rate of non-oil GDP, current account balance (measured as percentage of GDP), and investment (measured as percentage of GDP). Data on remittance outflows, non-oil GDP, current account balance were obtained from the Saudi Arabian Monetary Agency (SAMA) database. Data on investment were extracted from World Development Indicators (WDI) database.

Empirical Results

Posterior estimates of structural shocks stochastic volatility

The stable TVP-VAR model is estimated based on one lag, according to the AIC criterion and Schwartz information criteria. Following Nakajima [12], we use M=10000 samples discarding the initial 1000 samples of the MCMC algorithm. Posterior estimates of stochastic volatility for remittance outflows, non-oil GDP, CAB and investment variables are shown in Figures 1 and 2. We observe that the stochastic volatility of remittance outflows structural shock shows a quasi-steady progression from 1971 to 1988, decreases sharply from 1989 until 1999 and remains stable from 2000 to the end of the sample period. On the other hand, the stochastic volatility of non-oil GDP structural shocks shows an overall downward trend, especially from 1992, and remains stable and low until the end of the sample period. This low volatility of non-oil GDP is attributable to the fact that Saudi Arabian officials strive to invest heavily in the private sector to ease state dependence on oil revenues.

The evolution of current account balance stochastic volatility is likely to follow a similar path as that of non-oil GDP, with a minor spike occurring in 1981 followed by a downward trend occurring until the end of the study period. The stochastic volatility of investments' structural shocks presents a sharp increase from 1975 to 1989, and decline thereafter until the end of the sample period. Overall, the posterior estimates on stochastic volatility of structural shocks suggest that a TVP-VAR model is appropriate for investigating the time-varying structure of the relationship between remittance outflows, non-oil GDP, CAB and investment.

Regarding the estimated TVP-VAR parameters, Table 2 presents

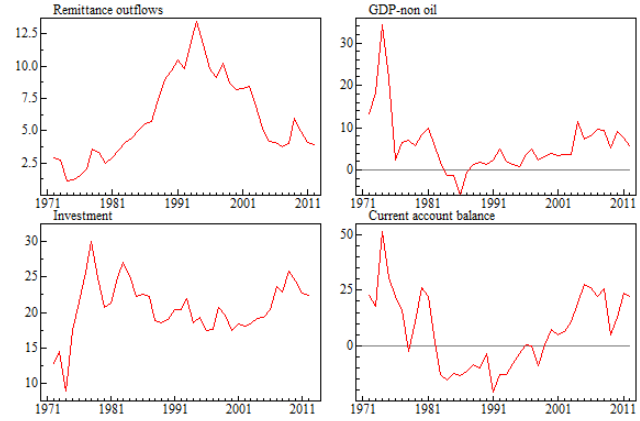

Figure 1: Remittance outflows, non oil-GDP, Investment and CAB.

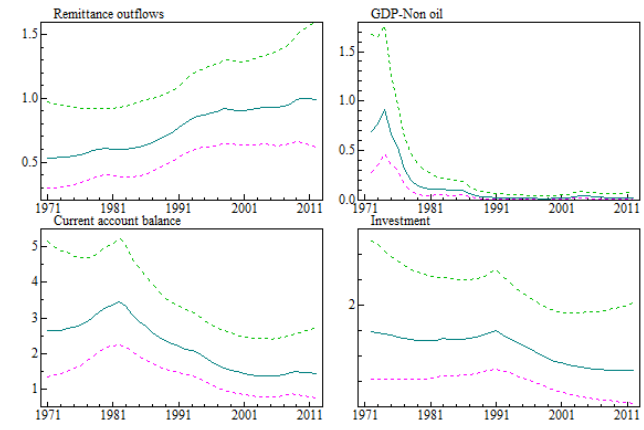

Figure 2: Posterior estimates for stochastic volatility of structural shocks. Posterior mean (solid line), 16th and 84th percentiles (dotted line).

Parameter	Mean	Stdev	95%L	95%U	Geweke	Inefficiency
$(\sum_{\beta})_1$	0.0252	0.0047	0.0179	0.0364	0.656	6.5
$(\sum_{\beta})_2$	0.0263	0.0051	0.0187	0.0382	0.000	8.42
$(\sum_{\alpha})_1$	0.0873	0.0390	0.0428	0.1895	0.625	24.27
$(\sum_{\alpha})_2$	0.0671	0.0214	0.0386	0.1191	0.162	19.93
$(\sum_{\eta})_1$	0.1897	0.1460	0.0523	0.5638	0.112	31.94
$(\sum_{\eta})_2$	0.5778	0.2538	0.2066	1.1819	0.865	29.39

Table 2: Estimation results for selected parameters in the TVP-VAR model.

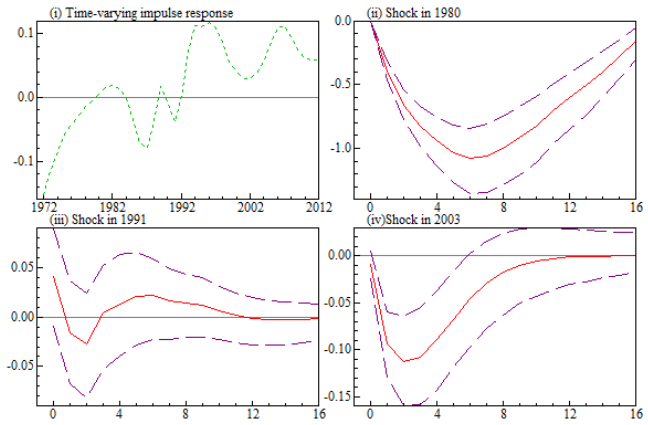

Figure 3: Non-oil GDP impulse response to a remittance outflows shock. (i) Time-varyaing response after 1 year; (ii)-(iv) response in each period with one-standard-deviation bands.

the estimates for the posterior means, standard deviations, the 95% credible intervals, the convergence diagnostics (CD) of Geweke and the inefficiency factors. The results indicate that (i) the null hypothesis of the convergence of the posterior distributions is not rejected for the parameters as the CD statistics are greater than the 5% significance level, (ii) an efficient sampling for the parameters in the TVP-VAR model is found as the inefficiency factors are low (less than 100), and (iii) the estimated posterior means are inside the 95% confidence intervals.

Impulse responses

The time-varying impulse response serves as an innovative way in which the TVP-VAR model captures changes in the transmission of structural shocks as a result of inter-temporal dynamics in the relationship between remittance outflows, non-oil GDP, current account balance and investment.The impulse response measures the response of one variable to a structural shock that affects another variable at each date for the sample period using time-varying parameters and the stochastic shock volatility. According to Nakajima [12], impulse responses are computed by fixing an initial shock size that is equal to the time series average of the stochastic volatility level for each series over the sample period.

Non-oil GDP responses to remittance outflows shock: Figure 3i shows the non-oil GDP impulse responses of to a positive remittance outflows shock after one year ahead for each point of the sample. The results indicate that a positive remittance shock had a diminishing negative impact on non-oil GDP from 1971 to1993 and a positive effect from 1994 until the end of the sample period. Thus, a low volatility of remittance outflows is likely to have a negative effect on non-oil GDP. The response patterns of non-oil GDP to remittance shocks can be explained by the 1970's high volatility of non-oil GDP and the low volatility of remittance outflows. Figure 3i clearly shows that non-oil GDPresponses to remittance shocks are time-dependent and changes in remittances shock propagation mechanism effects on non-oil GDP may have resulted from the stochastic volatility of remittance outflows shocks.

In order to get a better understanding of the extent and timing of the changes in the transmission of energy structural shocks, we compared the effects of remittance structural shocks on non-oil GDP at three different dates namely 1980, 1991 and 2003. The dates correspond to one year after the second oil crisis (1979 oil crisis), the 1990s oil-price shock and the 2000s energy crisis (the 2003's oil-price spike). A positive remittance shock in 1980 is likely to have a permanent negative effect on non-oil GDP, while the 1991's remittance shock has insignificant positive impact. The positive remittance shocks in 2003 (Figure 3ii-iv) have an increasing negative effect on non-oil GDP up to 5 periods and insignificant effect afterwards.

Further, it is possible to calculate the posterior probability that the responses in one time period were larger than that at the other time period. Table 3 reports the posterior probability for the difference in the impulse response of non-oil GDP to remittance outflows shock between time periods. The results indicated that the difference in the impulse response between those1980 and 1991, and those1991 and 2003 is strong while that between 1980 and 2003 is fairly milder.

Investment responses to remittance outflows shock: Figure 4i shows the effects of positive remittance outflows shock on investment

Horizon	1 year	5 years	10 years
(1) GDP to remittance shock			
1980/1991	57.3	60.8	80.3
1991/2003	59.1	70.5	77.9
1980/2003	53.6	67.4	60.1
(2) Investment to remittance shock			
1980/1991	51.5	44.7	74.1
1991/2003	70.8	83.2	86.3
1980/2003	67.1	69.3	72.1
(3) Current account balance to remittance shock			
1980/1991	57.9	72.4	67.6
1991/2003	81.8	75.1	40.1
1980/2003	84.8	75.2	58.6

Table 3: Posterior probability of the difference in the impulse response.

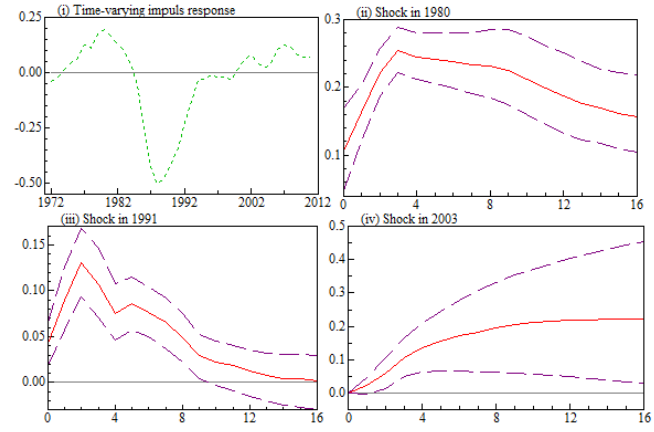

Figure 4: Investment impulse response to a remittance outflows shock. (i) Time- response after 1 year; (ii)-(iv) response in each period with one-standard-deviation bands.

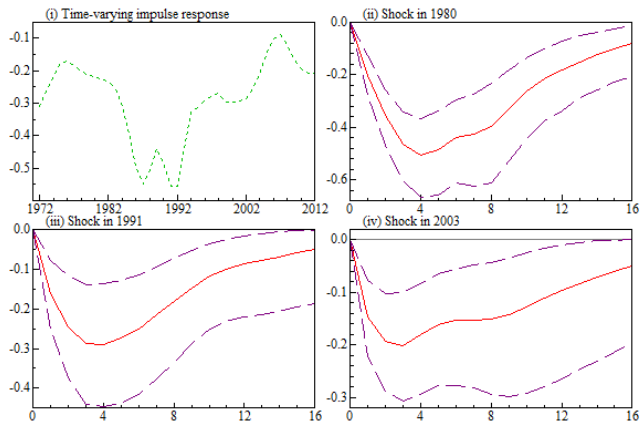

Figure 5: Current account balance Impulse response of to a remittance outflows shock. (i) Time-varying response after 1 year; (ii)-(iv) response in each period with one-standard-deviation bands.

for the sample period. In the 1970s, investment responses to positive remittance outflows shocks were positive. Responses showed a negative decrease for the period 1971-1985 with a sharp increase in 1982. Thus, a low remittance volatility is likely to have a positive impact on investment, while a high volatility of remittance had a negative effect on investment in the 1990s. On the other hand, a positive remittance shock in 1980 (Figure 4ii) leading to the gradual increase in investment in short-run, and investment starts picking up in long-run, while the remittance shock in 1991 (Figure 4iii) has a similar effect as the remittance shock in 1980 on investment. The positive remittance shock in 2003 (Figure 4iv) has a persistent and upward effect on investment.

As shown in Table 3, the results of the posterior probability for the difference in the impulse response of investment to remittance outflows shock indicated that the difference in the impulse response between 1980 and 1991 is milder, while those between1980 and 2003, 1991 and 2003 are strong.

Current account balance responses to remittance outflows shocks: Endogenous current account balance responses to positive remittance outflows shock are shown in Figure 5i. The remittance outflows shock negatively affected the current account balance during the sample period. Impulse responses increased rapidly from 1972 and the fluctuated between 1987 and 1999. Since 2000, the impulse has remained stable and high. Thus, a high remittance outflows volatility were likely to have an adverse negative effect on the current account. Furthermore, the results supported the cyclical patterns of the current account-remittance nexus over time.

On the other hand, a positive remittance shock in 1980 (Figure 5ii) leads to the gradual decrease in the current account in the short-run, and current account balances starts picking up in long-run, while the remittance shock in 1991 (Figure 5iii) has a similar effect as the remittance shock in 1980. The positive remittance shock in 2003 (Figure 5iv) has a short-run negative effect on current account balance, while in the long-run, the impact is insignificant.

As shown in Table 3, the results of the posterior probability for the difference in the impulse response of current account balance to remittance outflows shock indicates that the difference in the impulse response between 1980 and 1991 is weaker, while those between1980 and 2003, 1991 and 2003 are milder.

Conclusions, Discussion and Perspectives

The present study investigates inter-temporal dynamics between remittance outflows, non-oil GDP, investment and current account balances and the impact of remittance outflows shocks on non-oil GDP, investment and current account balance in Saudi Arabia for the period 1971-2012. A TVP-VAR with stochastic volatility was used to account for the time-dependent dynamics between remittance outflows and the macroeconomic indicators (non-oil GDP, investment and current account balance).

The results show that high- and low-volatility regimes of remittance outflows shocks have asymmetric effects (positive or negative) on non-oil GDP, investment and current account balance in Saudi Arabia. In particular, high observed remittance outflows volatility in the 1970s and the 1980s is likely to negatively affect non-oil GDP, investment and current account balance in Saudi Arabia, and low remittance outflows volatility positively affects non-oil GDP and investment. Thus, in formulating more efficient foreign workers remittance outflows policies, policy-makers must consider the high and low volatility of remittance outflows and time-varying patterns of the relationships between foreign remittance outflows, non-oil GDP, investment and current account balance in Saudi Arabia. In addition, these findings suggest more monetary incentives are required to keep in foreign workers' earnings such as wage-based incentives, real interest policy, banking-loans facilities and access to stock market, admitted recently (June 2015).

Drawing on these results, we can make both theoretical and managerial contributions. First, we dealt with the remittance outflows problem from different angles. Unlike the previous studies, we examined in particular the effects of remittances on non-oil GDP, investment and current account balance. Second, we brought to the stakeholders, particularly dynamic and correlational insights into the issue of remittance outflows, which might help in decision-making and in designing appropriate foreign worker policies.

Remittance outflows, non-oil GDP, investment and current account balance as macroeconomic aggregates could not be treated from an exclusively economic perspective. Remittance outflows are more than a simple economic aggregate. The focus on remittance outflows may not shed the light on the multiple advantages of externalization related to the foreign workers cultural and economic contributions. In order to deal efficiently with these aggregates, we need to enlarge our standpoint through integrating to institutional perspective [14] which include regulative, normative and cognitive dimensions of the remittance outflow phenomenon. We believe a further exploration through multidisciplinary approach will be more appropriate rather than one disciplinary investigation.

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