Current Account Balance and External Shocks: An Intertemporal Perspective for Post-Bergin and Sheffrin Model

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Abstract

This study is an attempt to investigate the behaviour of CA towards different shocks by using the Post Bergin and Sheffrin present value model of current account (BS-PVMCA). The model has been tested in the context of Pakistan by using the VAR approach covering the time period from 1972 to 2020. The Post BS PVMCA allows the transmission of global shocks through the consumption-based interest rate, which is adjusted for the world interest rate, the exchange rate, and the terms of trade. Based on both formal and informal tests, we concluded that the post-BS-PVMCA is consistent with Pakistan's data, as both results are significant. It implies that including the changes in the TOT variable in the BS-PVMCA improves the study's results. Contrary to the existing literature, this study also estimates the individual effects of external and country-specific net output shocks on the CA by decomposing the consumption-based interest rate into its components in the post-BS model. The findings of the study reveal that external shocks play a relatively significant role in determining the CA movements in the case of Pakistan.

Keywords: Current Account, Exchange Rate, Terms of Trade, Interest Rate.

Introduction

Over the past four decades, trade liberalisation and capital inflows have acquired the utmost importance in the face of emerging globalisation, technical innovation, financial deregulation, and financial integration across countries, leading to increasing external imbalances as reflected in the balance of payments (BOP) of many nations (Epaphra & Amin, 2022). Since BOP reflects all economic transactions at the government and individual levels with the rest of the world, it enables countries to adjust their economic policies according to the possible implications of the prevailing trade and investment inflows for their economies (Blecker, 2022; Busssiere et al., 2004).

The fluctuating behaviour of BOP is one of the most widely debated topics among academic economists and economic policymakers in both developed and developing countries, due to its essential policy implications for the long-term viability of a country's economic growth path (Artis & Bayoumi, 2021; Machi, 2013). A current account deficit (CAD) is a normal phenomenon in open economies, as a temporary CA deficit reflects capital re-allocating to the country where capital returns are high (Jayme, 2020). However, since independence, Pakistan has experienced persistent BOP issues as its Trade Balance (TB) and the CA balance remained in deficit (Mahmood & Chaudry, 2020). The CAD is large enough and growing too fast, which is detrimental to economic growth. The poor performance of external accounts is mainly attributed to factors such as excessive domestic demand, insufficient investment opportunities, low savings rates,

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inappropriate government measures to enhance exports and production capacity of the economy, and twin deficits (Safdar et al., 2021).

The importance of the CA analysis is also evident from economic theory, which suggests that nations can use CA as an instrument to smooth their consumption (Sachs, 1981). The present value model of the current account (PVMCA) is the most widely used framework to test the intertemporal approach to the CA. It smooths consumption by minimising the effect of shocks that mainly change the level of consumption, output, investment, and government expenditures in an economy (Kano, 2008). The PVMCA derives substantially from the works of Campbell and Mankiw (1989) to obtain the optimal CA of an optimising agent within the Vector Autoregressive (VAR). The advantage of this approach is that the CA serves as a saving, and the expected change in the net output acts as the anticipated change in labour income.

Several researchers believe that the Intertemporal Current Account (ICA) approach can be used to analyse consumption patterns intertemporally in different countries (Adler, 2002; Khundrakpam & Rajiv, 2008; Machi, 2013; Garg & Prabheesh, 2021). However, there is a dearth of literature in the context of Pakistan that focuses on the response of the CA towards any global and country-specific shocks. Ghosh and Ostry (1995) are pioneers in applying PVMCA to the data of 45 developing countries, including Pakistan. This study shows that the baseline ICA is inconsistent with Pakistan's data. One limitation of this study is its limited sample size; it covers the period from 1970 to 1990.

The work of Mukhtar and Khan (2011) overcomes this limitation by analysing the intertemporal behaviour of the CA from 1960 to 2009. This study seems valuable to the CA literature, but it is beset with certain limitations that may cause reservations about the study findings. Firstly, Mukhtar and Khan (2011) analysed the dynamics of the CA by constructing a single variable (consumption-based interest rate). They have not estimated the separate effect of the ER and the world interest rate on CA behaviour in Pakistan. Secondly, they have ignored the TOT shock in their analysis. In comparison, the present study focuses on the effect of the world interest rate, ER, and the TOT through a single variable consumption-based interest rate adjusted for the TOT variable using the Post-Bergin and Sheffrin model of PVMCA. The effect of each of the three variables has also been determined to analyse their relative importance.

The study significantly contributes to the existing literature in this research area and aims to investigate CA dynamics by employing the PVMCA. Notably, the focus is to observe the CA response to external shocks, such as the exchange rate (ER), terms of trade (TOT), and the world interest rate, as well as country-specific shocks (net output), by using the VAR. The objectives of the study are to examine the extent to which the inclusion of the time-varying world interest rate, ER, and TOT improves the fitness of the baseline ICA and, secondly, to measure the individual impact of the external shocks, such as TOT, world interest rate and the ER and the country-specific net output shocks on the CA.

The study proceeds in the following way: The second section provides the literature review and potential research gaps. Section three presents the theoretical framework used in estimation. The fourth section provides the results with the relevant policy implications.

Literature Review

The ICA became an active area of research in the early 1980s to analyse the CA movements. This approach assumes perfect capital mobility across countries, and the absence of this condition validates the ICA (Garg & Prabheesh, 2022). Over time, different researchers have attempted to theoretically refine the ICA, which led most empirical studies to apply different versions of the

ICA (Mukhtar & Khan,2011; Machi, 2013; Garg & Prabheesh, 2021). In the simplest form, the PVMCA states that the increase in the expected future output, including government spending and investment, should be equivalent to the CAD (Ghassan & Drissi, 2019). The empirical literature offers mixed support for the PVMCA investigating the CA fluctuations in developed and developing economies.

Later, Iscan (2000) extended the work of Glick and Rogoff (1995) by incorporating the traded and non-traded goods to test the country-specific and global shocks on the investment and CA. The results are consistent with the findings of Glick and Rogoff, which indicate that a productivity shock affects the CA more rapidly than investment when the country-specific shock originates from the traded sector. Adler (2002) applies the excess sensitivity hypothesis (ESH) to analyse the Swedish economy's consumption behaviour from 1951 to 1999 in an open economy. The model assessment was conducted by comparing the actual CA with the predicted CA series, as the validity of the PIH requires both series to be identical.

Lee and Chinn (2006) estimate a bivariate model for the G7 countries, considering the CA to GDP ratio and the ER. The study introduces productivity shocks as country-specific permanent shocks and monetary shocks as a measure of transitory shocks in the model. Results show that in the presence of constant net foreign assets at a steady state, neither the monetary nor the natural shocks would affect the CA to GDP ratio. Goh (2007) examines the CA and changes in the capital mobility nexus to predict the performance of the Malaysian economy by using the consumption smoothing model. The study suggests that the 1997 crisis deteriorated the current balance in Malaysia. In their study, Khundrakpam and Rajiv (2008) investigate the CA fluctuations in the Indian economy from 1950 to 2006. The CA balance remained insolvent in India during the pre-1990- 91 period; however, the post-reform period documents improvements in the CA balance. Significant efforts are devoted to liberalising the capital flows across the world. Similarly, Ismail and Ahmad (2008) extended the baseline PVMCA to analyse the solvency problem of the Malaysian economy using annual data from 1960 to 2004. The study's findings confirm the extended PVMCA's validity in explaining the CA dynamics for Malaysia.

Nakunyada and Chikoko (2012) employed the ICA to explore the sustainability of the CAD in Zimbabwe from 1990 to 2012. Results show that the CA deficit remains unsustainable in Zimbabwe. The study finds that rising external debt, increasing dependence on humanitarian assistance and imports, inadequate reserves, and lower levels of foreign direct investment are responsible for the unsustainability of Zimbabwe's CA. Machi's (2013) study shows that significant CA imbalances following the 1973-74 and 1979-80 world oil price hikes also proved powerful drivers in developing the intertemporal approach. However, for Pakistan, no further empirical investigation of the PVMCA has taken place. In a subsequent study, Mukhtar and Khan (2016) test the sustainability of CA in the context of Pakistan over the period 1960 to 2012. The findings of the Johansen and Juselius cointegration tests support the existence of a long-run relationship between real imports and real exports, implying that the intertemporal budget constraint is satisfied in the case of Pakistan. The results of the restricted cointegration test also verify that the intertemporal budget constraint is satisfied, as the coefficient value of real imports is unity.

Additionally, the findings of the ICA indicate that the behaviour of actual CA series cannot be best approximated by using the optimal CA series, as the CA series does not follow a systematic divergent pattern, which indicates the CA is volatile. The authors argue that the CA deficit remains sustainable in Pakistan, which protects the economy from external shocks. Therefore, we find a scope to carry out a research endeavour for analysing the behaviour of Pakistan's CA within the

framework of the PVMCA in the presence of different types of shocks, both global and country-specific. Furthermore, our study attempts to estimate the relative importance of country-specific shocks in determining CA in the context of Pakistan.

It is evident from the above discussion that the existing literature only aims to test the consumption-smoothing behaviour of CA in developed countries. It ignores the ICA and external shocks in developing countries, especially Pakistan. Ghosh and Ostry (1995) tested the PVMCA on forty-five developing countries, including India and Pakistan. The study sample ranges from 1960 to 1991 for Pakistan; the authors find that the intertemporal model of CA balance is inconsistent with Pakistan's data. It implies that the CA is volatile, and its role in smoothing consumption is not validated in Pakistan.

The study by Mukhtar and Khan (2011) explores the CA sustainability for Pakistan using the annual data from 1960 to 2009. The authors used the weighted average of the G-7 countries as a proxy for the real interest rate, and the CA variable is obtained by adding investment and government spending minus GDP. The findings of the Granger causality test reveal that the CA Granger-causes the net output in Pakistan, indicating that the CA behaviour helps economic agents accurately predict changes in the economy's net output. Mukhtar and Khan (2016) tested the sustainability of CA in the context of Pakistan from 1960 to 2012. The findings of the Johansen and Juselius cointegration tests support the long-run relationship between real imports and real exports. Zafar's (2020) study used the ARDL approach to examine the relationship between CA deficit, growth, foreign direct investment, and exports from 1975 to 2016. The study results revealed that CAD negatively affects economic growth in the short and long run. Rajakaruna and Suardi's (2021) study presents a panel analysis of five South Asian countries. The study showed that CAD and the budget deficit are mutually correlated, with causality running from the budget deficit to CAD.

The literature review shows that Pakistan's CA deficit remains sustainable, protecting the economy from external shocks. Therefore, we find a scope to carry out a research endeavour for analysing the behaviour of Pakistan's CA within the framework of the PVMCA in the presence of different types of shocks, i.e., global and country-specific shocks. Furthermore, our study attempts to estimate the relative importance of country-specific and external shocks in determining the CA in Pakistan.

Theoretical Framework

Consumption-Based Interest Rate with Terms of Trade Changes and the PVMCA

Following the study of Ostray (1988), Ghosh and Reinhert (1992), and Adedeji (2001), we can employ a Bergin and Sheffrin version of the PVMCA of the CA by introducing changes in TOT in the Bergin and Sheffrin model. Harberger (1950) and Laursen and Metzler (1950) are the pioneers in analysing the effects of TOT movements on the CA. Using the Keynesian model, these authors suggest that the TB improves as the TOT of an economy increases, which in turn boosts current income, provided that the marginal propensity to consume remains less than unity to encourage savings. Later on, the model presented by Harberger, Laursen, and Metzler (HLM) was tested by Sachs (1981), Obstfeld (1982), and Svensson and Razin (1983) within the framework of the deterministic intertemporal approach. Whereas Backus (1993) and Mendoza (1995), following the framework of Adedeji (2001) and Bouakez and Kano (2008), test the HLM effect by using the dynamic general equilibrium model.

The study by Bergin and Sheffrin (2000) is more practically appealing due to the incorporation of a stochastic world real interest rate and real ER. However, Bergin and Sheffrin's analysis ignores

the role of the TOT in the determination of the CA behaviour of a country. The TOT variable is considered one of the most important mechanisms through which external shocks originating in the rest of the world affect the performance of an economy. Additionally, the ICA indicates that the TOT, through its effect on savings, also alters the CA behaviour. However, the fundamental question is whether including the TOT variable in the Bergin and Sheffrin (2000) intertemporal approach enhances its ability to explain CA movements in Pakistan compared to the pure Bergin and Sheffrin model. To examine this question, the model of Bergin and Sheffrin is extended to a three-good framework, which is termed the post-Bergin and Sheffrin model as follows.

To measure the PVMCA, Bouakez and Kano(2008) developed a stochastic infinite-horizon model. The Post BS PVMCA assumes a small open economy that produces three types of goods: exportable goods, importable goods, and non-traded goods. Moreover, the model assumes that the economic agent consumes both traded and non-traded goods. In this case, the household's lifetime utility function would be"

$$U_t = E_t \sum_{k=t}^{\infty} \beta^{k-t} \frac{C_k^{1-\eta}}{1-\frac{1}{\eta}}, \quad 0<\beta<1, \quad \eta>0, \tag{16}$$

where β indicate the subjective discount factor and the index of total consumption is represented by C. It is assumed that C follows the Cobb-Douglas functional form:

$$C_t = \omega_t (C_t^T)^{\alpha} (C_t^N)^{1-\alpha}, 0<\alpha<1 \tag{17}$$

where C_t^N is the consumption of non-traded goods and C_t^T is the consumption of traded goods, α and $1-\alpha$ are the shares of traded and non-traded goods in total consumption and ω_t is a positive parameter which depends on the value of α and $1-\alpha$.Bouakez and Kano (2008) normalize the price of traded goods (P_t^T) to one and the consumption based price index (P_t^C) is constructed as follow

$$P_t^C = Q_t^{1-\alpha} \tag{18}$$

where $Q_t^{1-\alpha}$ is the price of non-traded goods. According to Obstfeld (1996) and Obstfeld and Rogoff (1996) consumption of traded goods (C_t^T) consists of both exported goods (X_t) and imported goods (M_t) of an economy. Now consider if the tradable goods which are aggregator of both domestic X_t and domestic M_t follow Cobb-Douglas production function then the tradable goods consumption can be written as:

$$C_t^T = \rho X_t^{\gamma} M_t^{1-\gamma} \tag{19}$$

As the price of tradable goods is normalized to one, therefore, the prices of exportable goods and importable goods must fulfill the following condition:

$$(P_t^X)^{\gamma} \left(P_t^M\right)^{1-\gamma} = 1 \tag{20}$$

Hence, the ratios of the price of exports to imports gives the TOT and it is constructed as:

$$P_t = \frac{P_t^X}{P_t^M} - \left(P_t^X\right)^{\frac{1}{1-\gamma}} \tag{21}$$

Now consider a small open economy with initial endowment of exportable net output (NY_t^X) and non-traded net output (NY_t^N) at time t. The representative economic agents spent a part of their income on the consumption of imported, exported and non-traded goods. Whereas, a part of total income is devoted to the purchase of bonds at international financial markets. In this case, the budget constraint of the economic agent will become:

$$B_{t+1} = (1+r_t)B_t + P_t^X NY_t^X + Q_t\, NY_t^N - P_t^C C_t \tag{22}$$

Next, we proceed to maximize utility (16) subjected to budget constraint given in equation (22) by imposing no-Ponzi game condition. The resulting Euler equation will be:

$$\beta E_t(1+r_{t+1})\left(\frac{P_t^C}{P_{t+1}^C}\right)\left(\frac{C_t}{C_{t+1}}\right)^{\frac{1}{\eta}} = 1 \tag{23}$$

The application of transversality condition on international bonds yields:

$$\lim_{k\to\infty} E_t(R_{t+k}, B_{t+1+k}) = 0$$

$$R_{t,k} = \frac{1}{\prod_{j=t+1}^{t+k}(1+r_j)}$$

$$1 \qquad i \geq 1$$

where $\text{if} i = 0$ (24)

The intertemporal budget constraint can be formed by using the budget constraint given in equation (22) and transversality condition in (24):

$$\sum_{k=0}^{\infty} E_t R_{t,k}, C_{t+k}^T = (1+r_t)B_t + \sum_{k=0}^{\infty} E_t R_t, P_{t+k}^X NY_{t+k}^X \tag{25}$$

Boukaz and Kano (2008) linearize the intertemporal budget constraint by applying the first order Taylor expansion. The consumption to output ratio $\left(\frac{C_t}{Y_t}\right)$ is denoted by ω_t, λ_t denotes exportable net output to total output ratio and foreign debt/ total output ratio $\left(\frac{B_t}{P_t^C Y_t}\right)$ is denoted by b_t. Thus, the linearize IC is given as:

$$\varepsilon\tilde{\omega}_t - \frac{1-\alpha}{1-\kappa}\tilde{\lambda}_t \approx (1-\alpha)E(r)\tilde{b}_t + (1-\alpha)E(r)b\tilde{r}_t - \varepsilon\omega\sum_{k=0}^{\infty}\alpha^k E_t\left[\Delta\tilde{c}_{t+k}^T - \tilde{r}_{t+k}\right]$$

$$+\omega\frac{1-\alpha}{1-\kappa}\sum_{k=0}^{\infty}\kappa^k E_t\left[\Delta n\tilde{y}_{t+1}^X - \Delta P_{t+k}^X - \tilde{r}_{t+k}\right] \tag{26}$$

where $\Delta c_t^T = \ln\left(\frac{C_t^T}{C_{t-1}^T}\right)$, $\Delta ny_t^X = \ln\left(\frac{NY_t^X}{NY_{t-1}^X}\right)$ and $\Delta p_t^X = \ln\left(\frac{P_t^X}{P_{t-1}^X}\right)$

All other variables including $\omega_t, \lambda_t, b_t, \Delta c_t^T, \Delta ny_t^x, \Delta y_t, r_t, and \Delta p_t^x$ are assumed to be stationary with unconditional means $\omega, \lambda, b, g^c, g^{ny}, g^y, r$ and g^p respectively. Moreover, α equals to $E(g^c - r)$

, β equals to $E(g^{p}+g^{ny}-r)$ and both are assumed to be less than one. The Euler equation (23) after applying the joint conditional homoscedasticity and log normality for consumer price index (P_t^c), world interest rate (r_t) and consumption bundle (C_t) can be written in log form as

$$E_t\Delta\tilde{C}_{t+1} = \varphi E_t\tilde{r}_{t+1} - \varphi(1-\varepsilon)E_t\Delta\tilde{q}_{t+1} \tag{27}$$

Next, we estimate the Euler equation (27) as follow

$$E_t\Delta\tilde{C}_{t+1} = \varphi E_t\tilde{r}_{t+1} - (1-\varphi)(1-\varepsilon)E_t\Delta\tilde{q}_{t+1} \tag{28}$$

The CA to output ratio is obtained by aggregating equation (26) and equation (28):

$$c\tilde{a}_t = b\tilde{r}_t + [\lambda+\varepsilon\omega(\sigma-1)]\sum_{k=1}^{\infty}\kappa^k E_t\tilde{r}_{t+k} - \lambda\sum_{k=1}^{\infty}\kappa^k E_t\Delta n\tilde{y}^{x}_{t+k} +$$

$$\varepsilon\omega(1-\varphi)(1-\varepsilon)\sum_{k=0}^{\infty}\kappa^k E_t\Delta q_{t+k} - \gamma(1-\eta)\sum_{k=0}^{\infty}\kappa^k E_t\Delta\tilde{P}_{t+k} \tag{29}$$

The first term $(b\tilde{r}_t)$ on the R.H.S of equation (29) represents the effect of world interest rate on the CA. If the country is net borrower at international financial market, then an increase in interest rate will immediately raise the net payments on the holding of foreign assets. Similarly, the effect of changes in expected world interest rate is captured through the second term $[\lambda+\varepsilon\omega(\sigma-1)]\sum_{k=1}^{\infty}\kappa^k E_t\tilde{r}_{t+k}]$. This effect can further be divided into wealth effect (λ), substitution effect $(\varepsilon\sigma\omega)$ and the income effect $(-\varepsilon\omega)$. It also indicates that a change in expected future interest rate will change the present consumption based interest rate. In such a situation, the current period consumption becomes relatively more expensive as compared to the future consumption. Therefore, economic agents will defer their present consumption for higher future consumption. It also implies higher current period savings and improvement in the CA position of an economy. The income effect states that the cost of future consumption will reduces with the rise of current period consumption based interest rate. It induces economic agents to extend their lifetime consumption bundle by consuming more and saving less today. Similarly, the wealth effect also deteriorates the CA. The negative wealth effect can be explained through reduction in the present value of lifetime wealth and the discount factor with a rise of world real interest rate. The wealth affect encourages economic agents to increase their savings by deferring their consumption to future periods. The term $[-\lambda\sum_{k=1}^{\infty}\kappa^k E_t\Delta n\tilde{y}^{x}_{t+k}]$ in equation (29) shows that the consumption smoothing behavior of the economic agents. The economic agents use CAprovidessupport to smooth their consumption in order to compensate any change in the expected future cash flows. The term $[\varepsilon\omega(1-\varphi)(1-\varepsilon)\sum_{k=0}^{\infty}\kappa^k E_t\Delta q_{t+k}]$ captures the effect of changes in ER on the CA. This affect is further separated into income effect $[(\varepsilon\omega(1-\varepsilon)]$ and substitution effect $[(-\varepsilon\varphi\omega(1-\varepsilon)]$. Finally, impact of the TOT on the CA is represented through the term $[-\gamma(1-\eta)\sum_{k=0}^{\infty}\kappa^k E_t\Delta\tilde{P}_{t+k}]$. Any improvement in the TOT of a country results in rise of exports prices in terms of imports. It

will further induce the economic agents to expand their consumption bundle due to increase in their lifetime income. As the marginal propensity to consume remains less than one which implies that current period consumption will remain less than current period income. Furthermore, any permanent shock to the TOT variable will not transmitted to the CA which is consistent with the PIH which states that economic agents are unab2le to adjust after the permanent shocks.
Bouakez and Kano (2008) test the Post BSPVMCA which decomposes the consumption based interest into the expected future fluctuation in real ERs, the time varying world interest rate and the term of trade variables. Rather than only investigating the impact of a composite index, this study focuses on the individual impact of the world interest rate, the ER and the term of trade. Thus, the post BS model not only measure the intertemporal substitution effect like the BS version of PVMCA but also the wealth effects of the changes in the world interest rate and the TOT.

Data Sources

The present study aims to analyze the CA dynamic for Pakistan by using the ICA over the period 1972 to 2020. All the required data have sources from the International Financial Statistics (IFS) and World Development Indicators (WDIs).

For variable construction, data on the gross national product (Y), government consumption (G), private consumption (C), private investment (I) have been collected to construct the nominal CA series. The investment expenditures consist of the gross fixed capital formation and the changes in inventories. The CA series is obtained by subtracting the C, G, and I from the GNP [Ghosh, 1995; Bergin & Sheffrin, 2000; Adler, 2000 and Tam, 2008]. The nominal net cash flow variable (Z) is constructed as GDP less private investment and government expenditures. The real per capita CA and real per capita net cash flow series are computed by dividing the nominal CA and net cash flow by total population and GDP deflator. Similarly, the weighted average of the real interest rates of G-7 countries has been used to compute the world real interest rate [Barro and Sala-i-Martin 1990]. The real interest rate of each country has been obtained by adjusting the interest rate for inflation expectations and inflation is measured by using the growth rate of CPI. The ER variable is used as an indicator to measure changes in relative prices of traded and non-traded goods (Rogoff, 1992; Bergin & Sheffrin, 2000; and Tam, 2008). The TOT (ΔP_t) variable is the relative price of imports in terms of export prices. Moreover, the consumption based interest rate (r_t^*) is obtained by adjusting it to the world interest rate and the ER. Whereas, the post BS PVMCA assumes the consumption based interest rate (r_t^{**}) adjusted for the world interest rate, the ER and the TOT variables.
Three parameter values are required to test the validity of the PVMCA empirically, namely, the elasticity of substitution (η), share of traded goods in total consumption (α) and the discount factor (β). The existing literature provides different views regarding the values of these three parameters. For example, Ostry and Reinhart (1992) estimate the elasticity of substitution between 0.38 and 0.503. Whereas, in the study of Hall (1998) η ranges between 0 and 1. Sheffrin and Bergin (2000) argue that PVMCA performs better in presence of low values of parameters and their estimated value of η ranges between 0.022 and 1. Similarly, Mehra and Prescott (19885), Kydland and Zarazag (2000), Uribe (2002), Landeau (2002), Darku (2008) use values 0.5, 0.2, 0.5, 0.5, and 0.45 for the η respectively. The present study use a value of 0.1 for the η parameter which is closer to the estimates of Bergin and Sheffrin (2000) and it is also with the range given by Hall

(1998). To calculate the share of traded goods in the total household's consumption (α), Bergin and Sheffrin follow the study of Kravis et. al. (1982) and Stockman and Tesar (1995) and use 0.5 as a value of α. Finally, the value of the discount factor (β) is computed from the world interest rate. The discount factor (β) is calculated by using the formula $\left(\frac{1}{1+\bar{r}}\right)$ where $\bar{r}$ is the sample mean of the real interest rate.

Empirical Results and Discussion

Testing for the Unit Roots

The first step before evaluating the validity of the PVMCA is to check the stationarity of all the relevant variables of the study. The presence of the unit root in the time series leads to spurious regression. Additionally, the PVMCA also requires that the CA series should be stationary because it assumes perfect capital mobility. In our analysis, we have applied theDicky Fuller (DF)–GLS test to check the stationarity properties of the time series. The results are given in the table 5.1.

Table 1: Dicky Fuller-GLS- Unit Root Test (1972-2022)

Variables	Level	First Difference	1 %	5 %	10 %	Order of Integration
ΔNO_t	-4.09	-	-2.62	-1.95	-1.61	$I(0)$
CA_t	2.46	-	-2.62	-1.95	-1.61	$I(0)$
$\widehat{CA}_t$	-4.09	-	-2.62	-1.95	-1.61	$I(0)$
r^{**}	-3.79	-	-2.62	-1.95	-1.61	$I(0)$
IR_t	-6.09	-	-2.62	-1.95	-1.61	$I(0)$
$REER_t$	-0.834	-4.363	-2.62	-1.95	-1.61	$I(1)$

The findings of the unit root test indicate that changes in net output (ΔNO_t), actual current account (CA_t), optimal CA $(\widehat{CA})$, consumption based interest rate adjusted for the changes in the world interest rate, effective ER and the terms of trade (r^{**}) are stationary at level world interest rate (IR_t) and $REER_t$ are stationary at level, Moreover, the validity of the PVMCA requires that the actual CA (CA_t) should be equal to the optimal CA $(\widehat{CA})$ and the optimal CA is a stationary variable. Therefore, CA_t should also be stationary. The findings of the DF-GLS show that CA_t is stationary which constitutes evidence in the favor of PVMCA.

Implications from the Post Bergin and Sheffrin PVMCA Model

We test the post BS version of the PVMCA of the CA by introducing changes in TOT in the Bergin and Sheffrin model (Ostray, 1988; Ghosh & Reinhert, 1992, Adedeji, 2001). The main reason behind testing the post BS version of the PVMCA is to check whether the inclusion of the consumption based interest rate adjusted for the world interest, changes in the ER and the TOT will improve the performance of the intertemporal model of the CA in context of Pakistan or not.

In next step, the appropriate lag length for VAR is checked. The VAR lag order selection criteria taking into consideration the Akaike information criteria (AIC) and Schwarz information criteria (SIC) implies that the appropriate lag length for the model is one lag. Table 5.2 displays the estimated coefficients of three equations within the VAR model along with some formal and informal tests results. A weak implication of PVMCA is that CA_t granger causes the ΔNO_t and r^{**}. The Granger causality test results indicate that there exits unidirectional causality from CA_t to ΔNO_t and r^{**} which implies that economic agents hold additional information to predict the net output behavior beyond that embodied in its past values in case of Pakistan. Moreover, this result is also supported by the estimated coefficients given in table 5.2. Hence, we can say that the post BS PVMCA is consistent with Pakistan's data. Results of informal tests indicate that that the post BSPVMCA performs well because the value of the ratio of two CA series and their correlation improves significantly in the post PVMCA (0.804 and 0.754) as compared to the baseline PVMCA (0.295 and 0.568) and the BS PVMCA (0.41 and 0.705). The formal tests which consist of the individual and joint restrictions for post BS PVMCA are tested through the Wald test and results are reported in Table 5.2. The statistical test with one lag and two variables yield the estimated values $[0.649\ 0.451\ 00.065]$. Results indicate that the coefficient of the changes in net output and the CA are statistically different from the expected value of zero and unity respectively. Whereas, the coefficient of the consumption based interest rate is not statistically different from its theoretical value of zero.

Overall, results obtain from the joint test of consumption smoothing CA_t on the basis of λ^2 value (1.749) reveal that the null hypothesis is not rejected with a probability value of 0.417 which implies that the post BS PVMCA can successfully explain the consumption smoothing behavior of the CA in context of Pakistan.

Table 2: Estimation Results of the VAR and Test Restrictions for Post Bergin and Sheffrin PVMCA

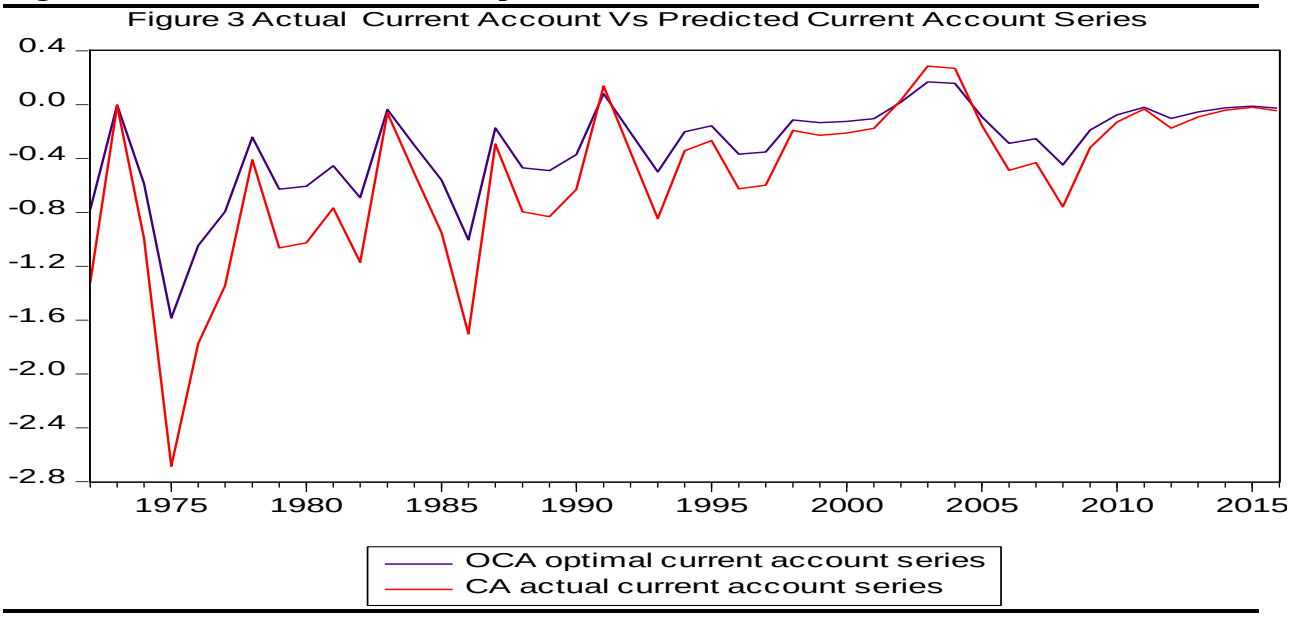
Dependent Variable	**Regressors**			Diagnostic Tests: χ^2 (p values are in the parentheses)			
	ΔNO_{t-1}	CA_{t-1}	r^{**}	S.Corr	ARCH	Heteroscedasticity	Normality
ΔNO_t	0.648 (0.000)	-0.011 (0.079)*	0.139 (0.159)	1.781 (0. 41)	1.366 (0. 268)	3.25 (0.753)	3.349 (0.187)
CA_t	1.450 (0.345)	0.980*** (0.000)	0.032 (0.926)	2.493 (0.287)	1.537 (0. 215)	0.211 (0.648)	1.519 (0.225)
r^{**}	-2.253 (0.723)	-0.045 (0.036)**	0.065 (0.681)	2. 956 (0.228)	0.220 (0.638)	0.171 (0.681)	2.283 (0.319)
Granger Causality Test: F statistic (p values are in the parenthesis)							
CA does not GCΔno				7.344 (0.000)			
Δno does not GCCA				0.693 (0. 602)			
CA does not GC r^{**}				2.335 (0.077)			
r^{**} does not GC CA				0.684 (0.608)			
				1.985			

Δno does not GC r^{**}	(0.121)	
	0.350	
r^{**} does not GCΔno	(0.841)	
Tests of Restrictions		
ΔNO_t	0.649^{*}	
	(0. 072)	$\frac{\text{var}(\hat{CA})}{\text{var}(CA)} = 0.804$
CA_t	0.451^{***}	
	(0.005)	
r^{**}	0.065	
	(0.158)	$Corr(CA, \hat{CA}) = 0.754$
	χ^2=1.748 ;*p*-value=0.417	

Note: Author's estimations

The graphical comparison of the actual CA series and the predicted CA series in case of Post BS PVMCA indicates the turning points of both series are much closer under this specification (see figure 1) which further implies that the model fits the data quite well. However, the actual CA series seems more volatile as compared to the predicted CA series.

Figure 1: Actual current account vs predicted current account series



Finally, we run the following regression $Z_t = \theta_0 + \theta_1 \Delta NO_{t-1} + \theta_2 CA_{t-1} + \theta_3 r^{**}_{t-1} + \nu_t$ and test the hypothesis that $\theta_1 = \theta_2 = \theta_3 = 0$ by using the Wald test. The orthogonality test results are reported in table 5.9. Results indicate that the null hypothesis that variable Z_t is independent of ΔNO_{t-1}, CA_{t-1} and r^{**}_{t-1} is not rejected which shows that the post BS PVMCA cannot be rejected for Pakistan.

Table 3: Orthogonality Test Results for Post BS PVMCA

Overall, on the basis of above discussion we can conclude that the post BS PVMCA is consistent with Pakistan's data as both the formal and informal results provide the same results. It implies that the inclusion of the changes in the TOT variable in the analysis improves the results of the study. Hence, we can say that the study conclude that the TOT proved as a major transmission mechanism of shocks in context of Pakistan.

Table 3: Orthogonality Test Results for Post BS PVMCA

Dependent Variable: Z_t		
ΔNO_{t-1}	-0.810 (2.36)	F-statistic 1.85; p-value=0.153
CA_{t-1}	0.029 (0.182)	χ^2=5.56; p-value=0.135
r^{**}_{t-1}	0.007*** (0.0075)	

Decomposition of the Consumption Based Interest Rate

The consumption based interest rate in the Post BS model is also decomposed into its three components to measure the impact of the world interest rate, real effective exchange rate and the terms of trade variable on the current account. However, before estimating the VAR, the stationarity property of the data is again checked by applying the DF-GLS test. Results reported in table 1 indicate that ΔNO_t, CA_t, and IR_t are stationary at level and the $REER_t$ and TOT_t are non-stationary at level. However, they become stationary at their first difference.

Table. 4 Dicky Fuller-GLS-Unit Root Test (1972-2016)

H_0: Series has a Unit Root							
Variables	**Level**	**First Difference**	**1 %**	**5 %**	**10 %**	**Decision**	**Order of Integration**
TOT_t	-1.745	-5.691	-2.62	-1.95	-1.61	Stationary at first difference	$I(1)$

Note:unit root test results of the ΔNO_t, CA_t, IR_t and $REER_t$ are already reported in table 1.

The AIC and SIC suggests that appropriate lag length is 1. Results of individual effects of regressors on current account are reported in table 5. The findings of the study reveal that own lagged value of the current is a major contributor of the current account. Whereas, ΔNO appears statistically insignificant in the analysis.

Table 5 Individual Effects of the Regressors on the Current Account

Dependent Variable: CA	
Variables	**Coefficients**
$CA(-1)$	0.913*** (0.014)
ΔNO	-0.051 (0.254)
IR_t	0.029** (0.011)
$D(REER_t)$	-0.201** (0.093)
$D(TOT_t)$	0.062** (0.021)
C	
$\bar{R}^2$ =0.99 DW-statistic=1.998	F-statistic=30.10 [0.000]

Additionally, the coefficient of IR_t is statistically significant and positively affecting the current account balance in Pakistan which implies that current account balance improves with an increase in the world real interest rate. The coefficient of exchange rate (-0.201) is statistically significant and it is negatively affecting the current account balance which is indicative of the fact that exchange rate depreciation will deteriorates the current account balance in Pakistan and vice versa. This finding is consistent with the study of Oshota and Badejo (2015) and Eita et. al. (2018) that there exists negative association between exchange rate and the current account. Finally, the coefficient of TOT_t is positively and statistically significantly affects the current account balance which implies that the Marshall-Lerner condition holds in context of Pakistan. Generally, when terms of trade improve it leads to the improvement in the purchasing power of a country's exports. As a result, the consumption smoothing phenomenon induces economic agents to decrease their current consumption by saving more today and consume in future which improves the current account balance of a country. The findings of Caldron et. al. (1999) and Kwalingana and Nkuna (2009) also indicate positive association between the terms of trade and current account balance while Gebregzabier (2003) and Amine (2017) found negative relationship between these two variables. Overall, the decomposition of the consumption based interest rate into its three components show that much of the variations in the current account balance is explained by the real effective exchange rate (20.1 percent) followed by the terms of trade (6.2 percent) and the world interest rate (2.9 percent) respectively. Whereas, country specific net output remains insignificant in the analysis.

Conclusion

This study is an attempt to test the validity of the intertemporal CA in the presence of country specific and external shocks by using the ICA. In this regard, the Post Bergin and Sheffrin model of PVMCA has been tested in context of Pakistan by using the VAR approach covering the time period from 1972 to 2020. Additionally, the performance of model has also been evaluated through some formal and informal tests. On the basis of both formal and informal tests we concluded that the post BS PVMCA is consistent with Pakistan's data as both the formal and informal results provide the empirical support in the favor of the model. It implies that the inclusion of the changes

in the TOT variable in the analysis improves the results of the study. Contrary to the existing literature, the present study also estimates the individual effects of the external as well as the country specific net output shocks on the CA by decomposing the consumption based interest rate into its components in case of post BS model. The findings of the study reveal that external shocks play relatively significant role in determining the ER movements in case of Pakistan. In the light of empirical findings of the present study, following policy recommendations are suggested: firstly, results indicate that the CA performance of Pakistan can be better explain with the help of consumption based interest rate adjusted for the world interest rate, ER and the TOT variables which implies that the government should adopt such policies which encourage economic integration with rest of the world. However, this should be done with great cautions so that the country becomes able to absorb external shocks smoothly. In order to explain the CA dynamics, researcher can further extend the present study by relaxing the assumption of the Ricardian Equivalence and by introducing the uncertainty in the PVMCA by taking investment, which appears in the net output equation, as endogenous in the model.

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